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(54) **Slide gate valve made of a refractory material for metallurgical vessels**

Schieberverschluss aus einer feuerfesten Masse für metallurgische Behälter

Dispositif de fermeture à coulisse, en matériau réfractaire, pour récipients métallurgiques

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Description

Slide-gate pouring appliances for ladles and similar devices have been commonly used for about two decades now. They were however designed far earlier, at the beginning of the last century, and the long delay before they were applied must be blamed on the fact that to enable them to operate properly, refractory bricks with high mechanical, thermal and chemical properties are required. These properties have become available only relatively recently, and since then slide-gate pouring appliances have continued to become increasingly widespread. First of all they were applied to smaller gates and then, gradually, to larger ones.

Ever since slide-gate pouring appliances were first introduced, attempts have been made to find solutions allowing replacement of at least some of the firebricks from outside the ladle, thus simplifying and speeding up maintenance operations.

It is well-known that the basic refractory elements of a slide-gate shut-off device consist of two holed plates of which one is fixed and one is sliding, of a sleeve below the sliding refractory plate known as the external pouring appliance and a sleeve above the fixed refractory plate known as the internal pouring appliance. The internal pouring appliance is not directly surrounded by the refractory lining of the ladle, but isolated from it by means of a larger sleeve, called the pouring-applicance holder and which, unlike the internal pouring appliance has to be fitted and replaced from inside the ladle. This pouring-appliance holder is also an integral part of the slide-gate pouring appliance.

In designing the refractory parts of slide-gate shut-off devices, it is of the utmost importance to achieve uniform wear of the parts so as to space maintenance activities efficiently. It is however not easy to achieve similar rates of wear for elements working in different ways, and therefore in the past it was found preferable to simplify the typology of the refractory elements forming the pouring appliance so at least the number of parts to be stocked was reduced.

This criterion is used in nearly all cases, but the different wear rates of the various components are magnified by the increased dimensions of the shut-off devices, and it is therefore necessary to choose between two alternatives:

(a) To reduce the number of stoppages for maintenance activities by replacing all the parts at the same time, even if some are only partly worn;
(b) To increase the number of stoppages for maintenance activities, replacing each time only those parts which have reached the maximum permissible limits of wear.
The first of these alternatives means a considerable waste of materials, and the second means interrupting the work cycle more frequently, reducing the exploitation of the production facilities.

Patent LU-A-59070 relates to flow control and closure means suitable for operation at very high temperature and in particular to the sliding plate valve for casting ladles and like containers for molten metal. The related device has a very different purpose from the present invention and apparently requires a relatively large number of stoppages for maintenance activities which cause frequent interruption of the work cycle.

The aim of this invention is to implement a large slide-gate shut-off device, the parts of which will wear out at the same rate. In this way it will be possible to space maintenance activities further apart, without the wastages caused by early replacement of parts which are not yet fully worn out. According to this invention, this aim has been fulfilled not only simply by increasing the dimensions (for example the thicknesses) of the parts which wear out more rapidly but also and above all by correctly configuring the various parts of the shut-off device.

This aim may be achieved by a slide gate according to claim 1. Further embodiments are defined in the dependent claims.

By adopting these dimensional ratios, a practically uniform wear rate of all the refractory parts has been achieved, leading to a good degree of efficiency in the exploitation of the system.

Following is a brief description of the attached drawings:

- figure 1 is a side view, shown half as a radial cross-section, of the shut-off device according to the invention;
- figure 2 is a side view, shown half as a radial cross-section, of the upper fixed sleeve, also known as the internal pouring appliance;
- figure 3 is a view from below of the fixed refractory plate, inserted in its metal container;
- figure 4 is a side view of the same refractory plate, shown half as a cross-section;
- figure 5 is a view from below of the fixed refractory place, without its metal casing;
- figure 6 is a side view of the fixed refractory plate, without its metal casing, shown half as a cross-section;
- figure 7 is an enlargement of the detail indicated by the circle VII in figure 6 and by the circle VII/A in figure 16 described below;
- figure 8 is a view from below of the metal casing of the fixed refractory plate;
- figure 9 is a side view of the same casing, shown half as a cross-section;
- figures 10, 11 and 12 are, on an enlarged scale, the details indicated by the circles X, XI and XII in figure 9 above and by the circles X/A, XI/A and XII/A in figure 18 described below;
- figure 13 is a view from above of the mobile refractory plate, inserted in its metal container;
- figure 14 is a side view of the same refractory plate, shown half as a cross-section;

- figure 15 is a view from above of the mobile refractory plate, without its metal casing;
- figure 16 is a side view of the mobile refractory plate, without its metal casing, shown half as a cross-section;
- figure 17 is a view from above of the metal casing of the mobile refractory plate;
- figure 18 is a side view of the same casing, shown half as a cross-section:
- figure 19 is a side view, shown half as a radial cross-section, of the external pouring appliance, consisting of a sliding refractory sleeve fastened solidly to the lower plate and inserted inside its own metal casing.

With specific reference to the above drawings, the shut-off device made of refractory material according to the invention includes an internal pouring-appliance holder made up of two superimposed elements indicated by 11 and 12, the mating surface of which is fitted with a centering key 13. These two elements have to be fitted from inside the ladle and of course their replacement times will be far longer than the replacement times of the remaining refractory elements of the shut-off device, which can be disassembled and reassembled from outside the ladle.

The inside surface of the pouring-device holder 11-12 has a first upper piece, truncated-cone shaped, 14, open at the top where it is shaped like a funnel suitable for conveying the liquid metal downwards. The height of this first part, indicated with the number 14, is about 2-3 times the radius R of the minimum cross-section of the duct through which the liquid metal passes. For the purpose of this description the value of said radius R shall be assumed as a conventional unit of measurement. The radius R is chosen, from time to time, depending on the dimensions of the ladle and of the capacity of the devices downstream from the latter which have to receive the flow of molten steel. The tangent of the opening angle of the conical surface 14 is comprised between above 0.2-0.4; below this first conical portion there is a second, cylindrical, portion 15, the height of which is equal to about 0.2 - 2 times R. Below this, the inside surface of the pouring-appliance holder 11-12 has again a conical shape, opening out towards the bottom, and the angle of opening of which is about 2-6 degrees. This angle allows the internal pouring appliance 20 to be inserted or removed from underneath.

The internal pouring appliance 20 has a height of about 10 times R, and is passed through by a hole 21 formed by an upper conical part 22, and a lower cylindrical part 23. The height of the lower cylindrical part 23 is about 3-4 times R. The tangent of the angle at the vertex of the conical surface 22 is approximately equal to 0.15-0.45. The width of the upper ring-shaped base 24 of the internal pouring appliance 20 is approximately equal to R and starts just below the cylindrical part 15 of the pouring-appliance holder 11-12. In this way a step is created which will wear out progressively due to the abrasive effect of the liquid steel, gradually transforming the conical surfaces 14 and 21 into a single surface shaped more or less like a paraboloid of revolution. The flow of liquid steel is now directed towards the boundary and enters the cylindrical duct 22-23 causing less wear.

The radial thickness of the lower ring-shaped base 25 of the internal pouring appliance 20 will be approximately equal to 2R. The lower ring-shaped base 25 of the internal pouring appliance 20 has a circular rib 26 located in the vicinity of the outer rim of the base itself. This circular rib serves as a centering element between the lower base of the internal pouring appliance 20 and the upper surface of the fixed refractory plate 30 which is equipped with a corresponding groove 31. The plate 30 is equipped with a central hole having a radius R, and its thickness is approximately the same; the remaining relative dimensions of the fixed refractory plate 30 are described in detail below.

The underside of the fixed upper plate 30 is accurately flattened, since it serves as a sealing surface over which the upper surface of the underlying sliding refractory plate 40 slides. The sliding plate 40 also has a central hole 42, and on its underside a circular groove 41 which accommodates a corresponding rib 51 protruding from the upper ring-shaped base 52 of the lower sleeve 50, which slides together with the lower plate 40 and forms the external pouring appliance. The radial thickness of the lower sleeve 50 is approximately equal to R, and its height H1 is about 6-12 times the radius R of the pouring hole. The hole 53 of the lower sleeve 50 is cylindrical, and its lateral surface 54 is also cylindrical although it has at the bottom a conically bevelled edge which makes it easier to insert the lower end of the external pouring appliance into the upper end of an underlying plunger type pouring appliance below it.

The fixed upper plate 20 is illustrated in detail in figures 3 and 12: it is symmetrical in respect of two orthogonal horizontal axes and its width is equal to approximately 5-7 times the radius R, while its length is approximately equal to 12-16 times the radius R. The two ends 33 of the refractory plate 30 are shaped as semicircles with centres 34. The distance between the centres 34 and 35 corresponds roughly to double the relative travel of the fixed and mobile plates. In this way the distribution of the refractory material is optimized, as its free edges are always at the same distance from the area in contact with the molten steel, whatever the working position of the distribution device may be.

The fixed upper refractory plate 30 has a metal covering 60 consisting of a sheet of lamina 61 which covers the contour of the plate 30 and has an outer edge 62. The height of this edge 62 is approximately equal to the thickness of the plate 30 and its upper edge 63 is curved slightly outwards, as shown in the close-up of figure 12, so as to strengthen the covering itself and allow easy insertion of the plate 30 inside the covering 60 during assembly, without excessive clearances and consequent excessive thickness of the layer of refractory mortar 64 located between the plate 30 and the covering 60. Fur-

thermore, the covering 60 also has on the bottom 61 a circular opening 65, the rim 66 of which is folded inwards into an arch so as to create a supporting surface for the refractory plate which is supported at a pre-established height from the bottom 61 of the covering. The height of this rim 66 also defines the thickness of the layer of mortar. The thickness of the layer of mortar 64 is also ensured by protrusions 67 made by presswork and arranged on the bottom 61.

It should be noted that the circular opening 65 in the bottom of the covering 60 is larger than the outside diameter of the internal pouring appliance 20, so that there is no interference, as shown in figure 1. The sliding refractory plate 40 differs from the fixed refractory plate 30 in that the circular groove 41 has a smaller diameter in view of the lesser thickness of the lower refractory sleeve 50 as compared to the thickness of the internal pouring appliance 20. This difference between the plates 30 and 40 on the one hand and the refractory sleeves 20 and 50 on the other, is very important for the purposes of the invention. Indeed the internal pouring appliance 20 wears out more quickly than the sleeve 50 in the hole of which the flow of liquid steel is already perfectly directed along vertical flowlines.

By keeping to the dimensions indicated for the elements 11-12, 20, 30, 40 and 50, wear progresses at different rates but thanks to the different thicknesses involved, in such a way that the working life of these elements is approximately the same. The maintenance activities for replacement of the worn parts of the shut-off device can therefore be scheduled rationally, with no losses due to replacement of only partly worn refractory elements.

As far as concerns the refractory sleeve 50, it should be noted that it too has a metal casing 56, with a double sloping truncated cone shape. The lower part 58 supports directly the weight of the sleeve 50, while the upper part 57 defines a meatus with a decreasing thickness inside which the connecting refractory mortar is placed.

Claims

1. Slide-gate shut-off device made of refractory material of the type having: (a) a fixed refractory plate (30), (b) a sliding refractory plate (40), below it, both plates provided with a through hole having a radius R, (c) a sleeve (50) made of refractory material solidly connected to the latter, above the fixed refractory plate (30), (d) a fixed refractory sleeve, also known as internal pouring appliance (20) provided with a through duct having minimum cross-section of radius R, for passage of a liquid metal, around which a pouring-appliance holder (11-12) (e) is arranged, characterized by the fact that said refractory plates (30 and 40) are holed in the centre and are symmetrical in respect of two orthogonal horizontal axes;
in which said internal pouring appliance (20) has a radial thickness at its bottom base (25) about twice the radial thickness of the lower sliding refractory sleeve (50), the radial thickness of which being approximately equal to R; in which said internal pouring appliance (20) has a height of about 10 times R and is passed by a hole (21) formed by an upper conical part (22), said conical part (22) having a tangent of the angle at the vertex ranged from 0.15 to 0.45, and by a lower cylindrical part (23), said cylindrical part (23) having a radius equal to R; in which said internal pouring appliance (20) has an upper ring-shaped base perpendicular to a wall having a thickness, at the level of base (24) equal to R, said wall being located just below a cylindrical part (15) of the pouring appliance holder (11-12).

2. Shut-off device according to the foregoing claim, characterized in that said refractory plates (30 and 40) have semi-circular shaped edges on the ends; the thickness of these plates (30 and 40) is approximately equal to the radius R of the pouring hole passing through them.

3. Slide-gate shutoff device according to claim 1, characterized in that the outer surface of the internal pouring appliance (20) is conical, narrowing towards the top, with an opening angle of about 2-6 degrees.

4. Shut-off device according to claim 1 characterized in that internal pouring appliance (20) has the height of the lower length equal to about 3-5 times the total height of the internal pouring appliance.

5. Shut-off device according to claim 1 above, characterized by the fact that the radial thickness of the upper base (24) of the internal pouring appliance (20) is approximately equal to the radius R.

6. Slide-gate shut-off device according to claim 1, characterized by the fact that the height of the lower refractory sleeve (50) is equal to about 6-12 times the radius R.

7. Slide-gate shut-off device according to claim 1, characterized by the fact that it has a pouring-appliance holder (11-12) equipped with an axial hole divided up into three superimposed lengths; the first of these lengths starting from the bottom has a conical surface (14) suitable for accommodating the corresponding conical surface (21) of the internal pouring appliance (20); the second of these lengths is cylindrical (15) and has a height of about 0.2-2 times the radius R; the third of these lengths is again conical, and widens out upwards, with an opening angle of the tangent equal to about 0.2-0.4 and with a height of about 2-4 times the radius R.

8. Slide-gate shut-off device according to claim 7, characterized by the fact that the pouring-appliance holder (11-12) consists of two superimposed ele-

ments, the mating surfaces of which are fitted with corresponding centering steps (13).

9. Slide-gate shut-off device according to claim 1, characterized in that each of the refractory plates (20) has a width comprised between four and eight times the radius R and a length of about 12-16 times said radius R.

10. Slide-gate shut-off device according to claim 1, characterized by the fact that the internal pouring appliance (20) has on the outer rim of its ring-shaped lower base (25) a ring-shaped centering rib (26) the corresponding seat of which is in a ring-shaped groove (31) on the upper surface of the upper fixed plate (30).

11. Slide-gate shut-off device according to claim 1, characterized by the fact that the external pouring appliance has, in the vicinity of the outer rim of its ring-shaped upper base (24) a ring-shaped centering rib the corresponding seat of which is in a ring-shaped groove (41) on the upper surface of the lower sliding plate (40).

12. Slide-gate shut-off device according to claims 10 and 11, characterized by the fact that said ribs (26) and grooves (31 and 41) in the fixed plate (30) and internal pouring appliance (20) on the one hand, and in the sliding plate (40) and external pouring appliance on the other hand, have different diameters.

13. Slide-gate shut-off device according to claim 1, characterized by the fact chat both the fixed plate (30) and the sliding plate (40) are equipped with a metal covering (60) made of sheeting covering the surface of the base opposite to the surface of reciprocal contact and the lateral surface around the edge (62).

14. Slide-gate shut-off device according to claim 13, characterized by the fact that the edges (62) of said covering (60) are folded outwards to make it easier to insert the refractory plate (30) and to stiffen the covering (60).

15. Slide-gate shut-off device according to claims 13 and 14, characterized by the fact that the flat bottom (61) of said metal covering (60) has a circular opening (65) with a diameter larger than that of the ring-shaped groove (41) located on the associated refractory plate (40).

16. Slide-gate shut-off device according to claim 15, characterized by the fact that the edge of said opening (65) is folded inwards, so as to stiffen the bottom of the covering (60) and so as to keep the associated refractory plate away from said bottom (61) of the casing by a certain pre-established distance, equal to the required thickness of refractory mortar (64).

17. Slide-gate shut-off device according to claim 16, characterized by the fact that protrusions (67) are arranged on the bottom (61) of the covering (60) capable of defining, together with the folded edges of said opening, the resting surface of the refractory plate (30) and thus the thickness of mortar (64) required.

18. Slide-gate shut-off device according to claim 1, characterized by the fact that the lower refractory sleeve (50) has a metal covering (56) extending over its outer side surfaces.

19. Slide-gate shut-off device according to claims 10, 11 and 12, characterized by the fact that the radial profile of said ring-shaped ribs (26) and grooves (41 and 31) has a substantially sinusoidal shape and preferably consists of three alternately concave and convex arches of a circle.

Patentansprüche

1. Schieber-Absperreinrichtung, hergestellt aus feuerfestem Material der Bauart mit:

(a) einer festen Feuerfestplatte (30)
(b) einer unter ihr angeordneten Schieber-Feuerfestplatte, wobei beide Platten mit einem durchgehenden Loch mit einem Radius R versehen sind,
(c) einer Buchse aus Feuerfestmaterial, hergestellt aus feuerfesten fest mit dem letzteren verbundenen Material oberhalb der festen Feuerfestplatte (30),
(d) einer festen Feuerfestbuchse, auch als innere Gießeinrichtung (20) bekannt, die mit einer durchgehenden Führung mit Minimumquerschnitt vom Radius R versehen ist, zum Durchleiten eines flüssigen Metalls, um die ein Gießeinrichtungshalter (11-12) (e) angeordnet ist, dadurch gekennzeichnet, daß diese Feuerfestplatten (30 und 40) in der Mitte mit einem Loch versehen und symmetrisch bezüglich zwei orthogonalen und horizontalen Axen sind;
daß diese innere Gießeinrichtung (20) eine radiale Dicke an ihrer Bodenbasis (25) hat, die etwa gleich der doppelten radialen Dicke der unteren gleitenden Feuerfestbuchse (50) ist, wobei deren radiale Dicke in etwa gleich R ist; wobei diese innere Gießeinrichtung (20) eine Höhe etwa gleich dem 10-fachen von R ist und durch die ein Loch (21) geht, das durch einen oberen konischen Teil (22) gebildet ist, wobei dieser konische Teil (22) einen Tangentenwinkel am Scheitel zwischen 0,15 bis 0,45 hat, und ein zylindrischer unterer Teil (23) vorgesehen ist, wobei dieser zylindrische Teil (23) über einen Radius gleich R verfügt; wobei diese innere Gießeinrichtung (20) über eine obere ringför-

mige Basis senkrecht zu einer Wand mit einer Dicke in Höhe der Basis (24) gleich R verfügt, wobei diese Wand kurz unterhalb eines zylindrischen Teils (15) des Gießeinrichtungshalters (11-12) positioniert ist.

2. Gießeinrichtung nach dem vorhergehenden Anspruch, dadurch gekennzeichnet, daß diese Feuerfestplatten (30 und 40) halbkreisförmig ausgestaltete Ränder auf ihren Enden haben; daß die Dicke dieser Platten (30 und 40) in etwa gleich dem Radius R des durch sie hindurchgehenden Gießloches ist.

3. Schieber-Absperreinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die äußere Fläche der inneren Gießeinrichtung (20) konisch ist und sich gegen den Kopf mit einem Öffnungswinkel von etwa 2 - 6 Grad verschmälert.

4. Absperreinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß diese innere Gießeinrichtung (20) die Höhe der unteren Länge, gleich dem etwa 3 - 5-fachen Gesamthöhe der inneren Gießeinrichtung, hat.

5. Absperreinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die radiale Dicke der oberen Basis (24) der inneren Gießeinrichtung (20) etwa gleich dem Radius R ist.

6. Schieber-Absperreinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Höhe der unteren feuerfesten Buchse (50) gleich etwa dem 6 - 12-fachen des Radius R ist.

7. Schieber-Absperreinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß sie einen Gießeinrichtungshalter (11-12) hat, der mit einem Axialloch versehen ist, der in drei übereinander lagernden Längen unterteilt ist, wobei die erste dieser Längen, die vom Boden ausgeht, eine konische Fläche (14) hat, die geeignet ist, um die entsprechende konische Fläche (21) der inneren Gießeinrichtung (20) aufzunehmen; die zweite dieser Längen (15) zylindrisch ist und über eine Höhe von etwa dem 0,2 - 2-fachen des Radius R verfügt; die dritte dieser Längen wieder konisch ist und sich nach oben weitet, mit einem Öffnungswinkel der Tangente gleich etwa 0,2 - 0,4 und mit einer Höhe von etwa dem 2 - 4-fachen des Radius R.

8. Schieber-Absperreinrichtung nach Anspruch 7, dadurch gekennzeichnet, daß der Gießeinrichtungshalter (11-12) aus zwei einander überlagernden Elementen besteht, dessen zueinander passende Flächen mit entsprechenden Zentrierstufen (13) versehen sind.

9. Schieber-Absperreinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß jede der Feuerfestplatten (20) eine Breite zwischen dem 4- und 8-fachen des Radius R und eine Länge von etwa dem 12 - 16-fachen dieses Radius R hat.

10. Schieber-Absperreinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die innere Gießeinrichtung (20) auf dem äußeren Rand ihrer ringförmigen unteren Basis (25) eine ringformige Zentrierrippe (26) hat, deren entsprechender Sitz sich in einer ringförmigen Nut (31) auf der Oberseite der oberen festen Platte (30) befindet.

11. Schieber-Absperreinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die äußere Gießeinrichtung benachbart dem äußeren Rand ihrer ringförmigen oberen Basis (24) eine ringförmige Zentrierrippe hat, deren entsprechender Sitz sich in einer ringförmigen Nut (41) auf der oberen Fläche der unteren Schieberplatte (40) befindet.

12. Schieber-Absperreinrichtung nach den Ansprüchen 10 und 11, dadurch gekennzeichnet, daß diese Rippen (26) und Nuten (31 und 41) in der festen Platte (30) und der inneren Gießeinrichtung (20) auf der einen Seite und in der Schieberplatte (40) und der äußeren Gießeinrichtung auf der anderen Seite unterschiedliche Durchmesser haben.

13. Schieber-Absperreinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß beide, die feste Platte (30) und die Schieberplatte (40) mit einer Metallabdeckung (60) ausgestattet sind, die aus Blech gemacht ist und die Oberfläche der Basis gegenüber der Oberfläche des gegenseitigen Kontakts und die Seitenfläche um die Kante (62) abdeckt.

14. Schieber-Absperreinrichtung nach Anspruch 13, dadurch gekennzeichnet, daß die Kanten (62) dieser Abdeckung (60) nach außen gebogen sind, um das Einführen der Feuerfestplatte (30) und das Aussteifen der Abdeckung (60) zu erleichtern.

15. Schieber-Absperreinrichtung nach Anspruch 13 und 14, dadurch gekennzeichnet, daß der flache Boden (61) dieser Metallaodeckung (60) über eine kreisförmige Öffnung (65) mit einem Durchmesser verfügt, der größer als der der ringförmigen Nut (41), die auf der zugeordneten Feuerfestplatte (40) sich befindet, ist.

16. Schieber-Absperreinrichtung nach Anspruch 15, dadurch gekennzeichnet, daß die Kante dieser Öffnung (65) nach innen umgebogen ist, um so den Boden der Abdeckung (60) auszusteifen und so die zugeordnete Feuerfestplatte vom Boden (61) des Gehäuses um einen bestimmten voreingestellten

Abstand, der gleich der gewünschten Dicke des feuerfesten Mörtels (64) ist, entfernt zu halten.

17. Schieber-Absperreinrichtung nach Anspruch 16, dadurch gekennzeichnet, daß die Vorsprünge (67) auf dem Boden (61) der Abdeckung (60) angeordnet und in der Lage sind, zusammen mit den abgebogenen Kanten dieser Öffnung, die verbleibende Fläche der Feuerfestplatte (30) und damit die erforderliche Dicke des Mörtels (64) zu definieren.

18. Schieber-Absperreinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die untere feuerfeste Buchse (50) eine Metallabdeckung (56) hat, die sich über ihre äußeren Seitenflächen erstreckt.

19. Schieber-Absperreinrichtung nach Anspruch 10, 11 und 12, dadurch gekennzeichnet, daß das radiale Profil dieser ringförmigen Rippen (26) und Nuten (41 und 31) von im wesentlichen sinusförmiger Gestalt ist und bevorzugt aus drei abwechselnd konkaven und konvexen Bögen eines Kreises besteht.

Revendications

1. Dispositif de fermeture à coulisse en matériau réfractaire du type ayant;

(a) une plaque de réfractaire fixe (30, (b) une plaque de réfractaire coulissante (40) en dessous de la plaque fixe, les deux plaques étant munies d'un trou traversant de rayon R, (c) un manchon (50) en matériau réfractaire assemblé solidement à cette dernière au-dessus de la plaque de réfractaire fixe (30), (d) un manchon fixe en réfractaire, également appelé l'instrument intérieur de coulée (20) muni d'un passage traversant de section transversale minimum de rayon R, pour le passage d'un métal liquide et autour duquel est agencé un support d'instrument de coulée (11-12)(e) caractérisé par le fait que lesdites plaques de réfractaire (30 et 40) sont percées d'un trou au centre et sont symétriques par rapport à deux axes horizontaux orthogonaux; dans lequel ledit instrument interne de coulée (20) présente une épaisseur radiale à sa base inférieure (25) qui est environ le double de l'épaisseur radiale du manchon intérieur réfractaire coulissant (50) dont l'épaisseur radiale est approximativement égale à R; dans lequel ledit instrument intérieur de coulée présente une hauteur d'environ 10 fois R et est traversé par un trou (21) formé par une partie supérieure conique (22), ladite partie conique (22) présentant une tangente de l'angle au sommet comprise entre 0,15 et 0,45, et par une partie inférieure cylindrique (23) présentant un rayon égal à R; dans lequel ledit instrument intérieur de coulée (20) présente une base supérieure en forme de bague perpendiculaire à une paroi dont l'épaisseur au niveau de la base (24) est égale à R, ladite paroi étant disposée juste au-dessous d'une partie cylindrique (15) du support d'instrument de coulée (11-12).

2. Dispositif de fermeture selon la revendication précédente, caractérisé en ce que lesdites plaques de réfractaire (30 et 40) ont des bords de forme semi-circulaire à leurs extrémités, l'épaisseur de ces plaques (30 et 40) est approximativement égale au rayon R du trou de coulée les traversant.

3. Dispositif de fermeture à coulisse selon la revendication 1, caractérisé en ce que la surface extérieure de l'instrument intérieur de coulée (20) est conique, en se rétrécissant vers le sommet, avec un angle d'ouverture d'environ 2 à 6 degrés.

4. Dispositif de fermeture selon la revendication 1, caractérisé en ce que ledit instrument intérieur de coulée (20) a une hauteur de la section inférieure égale à environ 3 à 5 fois la hauteur totale de l'instrument intérieur de coulée.

5. Dispositif de fermeture selon la revendication 1 ci-dessus, caractérisé par le fait que l'épaisseur radiale de la base supérieure (24) de l'instrument intérieur de coulée (20) est approximativement égale au rayon R.

6. Dispositif de fermeture à coulisse selon la revendication 1, caractérisé par le fait que la hauteur du manchon inférieur en réfractaire (50) est égale à environ 6 à 12 fois le rayon R.

7. Dispositif de fermeture à coulisse selon la revendication 1, caractérisé par le fait qu'il présente un support d'instrument de coulée (11-12) pourvu d'un trou axial divisé en trois sections superposées; la première de ces sections commençant à la base a une surface conique (14) appropriée pour recevoir la surface conique correspondante (21) de l'instrument intérieur de coulée (20); la deuxième (15) de ces sections étant cylindrique (15) et ayant une hauteur d'environ 0,2 à 2 fois le rayon R; la troisième de ces sections étant à nouveau conique et s'élargissant vers le dessus avec un angle d'ouverture de la tangente égal à environ 0,2-0,4 et avec une hauteur d'environ 2 à 4 fois le rayon R.

8. Dispositif de fermeture à coulisse selon la revendication 7, caractérisé par le fait que le support d'instrument de coulée (11, 12) est constitué de deux éléments superposés dont les surfaces en contact sont ajustées avec des gradins de centrage correspondants (13).

9. Dispositif de fermeture à coulisse selon la revendication 1, caractérisé par le fait que chacune des plaques réfractaires (20) a une largeur comprise entre quatre et huit fois le rayon R et une longueur d'environ 12 à 16 fois ledit rayon R.

10. Dispositif de fermeture à coulisse selon la revendication 1, caractérisé par le fait que l'instrument intérieur de coulée (20) possède, sur le bord extérieur de sa base intérieure annulaire (25) une nervure de centrage annulaire (26) dont le siège correspondant est constitué d'une rainure annulaire (31) sur la surface supérieure de la plaque supérieure fixe (30).

11. Dispositif de fermeture à coulisse selon la revendication 1, caractérisé par le fait que l'instrument extérieur de coulée présente, à proximité du bord extérieur de sa base supérieure annulaire (24), une nervure annulaire de centrage dont le siège correspondant est une rainure annulaire (41) sur la surface supérieure de la plaque coulissante inférieure (40).

12. Dispositif de fermeture à coulisse selon les revendications 10 et 11, caractérisé par le fait que lesdites nervures (26) et rainures (31 et 41) dans la plaque fixe et l'instrument intérieur de coulée (20) d'une part, et dans la plaque coulissante (40) et l'instrument extérieur de coulée d'autre part, ont des diamètres différents.

13. Dispositif de fermeture à coulisse selon la revendication 1, caractérisé par le fait que la plaque fixe (30) et la plaque coulissante (40) sont équipées toutes deux d'un recouvrement en métal (60) constitué de tôle recouvrant la surface de la base opposée à la surface de contact réciproque et la surface latérale autour du bord (62).

14. Dispositif de fermeture à coulisse selon la revendication 13, caractérisé par le fait que les bords (62) dudit recouvrement (60) sont repliés vers l'extérieur pour faciliter l'insertion de la plaque réfractaire (30) et pour rigidifier le recouvrement (60).

15. Dispositif de fermeture à coulisse selon les revendications 13 et 14, caractérisé par le fait que le fond plat (61) dudit recouvrement métallique (60) a un orifice circulaire (65) dont le diamètre est supérieur à celui de la rainure annulaire (41) située sur la plaque réfractaire associée (40).

16. Dispositif de fermeture à coulisse selon la revendication 15, caractérisé par le fait que le bord dudit orifice (65) est replié vers l'intérieur, de façon à rigidifier le fond du recouvrement (60) et à maintenir ainsi la plaque réfractaire associée à l'écart dudit fond (61) de l'enveloppe suivant une certaine distance prédéterminée, égale à l'épaisseur requise pour le mortier réfractaire (64).

17. Dispositif de fermeture à coulisse selon la revendication 16, caractérisé par le fait que des parties en saillie (67) sont disposées sur le fond (61) du recouvrement (60) et sont capables de définir, avec les bords repliés dudit orifice, la surface de support de la plaque réfractaire (30) et ainsi l'épaisseur de mortier (64) requise.

18. Dispositif de fermeture à coulisse selon la revendication 1, caractérisé par le fait que le manchon inférieur réfractaire (50) a un recouvrement métallique (56) s'étendant par-dessus ses surfaces latérales extérieures.

19. Dispositif de fermeture à coulisse selon les revendications 10, 11 et 12, caractérisé par le fait que le profil radial desdites nervures (26) et rainures (41 et 31) annulaires a une forme sensiblement sinusoïdale et est constitué de préférence de trois arcs de cercle alternativement concaves et convexes.

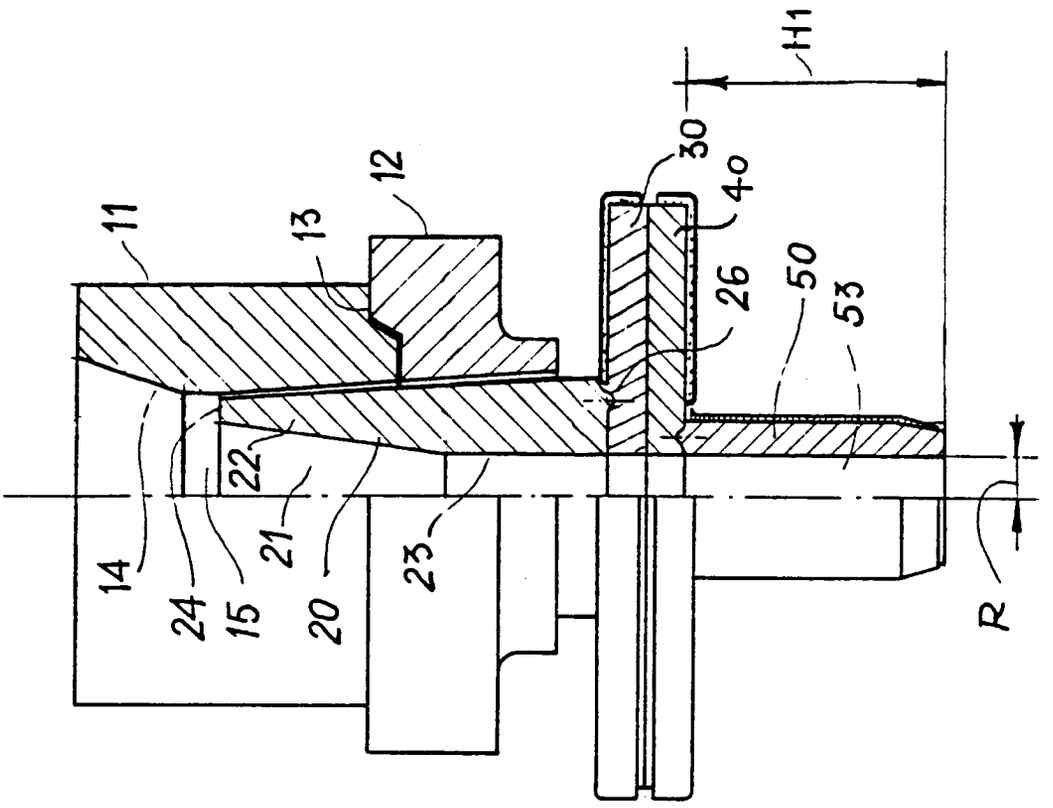


FIG. 1

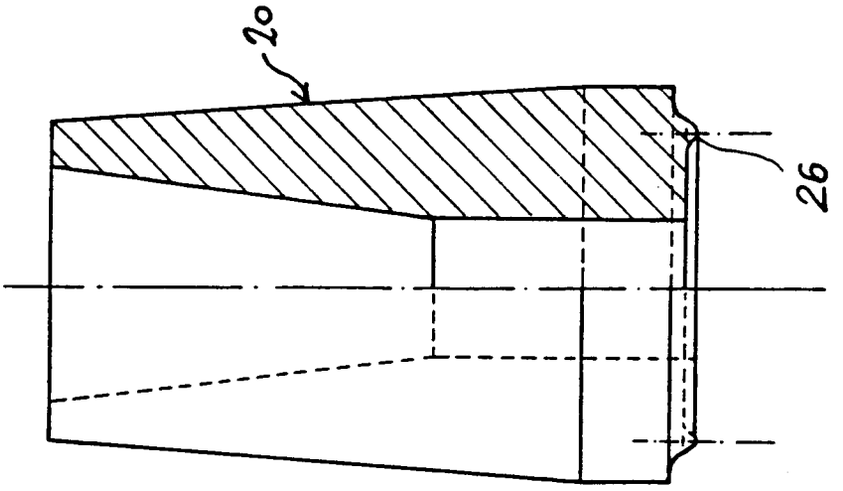


FIG. 2

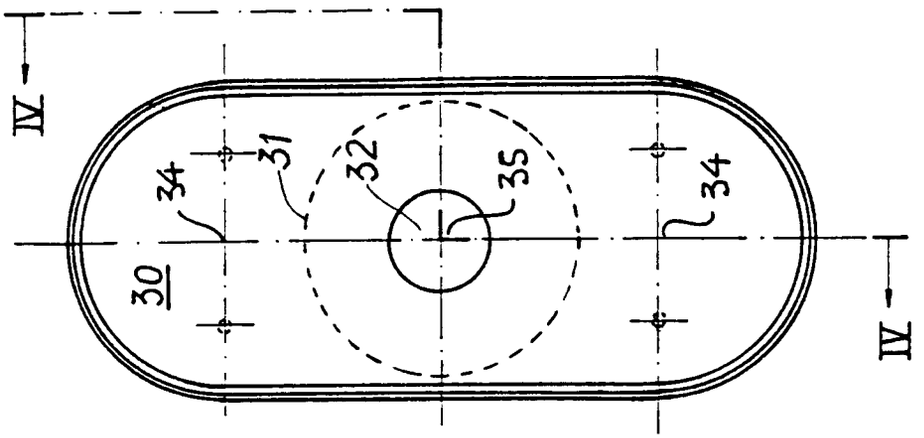


FIG. 3

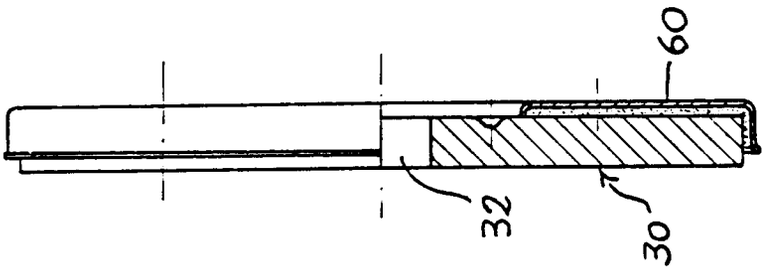


FIG. 4

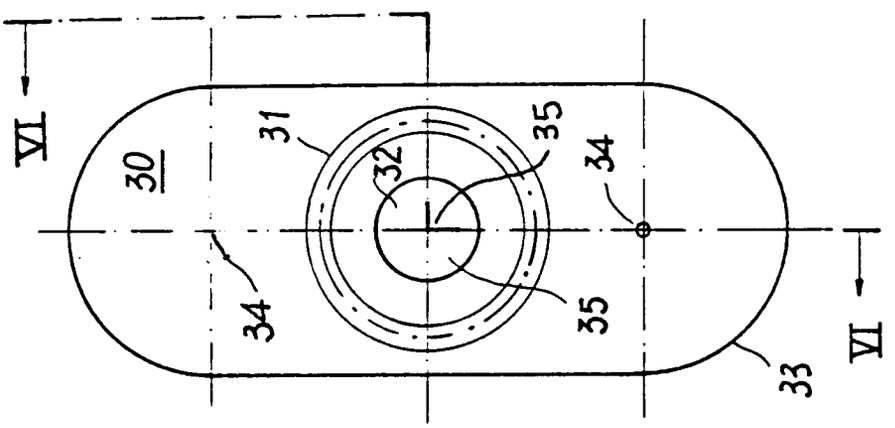


FIG. 5

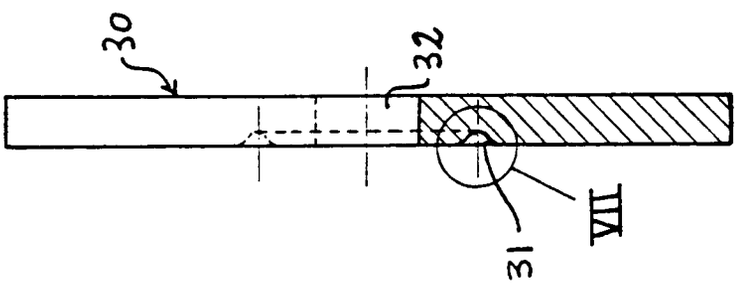


FIG. 6

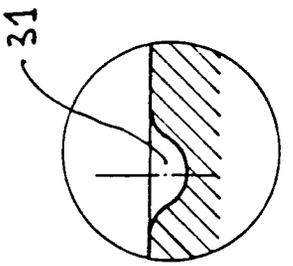


FIG. 7

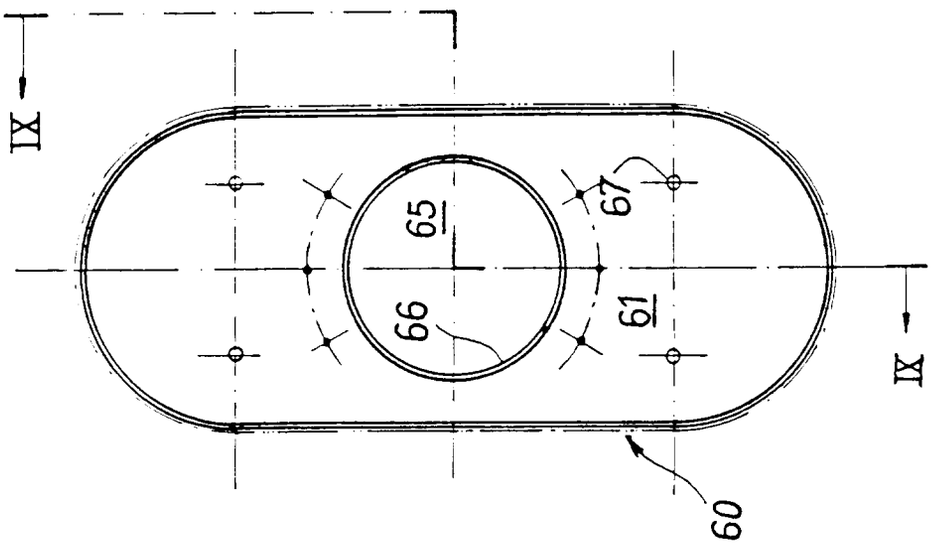


FIG.8

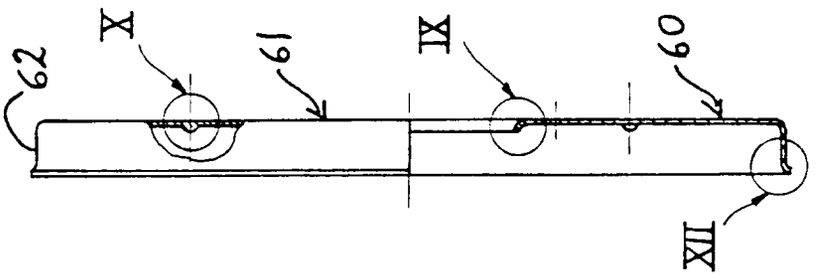


FIG.9

FIG.10

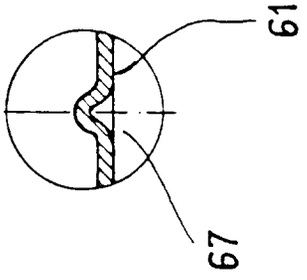


FIG.11

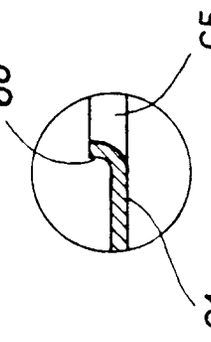
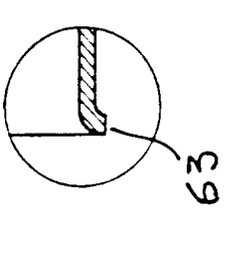


FIG.12



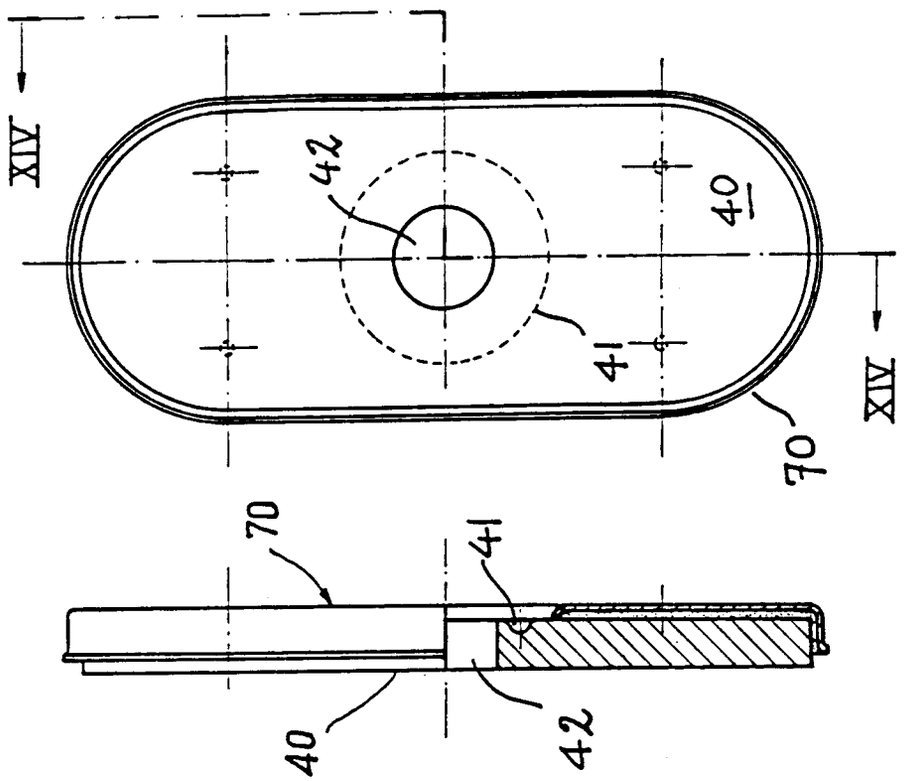


FIG. 13

FIG. 14

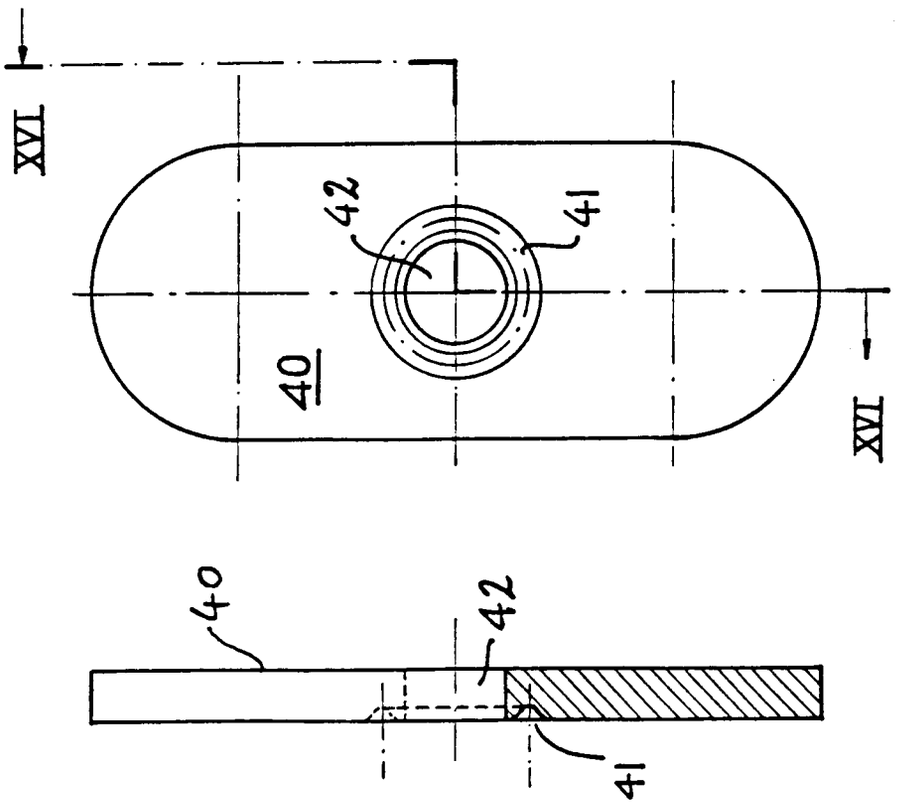


FIG. 15

FIG. 16

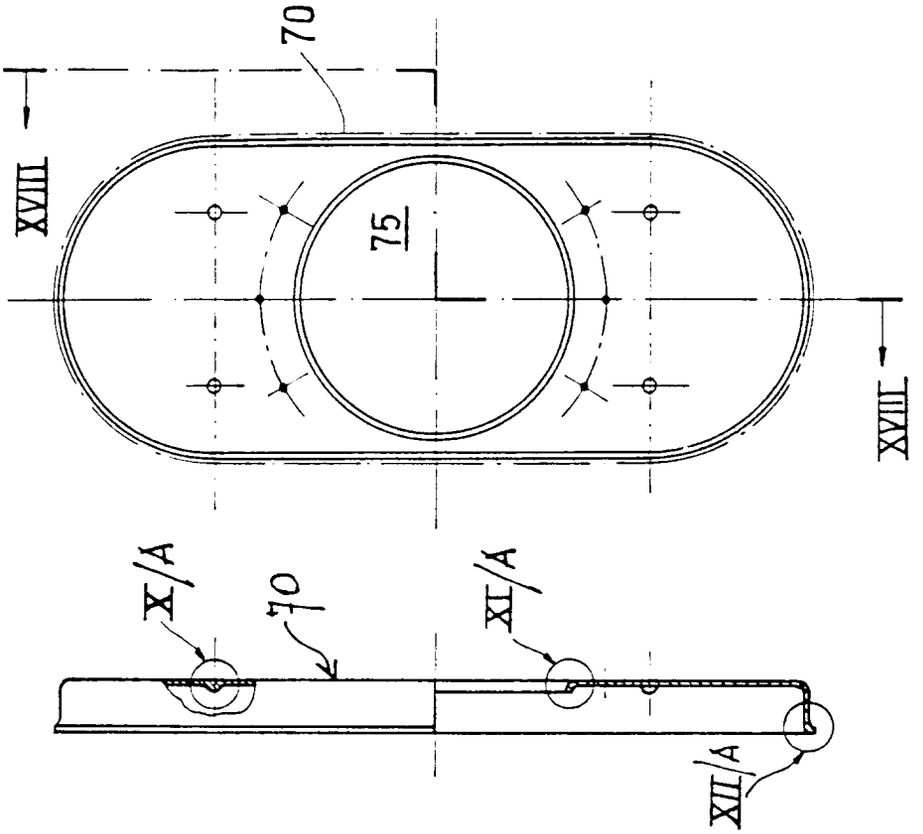


FIG.17

FIG.18

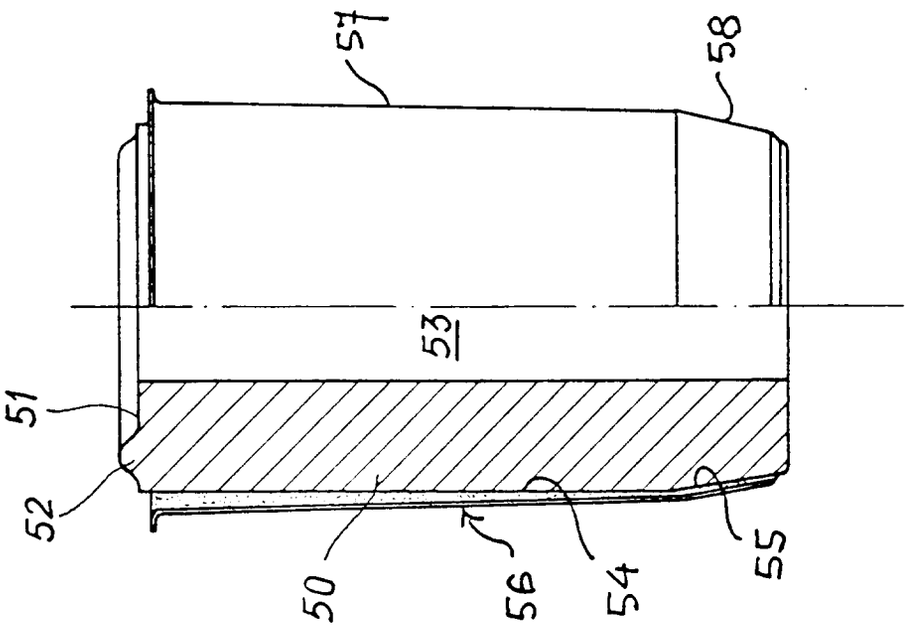


FIG.19