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⑰ **A valving element for a plate-type valve.**

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Description

This invention pertains, specifically, to valving elements, and generally to valves within which such elements function, such as the valves used in reciprocating gas compressors. These valves are essentially one-way devices allowing gas flow in a single direction. They (i.e., the valving elements therein) respond to pressure differences across them and, commonly, closing springs are used to assist the valving elements therein in closing at a particular time relative to the compressor cycle.

Valving elements come in a variety of types, and the particular one addressed by this disclosure is of the plate type well known in the prior art. Exemplary thereof are the plate-type valving elements in the "Plate Valve" disclosures in U.S.—A—3,327,731 and 3,703,912. Each of such valving elements, essentially, is a series of concentric rings joined together by webs and strengthened by radial ligaments. They can range in diameter from approximately three inches up to twelve inches, and have a typical plate thickness of .080 inches (1 inch $\triangleq$ 25.4 mm).

Valving elements in plate-type valves cycle as high as twenty times per second with total lifts of approximately .060 inches. Typically, impact velocities thereof, at the valve seat, are in the four to eight feet (1 foot $\triangleq$ 304.8 mm) per second range although, in some cases, impacts in excess of ten feet per second have been measured. Impact of the valving element with the valve seat has been shown, experimentally, to produce high stresses in the outer rim near the theradjacent flow port(s). Typically, the valving element approaches the valve seat in a tilted manner. Contact then takes place over a small area, i.e., a point contact, of the valving element periphery, causing bending. Eventually, the valving element plate material fatigues, and a crack develops, forcing the machine (i.e., gas compressor) to be shut down for repairs to be made.

GB—A—1,287,164 discloses as defined in the first part of claim 1 a valve plate for piston compressors, the valve plate comprising concentric rings with adjacent rings interconnected by radial webs. The major part of the outer edge of the valve plate is circular and accordingly each part of any one of the concentric rings is equidistant from the outer edge. However, where the radial webs are provided (between the concentric rings), the valve plate is provided with radially outwardly extending projections which are accordingly spaced apart around the circumference of the valve plate. The function of the projections is to protect the edge of the plate against any powerful impact during the opening and closing movements of the valve. However, the valve plate does not overcome the effect of full line impacting and only allows for point impacts.

It is an object of the invention to provide a valving element for a plate-type valve which is not subject to early fatigue, failure and fracture.

According to the present invention as defined in claim 1, there is provided a valving element for a plate-type valve, comprising a plate; said plate having apertures formed therein for the conduct of fluid therethrough, a given centre, and an outer periphery defining the outermost edge of said plate; wherein said apertures subtend given arcs drawn from said given centre; and characterised in that at least given ones of said apertures each have a first portion intermediate the length thereof which is more proximate to said edge than at least another portion thereof which subsists at one side of said first portion and towards the end of the aperture.

For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:—

Figure 1 is a plan view of a prior art, plate-type, valving element similar to those in the cited U.S. patents;

Figures 2A and 2B are (a) a partial plan view of an edge of such a prior art, valving element, and (b) an illustration in simple line drawing of such a plate approaching contact with its valving plate, the angle of incidence being shown in exaggeration only to clarify the matter;

Figures 3A and 3B are illustrations, generally corresponding with Figures 2A and 2B, representing the valving element (of Figures 2A and 2B) upon its having made contact with the valve seat, and showing a fatigue fracture occurring therein;

Figure 4 is a plan view of a first embodiment of the valving element, according to the invention;

Figure 5 is a greatly enlarged plan view of a portion of the valving element of Figure 4;

Figures 6 and 7 are plan views, similar to that of Figure 5, depicting alternate embodiments of the invention; and

Figure 8 is a plan view of the first embodiment of the invention, again with geometric reference lines superimposed thereon.

As shown in Figs. 1 to 3, known plate-type valving elements 10 commonly comprise a plate 12 having a circular edge or periphery 14, and having a plurality of apertures, or flow ports 16, formed therethrough, the periphery 14 and the flow ports 16 being concentric about the radial centre 18 of the plate 12. The apertures, or flow ports 16, are spaced in the radial direction by webs 20, and in the circumferential direction by radially extending ligaments 22. The webs 20 and ligaments 22 strengthen the plate. In use, the plates 12 are commonly cycled at a high rate, and almost impact on the complementary valve seat at an angle. Consequently, inwardly of the point of contact, bending occurs. Too soon, the plate metal fatigues and experiences a fracture 24, usually through an area adjacent an end of a radially-outermost flow port 16.

In order to render such valving elements more durable and long-lived, the invention contemplates the strengthening thereof adjacent the ends of the outermost flow ports 16, by spacing at

least one end of such outermost flow ports 16 a greater distance from the periphery 14 than the radial spacing of an intermediate part of such outermost flow passages from the periphery. This is achieved in one embodiment by configuring the periphery of the plate as a plurality of arcuate portions joined by rectilinear edge portions, the arcuate edge portions having a radius of curvature less than that of the arcuate flow apertures. This results in a plate 12a having an undulated or scalloped periphery 14a, as shown in the embodiment of Figs. 4 and 5. The rectilinear edge portions 26 avoid point-contact impacts. It can be seen that the outermost flow ports 16 are substantially in parallel with most adjacent, flat edge sections 26 of the periphery 14a of the plate 12a. The outermost ports 16 are spaced between by arcuate sectors 28 which are substantially devoid of flow ports; sectors 28, for example, encompass areas subsisting between points "A" and "B", "C" and "D", and "E" and "F", and radius origins 30.

The flow ports 16 subtend the angles "I", "II", "III" and, in fact, are concentric with the radial centre 32 of the plate 12a. The sectors 28, however, are drawn on foreshortened radii from the origins 30. Hence, they define plate portions, between the outermost ports 16, which are like extending lobes 34. By way of understanding a feature of the invention, each outermost port 16 may be considered to be subdivided into sections "a" through "e". The centre section "a", as can be seen, is more proximate to the edge or periphery 14a of the plate 12a than are the terminal sections "d" and "e". Increased spacing from the periphery 14a, for sections "d" and "e" is provided, therefore, by the arcuate sectors 28 or lobes 34 thereof, which, due to their foreshortened radii, define some of the undulation of the periphery 14a.

Each of the outermost ports 16 has a pair of surfaces 36 and 36a which are tangent to an imaginary, broken, straight line 38 drawn therebetween. This line 38 may also be regarded as a chord to the arcuate inner edge of the outermost ports 16. Lines 38 are parallel with the thereadjacent flat edge sections 26 of the periphery 14a, in that such sections 26 are linear. Sections 26 obtain between peripheral points "B" and "C", and "E" and "A"; further ones thereof extend from points "D" and "F".

The ends of the outermost ports 16, then, which were at risk in prior art, plate-type valving elements, are considerably more inboard of the periphery 14a in this embodiment of the invention. Such ends enjoy a greater, protective width 42 of plate material to isolate them from impacting shocks, and the latter shocks are more readily dissipated through the thereadjacent sectors 28. As for the greater, intermediate portions of the outermost ports 16, they too are less subject to damaging shock. The thereadjacent linear sections 26 can only effect a line contact, upon impactingly closing on a complementary valve seat (or stop plate). This defines a marked

improvement over prior art valving elements which, for being wholly arcuate about the periphery thereof, unavoidably must sustain localized, point-contact impacts.

The plate 12a has a maximum outside diameter 44, defined by the sectors 28 or lobes 34, and represented by a broken line, as well as a minimum outside diameter 46, defined by the sections 26, and represented by a further broken line. The configuration of the plate 12a, then, comprises portions defined in part by sectors 28 or lobes 34 which are addendums to the minimum outside diameter 46, and portions defined in part by the sections 26 which are dedendums from the maximum outside diameter 44.

An alternative embodiment of the invention is shown in Figure 6, which is a fragmentary view, similar to Figure 5. Here too, the outermost flow ports 16a of the plate 12b are arcuate but in this case they are of a lesser radius of curvature so that instead of being concentric formed through arcs drawn from radial centres 48 which are about the centre 32a of the plate each is concentric about a separate centre 48 spaced radially outward from the radial centre 32a of the plate 12b. It is preferred that the centres 48 be equally spaced from the centre 32a. By this teaching, the valve plate 12b may have a circular configuration of the periphery 14b, concentric about the centre 32a, although the ends of the outermost ports 16a are spaced further from the periphery than an intermediate portion thereof so that these ends are protected from early fatigue and failure. The ports 16a have an arc of narrower angle and thus provide the increased radial dimension 42a between the outer ends thereof and a proximity thereof to the outer periphery 14b which would obtain if ports 16a were concentric with centre 32a. To revert to Figure 1, such more narrowly radiused ports 16a (as provided by this invention), and their radial centres 48, are shown, thereon, in two locations, by ports 16a depicted by broken or phantom lines. Thus it can be appreciated how simply the prior art valving elements can easily be improved by a practice of the invention.

As explained, and as shown in Figure 5, plate 12a is so configured as to define an improved, increasing spacing, of both of the ends, i.e. sections "d" and "e", of outermost ports 16 from the edge or periphery 14a. The lobes 34, however, defining the addendums to the diameter 46, extend further than the width 42 thereof obtaining at the port ends. The further alternative embodiment shown in Figure 7, comprises a plate 12c in which the maximum width afforded by the lobes 34 is used to protect first ends of the outermost ports 16.

The Figure 7 embodiment has the lobes 34' and linear sections 40 slightly rotated, relative to the outermost ports 16. Accordingly, first ends, i.e., sections "e", of the latter ports are substantially in the midplane of the sectors 28. Sections "e", of the outermost ports, then, are at a maximum width 42b from the periphery 14c of the plate 12c. Second ends, i.e., sections "d" of the outermost

ports 16, are spaced apart from the periphery 14c no further, perhaps, than in the prior art plates. However, the latter ends or sections "d" subsist in approximately the midplane of the peripheral linear sections 40. Consequently, impacts are borne there along a line contact, and the impacting shock is more widely dispersed.

The geometric definitions of the invention are critical to its superior durability. Accordingly, to enhance the disclosure and its clarity, Figure 8 is provided. The latter corresponds to the first embodiment, as depicted in Figures 4 and 5. As shown in Figure 8, plate 12a has a first, central, circular area 50 having an outer circumference 52; the latter is represented by a phantom circle, and is drawn from the plate centre 32 on a given radius. Plate 12a, then, has a second, outer, annular area 54 which is integral with, and in circumscription of, first area 50. The radius origins 30 of the sectors 28 are traversed by the circumference 52, and the sectors 28, as depicted, are spaced apart from each other.

Each of the sectors 28 is bounded by an arc 56 which is a portion of an imaginary circle 58 (two of which circles are represented in phantom). Arcs 56, of adjacent sectors 28, or lobes 34, bisect at points 60 in area 54. Then, radial lines 62, drawn radially outward from the centre 32, and through points 60, traverse the outermost apertures or flow ports 16. Lines 62 subdivide these flow ports, traversing the midpoint of the length thereof.

The arcs 56 extend through approximately fifty degrees, and on opposite sides of each they merge into tangency with the intervening linear sections 26 of the periphery 14a.

It will be appreciated that the invention provides a valving element for a plate-type valve comprising a plate having flow apertures which are elongate about a given centre of the plate characterised in that at least one of the periphery of the plate and the outermost of the flow apertures considered radially of said centre is configured to provide a greater spacing between at least one end of such outermost apertures and the periphery of the plate than is provided between an intermediate part of said apertures and said periphery.

With advantage the outermost apertures are arcuate and concentric about said centre, the periphery of the plate is configured as a plurality of spaced rectilinear edge portions joined by arcuate portions having a radius of curvature less than said outermost apertures, said at least one end of the outermost apertures lies on a radius with respect to said centre which intersects a peripheral arcuate portion and said intermediate portion lies on a radius which intersects a peripheral rectilinear edge portion.

Preferably both ends of the outermost apertures lie on radii with respect to said centre one of which radii intersects a first peripheral arcuate position and the second of which radii intersects a second peripheral arcuate portion.

In an alternative embodiment the periphery of

the plate is circular about the centre and the outermost apertures are arcuate to a radius of curvature less than that of the periphery.

Claims

1. A valving element for a plate-type valve, comprising a plate (12a, 12b, 12c), said plate having apertures (16) formed therein for the conduct of fluid therethrough, a given centre (32), and an outer periphery (14a) defining the outermost edge of said plate; wherein said apertures subtend given arcs (I, II, III) drawn from said given centre; and characterised in that at least given ones of said apertures each have a first portion (a) intermediate the length thereof which is more proximate to said edge than at least another portion thereof (d—b or c—e) which subsists at one side of said first portion and towards the end of the aperture.

2. A valving element according to claim 1, characterised in that said given ones of said apertures each have surfaces (36, 36a), adjacent opposite ends thereof, which are tangent to a straight line (38) drawn between said surfaces; and respective sections (26) of said edge, which are most adjacent to said given ones of said apertures, are straight and are parallel with said drawn lines (Fig. 5).

3. A valving element according to claim 1, characterised in that sections (34) of said edge are arcuately formed from radial centres (30) spaced apart from said given centre (Fig. 8).

4. A valving element according to claim 1, characterised in that sections (26) of said edge are linear; and said first portions of said given ones of said apertures are more proximate, as aforesaid, to said linear sections of said edge (Fig. 4, 5).

5. A valving element according to claim 4, characterised in that each of said linear sections (26) of said edge (14a) join others thereof through intervening sectors (28) of said plate; each of said intervening sectors terminates in a portion of said edge (34) which has an arcuate conformation drawn from a radial centre (30) located outward from said given centre (Fig. 5).

6. A valving element according to claim 5, characterised in that said sectors (28) encompass areas of said plate (12a) which are substantially devoid of apertures.

7. A valving element according to claim 1, characterised in that said plate has a maximum outside diameter (44); and given sections (26) of said periphery comprise dedendums relative to said diameter.

8. A valving element according to claim 1, characterised in that said plate has a minimum outside diameter (46); and prescribed sections (34) of said periphery comprise addendums relative to said diameter.

9. A valving element according to claim 1, characterised in that said apertures (16) are of arcuate configuration and are concentric with said given centre (32).

10. A valving element according to claim 1,

characterised in that given sections (26, 40) of said edge define means, responsive to a closure thereof onto a flat surface, for causing said given sections to impact, with such a flat surface, only with full line contacts (Fig. 5, 7).

11. A valving element according to claim 10, characterised in that said given sections (26) of said edge are more proximate to said first portions (a) of said given ones of said apertures (Fig. 5).

12. A valving element according to claim 10, characterised in that said given sections (40) of said edge are more proximate to at least one of said another portions (d—b) of said apertures (Fig. 7).

13. A valving element according to claim 1, characterised in that said periphery is defined, at least in part, by a plurality of radii drawn from radial centres (30) which are spaced apart from said given centre; wherein said plate further has a first, central, circular area (50) having a given circumference (52); said circumference has a radius drawn from said given centre; said plate further has a second, outer, annular area (54) integral with, and in circumscription of, said first area; said radial centres (30) are traversed by said circumference (52) and said plurality of radii define said second area with a plurality of spaced-apart sectors (28) (Fig. 8).

14. A valving element according to claim 13, characterised in that each of said sectors (28) is defined by an arc (56) which intersects another such arc, of another, adjacent one of said sectors, at a prescribed point (60) on said second area; and an imaginary, radial line (62), drawn radially outward from said given centre (32) and through said prescribed point, traverses an outermost one of said apertures (16) substantially across a mid-point of the length of said one aperture.

15. A valving element according to claim 13, characterised in that said plurality of radii define said edge with a plurality of spaced-apart, arcuate lobes (34); said edge has a plurality of linear sections (26); and adjacent ones of said lobes are joined therebetween by an intervening one of said linear sections.

16. A valving element according to claim 15, characterised in that each of said intervening, linear sections (26) is tangent to those of said adjacent lobes which said linear section joins.

17. A valving element according to claim 1, characterised in that outermost ones of said apertures, considered radially of said centre, are arcuate and concentric about said centre, the periphery of the plate is configured as a plurality of spaced rectilinear edge sections joined by arcuate sections having a radius of curvature less than said outermost apertures, at least one end of each of such outermost apertures lies on a radius with respect to said centre which intersects a peripheral arcuate section and said intermediate portion of such outermost apertures lies on a radius which intersects a peripheral rectilinear edge section.

18. An element according to claim 17, charac-

terised in that both ends of such outermost apertures lie on radii, with respect to said centre, one of which radii intersects a first peripheral arcuate section and the second of which radii intersects a second peripheral arcuate section.

19. An element according to claim 1, characterised in that the periphery of the plate is circular about the centre and the outermost apertures are arcuate to a radius of curvature less than that of the periphery (Fig. 6).

Patentansprüche

1. Ventilelement für ein Plattenventil, mit einer Platte (12a; 12b; 12c); welche Platte in ihr geformte Öffnungen (16) für die Hindurchleitung eines Fluids, ein gegebenes Zentrum (32) und einen den äußersten Plattenrand definierenden Außenumfang (14a) aufweist; wobei die Öffnungen sich über gegebene Bögen (I, II, III) erstrecken, die vom gegebenen Zentrum gezogen sind; und dadurch gekennzeichnet, daß wenigstens bestimmte Öffnungen je einen ersten Teil (a) in einem Zwischenbereich ihrer Länge haben, der näher dem Rand ist als wenigstens ein anderer Teil (d—b oder c—e) hiervon, welcher an einer Seite des ersten Teiles und zum Ende der Öffnung hin liegt.

2. Ventilelement nach Anspruch 1, dadurch gekennzeichnet, daß die bestimmten Öffnungen je Flächen (36, 36a) benachbart ihren entgegengesetzten Enden haben, die eine zwischen den Flächen gezogene gerade Linie (38) berühren; und entsprechende Abschnitte (26) des Randes, die den bestimmten Öffnungen am nächsten liegen, gerade und parallel zu den gezogenen Linien sind (Fig. 5).

3. Ventilelement nach Anspruch 1, dadurch gekennzeichnet, daß Abschnitte (34) des Randes von radialen Zentren (30) aus, die in Abstand vom gegebenen Zentrum vorgesehen sind, bogenförmig geformt sind (Fig. 8).

4. Ventilelement nach Anspruch 1, dadurch gekennzeichnet, daß Abschnitte (26) des Randes linear sind; und die ersten Teile der bestimmten Öffnungen näher, wie oben erwähnt, diesen linearen Abschnitten des Randes sind (Fig. 4, 5).

5. Ventilelement nach Anspruch 4, dadurch gekennzeichnet, daß jeder lineare Abschnitt (26) des Randes (14a) an andere hiervon über dazwischenliegende Sektoren (28) der Platte anschließt; jeder dazwischenliegende Sektor in einem Teil des Randes (34) endet, der eine bogenförmige Gestalt von einem radialen Zentrum (30) ausgezogen hat, das außerhalb des gegebenen Zentrums angeordnet ist (Fig. 5).

6. Ventilelement nach Anspruch 5, dadurch gekennzeichnet, daß die Sektoren (28) Bereiche der Platte (12a) umfassen, die im wesentlichen frei von Öffnungen sind.

7. Ventilelement nach Anspruch 1, dadurch gekennzeichnet, daß die Platte einen maximalen Außenseitendurchmesser (44) hat; und gegebene Abschnitte (26) des Umfangs zurückgezogene Teile bezüglich dieses Durchmessers aufweisen.

8. Ventilelement nach Anspruch 1, dadurch gekennzeichnet, daß die Platte einen minimalen Außenseitendurchmesser (46) hat; und vorgeschriebene Abschnitte (34) des Umfangs vorspringende Teile bezüglich dieses Durchmessers aufweisen.

9. Ventilelement nach Anspruch 1, dadurch gekennzeichnet, daß die Öffnungen (16) Bogenform haben und konzentrisch bezüglich des gegebenen Zentrums (32) sind.

10. Ventilelement nach Anspruch 1, dadurch gekennzeichnet, daß gegebene Abschnitte (26, 40) des Randes auf ein Schließen hievon auf einer flachen Fläche ansprechende Mittel definieren, um diese Abschnitte zu veranlassen, bei einer solchen flachen Fläche nur in einer vollständigen Linienberührung aufzutreffen (Fig. 5, 7).

11. Ventilelement nach Anspruch 10, dadurch gekennzeichnet, daß die gegebenen Abschnitte (26) des Randes näher den ersten Abschnitten (a) der gegebenen Öffnungen sind (Fig. 5).

12. Ventilelement nach Anspruch 10, dadurch gekennzeichnet, daß die gegebenen Abschnitte (40) des Randes näher zumindest einem der anderen Teile (d—b) der Öffnungen sind (Fig. 7).

13. Ventilelement nach Anspruch 1, dadurch gekennzeichnet, daß der Umfang zumindest teilweise durch eine Mehrzahl von Radien definiert ist, die von radialen Zentren (30) gezogen sind, die in Abstand vom gegebenen Zentrum vorliegen; wobei die Platte weiter einen ersten, zentralen kreisförmigen Bereich (50) mit einem gegebenen Kreisumfang (52) hat; der Kreisumfang einen vom gegebenen Zentrum gezogenen Radius hat; die Platte weiter einen zweiten, äußeren, ringförmigen Bereich (54) in einem Stück mit dem ersten Bereich und ihn umschreibend hat; die radialen Zentren (30) vom Kreisumfang (52) durchlaufen werden und die Mehrzahl von Radien den zweiten Bereich mit einer Mehrzahl von mit Abstand voneinander vorgesehenen Sektoren (28) definiert (Fig. 8).

14. Ventilelement nach Anspruch 13, dadurch gekennzeichnet, daß jeder der Sektoren (28) durch einen Bogen (56) definiert ist, der einen anderen solchen Bogen eines anderen, benachbarten Sektors in einem vorgeschriebenen Punkt (60) im zweiten Bereich schneidet; und eine gedachte radiale Linie (62), die vom gegebenen Zentrum (32) radial auswärts und durch den vorgeschriebenen Punkt gezogen ist, eine äußerste der Öffnungen (16) im wesentlichen in der Mitte der Länge dieser einen Öffnung quert.

15. Ventilelement nach Anspruch 13, dadurch gekennzeichnet, daß die genannte Mehrzahl von Radien den Rand mit einer Mehrzahl von mit Abstand voneinander angeordneten, bogenförmigen Vorsprüngen (34) definiert; der Rand eine Mehrzahl von linearen Abschnitten (26) hat; und benachbarte Vorsprünge untereinander durch einen dazwischenliegenden der geraden Abschnitte verbunden sind.

16. Ventilelement nach Anspruch 15, dadurch gekennzeichnet, daß jeder der dazwischenliegenden geraden Abschnitte (26) zu jenen benachbar-

ten Vorsprüngen, die er verbindet, tangential verläuft.

17. Ventilelement nach Anspruch 1, dadurch gekennzeichnet, daß die äußersten Öffnungen, radial vom Zentrum gesehen, bogenförmig und konzentrisch zum genannten Zentrum sind, der Umfang der Platte als Mehrzahl von beabstandeten geradlinigen Randabschnitten, die durch bogenförmige Abschnitte mit einem Krümmungsradius kleiner als die äußersten Öffnungen verbunden sind, gestaltet ist, wenigstens ein Ende einer jeden der äußersten Öffnungen auf einem Radius bezüglich des Zentrums liegt, der einen bogenförmigen Umfangsabschnitt schneidet, und der Zwischenteil dieser äußersten Öffnungen auf einem Radius liegt, der einen geradlinigen Umfangsrandabschnitt schneidet.

18. Element nach Anspruch 17, dadurch gekennzeichnet, daß beide Enden der äußersten Öffnungen auf Radien bezüglich des Zentrums liegen, einer der Radien einen ersten bogenförmigen Umfangsabschnitt schneidet und der zweite der Radien einen zweiten bogenförmigen Umfangsabschnitt schneidet.

19. Element nach Anspruch 1, dadurch gekennzeichnet, daß der Umfang der Platte um das Zentrum herum kreisförmig ist und die äußersten Öffnungen bogenförmig sind bei einem Krümmungsradius kleiner jenem des Umfangs (Fig. 6).

Revendications

1. Un élément de clapet pour un clapet du type à plaque, comprenant une plaque (12a, 12b, 12c), ladite plaque étant munie d'ouvertures (16) formée à l'intérieur pour y permettre la traversée de fluide, un centre défini (32), et une périphérie extérieure (14a) définissant le bord le plus extérieur de ladite plaque, dans lequel lesdites ouvertures sous-tendent des arcs définis (I, II, III) tracés à partir dudit centre défini; et caractérisé en ce qu'au moins un certain nombre desdites ouvertures comportent chacune une première partie (a) placée dans une position intermédiaire par rapport à sa longueur et qui est plus proche dudit bord qu'au moins une autre partie de l'ouverture (d—b ou c—e) subsistent d'un côté de ladite première partie et vers l'extrémité de l'ouverture.

2. Un élément de clapet selon la revendication 1, caractérisé en ce que lesdites ouvertures dudit certain nombre d'ouvertures comportent chacune des surfaces (36, 36a), adjacentes à leurs extrémités opposées et qui sont tangentes à une ligne droite (38) tirée entre lesdites surfaces; et en ce que les sections respectives (26) dudit bord, qui sont les plus proches desdites ouvertures dudit certain nombre d'ouvertures, sont droites et sont parallèles auxdites lignes tracées (figure 5).

3. Un élément de clapet selon la revendication 1, caractérisé en ce que les sections (34) dudit bord sont formées arquées, à partir du centre radiaux (30) placé à distance dudit centre défini (figure 8).

4. Un élément de clapet selon la revendication 1, caractérisé en ce que les sections (26) dudit

bord sont linéaires; et en ce que lesdites premières parties desdites ouvertures dudit certain nombre d'ouvertures sont plus proches, comme mentionné précédemment, desdites sections linéaires dudit bord (figures 4, 5).

5. Un élément de clapet selon la revendication 4, caractérisé en ce que chacune desdites sections linéaires (26) dudit bord (14a) relie d'autres sections par l'intermédiaire de secteurs de liaison (28) de ladite plaque; en ce que chacun desdits secteurs de liaison en cause se termine dans une partie dudit bord (34) qui présente une conformation arquée, tirée à partir d'un centre radial (30) situé à l'extérieur dudit centre défini (figure 5).

6. Un élément de clapet selon la revendication 5, caractérisé en ce que lesdits secteurs (28) recouvrent des zones de ladite plaque (12a) qui sont sensiblement exemptes d'ouvertures.

7. Un élément de clapet selon la revendication 1, caractérisé en ce que ladite plaque présente un diamètre extérieur maximal (44); et en ce que lesdites sections définies (26) de ladite périphérie comportent des parties en creux par rapport audit diamètre.

8. Un élément de clapet selon la revendication 1, caractérisé en ce que ladite plaque présente un diamètre extérieur minimal (46); et en ce que les sections précitées (34) de ladite périphérie comportent des parties en saillie par rapport audit diamètre.

9. Un élément de clapet selon la revendication 1, caractérisé en ce que lesdites ouvertures (16) présentent une configuration arquée et en ce qu'elles sont concentriques audit centre défini (32).

10. Un élément de clapet selon la revendication 1, caractérisé en ce que les sections définies (26, 40) dudit bord définissent des moyens apte à réaliser une obturation sur une surface plane, de manière à obliger lesdites sections définies à venir s'écraser sur une telle surface plane, seulement en venant en contact sur toute une ligne (figures 5, 7).

11. Un élément de clapet selon la revendication 10, caractérisé en ce que lesdites sections définies (26) dudit bord sont plus proches desdites premières parties (a) desdites ouvertures dudit certain nombre d'ouvertures (figure 5).

12. Un élément de clapet selon la revendication 10, caractérisé en ce que lesdites sections définies (40) dudit bord sont plus proches d'au moins l'une desdites autres parties (d—b) desdites ouvertures (figure 7).

13. Un élément de clapet selon la revendication 1, caractérisé en ce que ladite périphérie est définie, au moins en partie, par une pluralité de rayons tracés à partir du centre radiaux (30) qui sont placés à distance dudit centre défini; dans lequel ladite plaque comporte, en outre, une première zone circulaire centrale (50) de circonférence définie (52); en ce que ladite circonférence présente un rayon tracé à partir dudit centre défini; en ce que ladite plaque comporte en outre

une seconde zone annulaire extérieure (54) monobloc avec ladite première zone et l'entourant; en ce que lesdits centres radiaux (30) sont traversés par ladite circonférence (52) et en ce que ladite pluralité de rayons définissent ladite seconde zone avec une pluralité desdits secteurs (28) placé à distance les uns des autres (figure 8).

14. Un élément de clapet selon la revendication 13, caractérisé en ce que chacun desdits secteurs (28) est défini par un arc (56) qui coupe un autre arc identique, d'un autre secteur adjacent à l'un desdits secteurs, en un point défini (60) sur ladite seconde zone; en ce qu'une ligne imaginaire radiale (62), tracée radialement vers l'extérieur, à partir dudit centre défini (32) et via ledit point prédéterminé, traverse une des plus extérieures desdites ouvertures (16), sensiblement par un point milieu sur la longueur de ladite ouverture.

15. Un élément de clapet selon la revendication 13, caractérisé en ce que ladite pluralité de rayons définissent ledit bord avec une pluralité de lobes arqués (34) placés à distance les uns des autres; en ce que ledit bord comporte une pluralité de sections linéaires (26); et en ce que les lobes adjacents parmi lesdits lobes sont reliés entre eux par l'une desdites sections linéaires en cause.

16. Un élément de clapet selon la revendication 15, caractérisé en ce que chacune desdites sections linéaires en cause (26) est tangente à ceux desdits lobes adjacents qui sont reliés à ladite section linéaire.

17. Un élément de clapet selon la revendication 1, caractérisé en ce que les plus extérieures desdites ouvertures, considérées radialement à partir dudit centre, sont arquées et concentriques audit centre, en ce que la périphérie de la plaque présente une configuration sous la forme d'une pluralité de sections de bordure rectilignes placées à distance les unes des autres, reliées par des sections arquées, présentant un rayon de courbure inférieur auxdites ouvertures les plus extérieures, au moins une extrémité de chacune desdites ouvertures les plus extérieures se trouvant sur un rayon, par rapport audit centre, qui coupe une section périphérique arquée et en ce que ladite partie intermédiaire des ouvertures les plus extérieures se trouvent sur un rayon qui coupe une section de bordure rectiligne périphérique.

18. Un élément selon la revendication 17, caractérisé en ce que les deux extrémités de ces ouvertures les plus extérieures se trouvent, par rapport audit centre, sur des rayons dont l'un coupe une première section périphérique arquée et dont le second coupe une seconde section périphérique arquée.

19. Un élément selon la revendication 1, caractérisé en ce que la périphérie de la plaque est circulaire autour du centre et en ce que les ouvertures les plus extérieures sont arquées sur un rayon de courbure inférieur à celui de la périphérie (figure 6).

FIG. 1
PRIOR ART

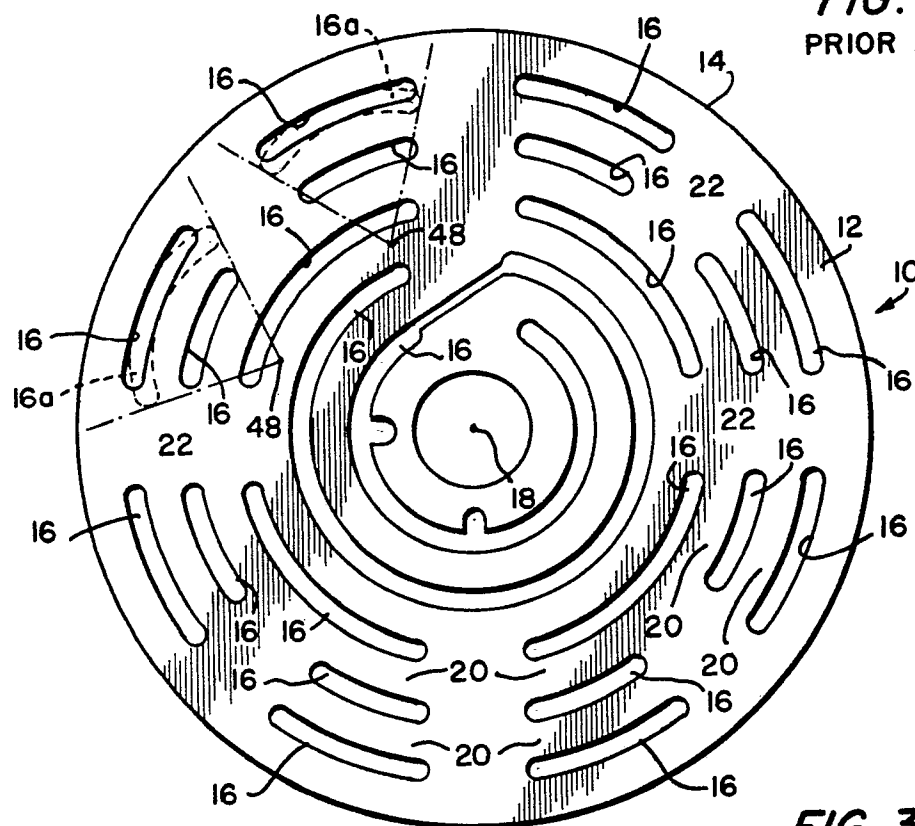


FIG. 2A
PRIOR ART

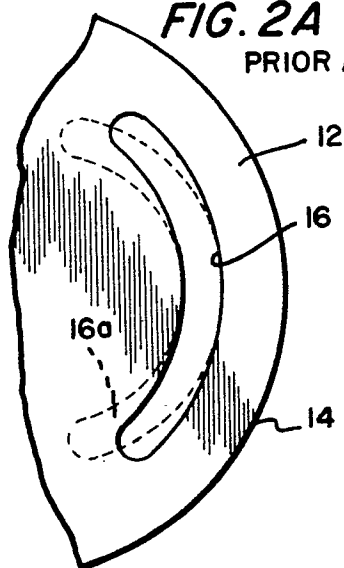


FIG. 3A
PRIOR ART

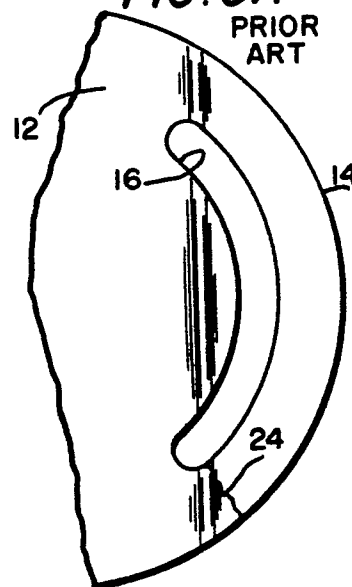


FIG. 2B
PRIOR ART

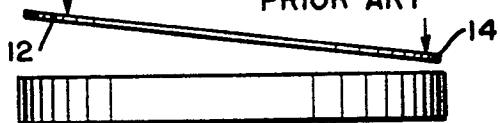
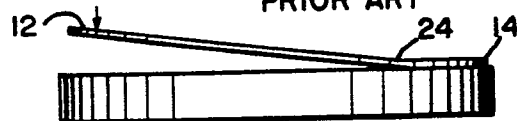
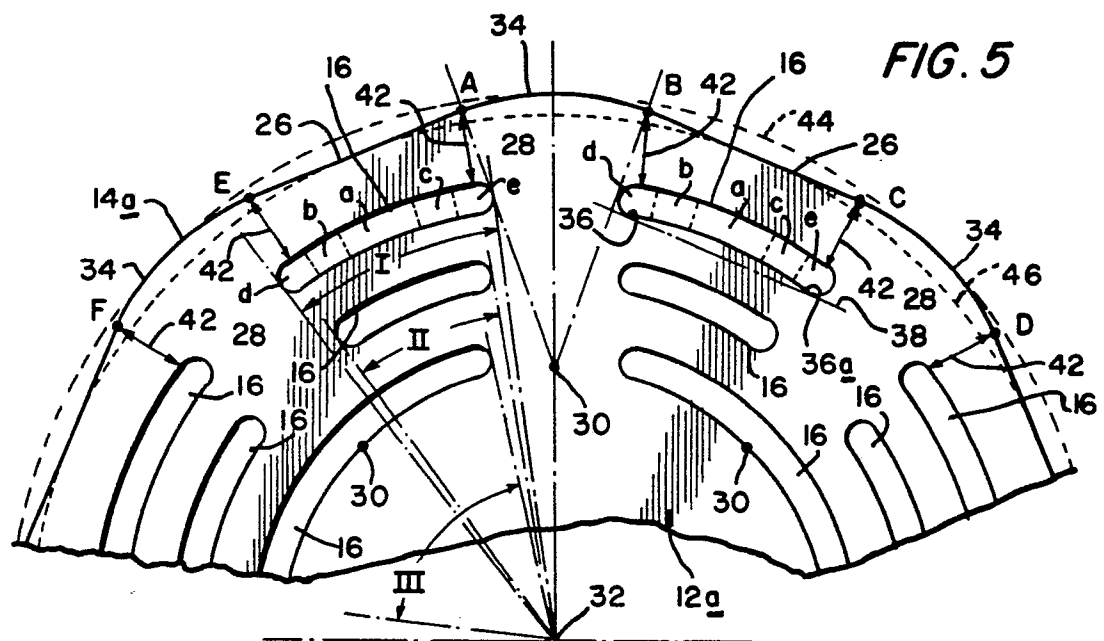
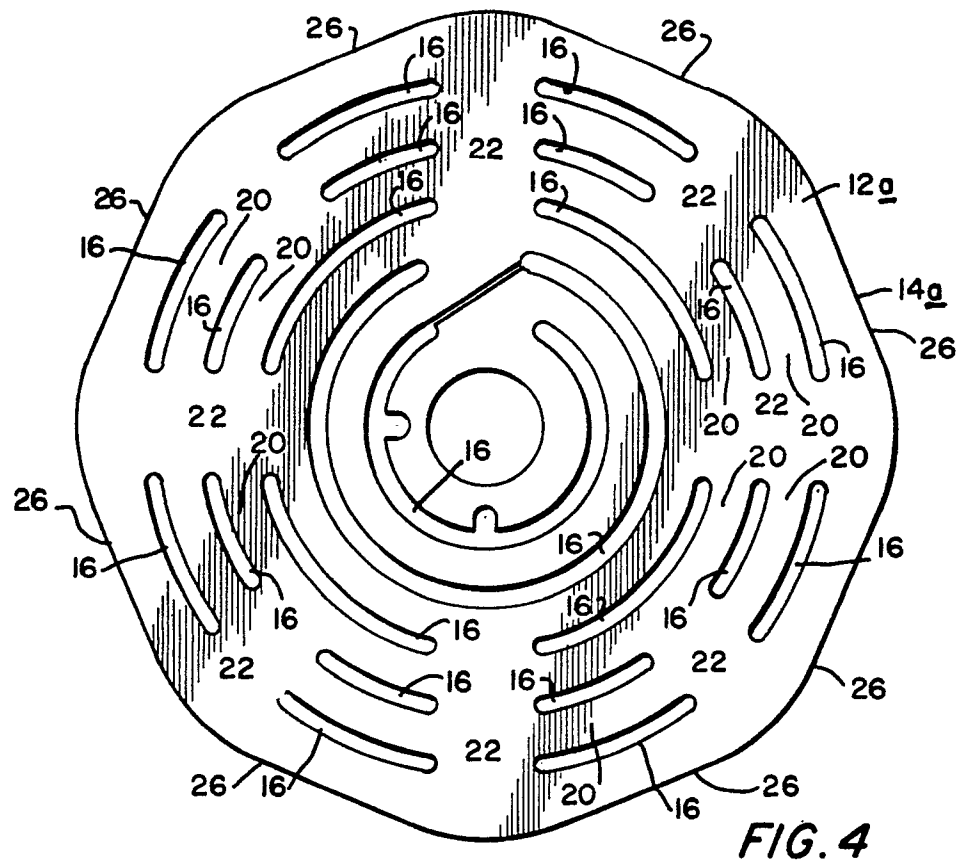


FIG. 3B
PRIOR ART





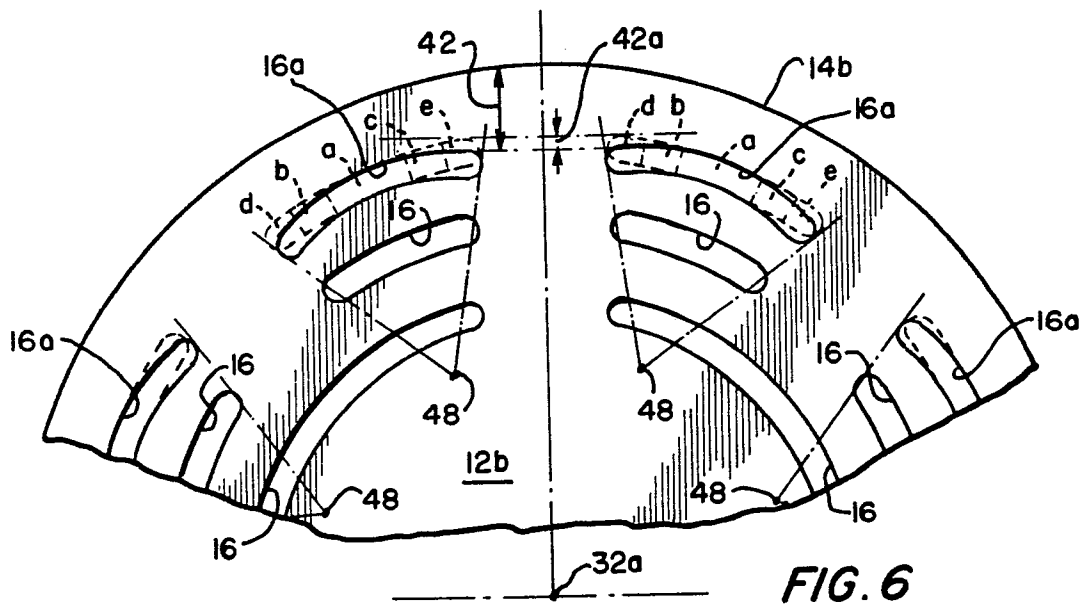


FIG. 8

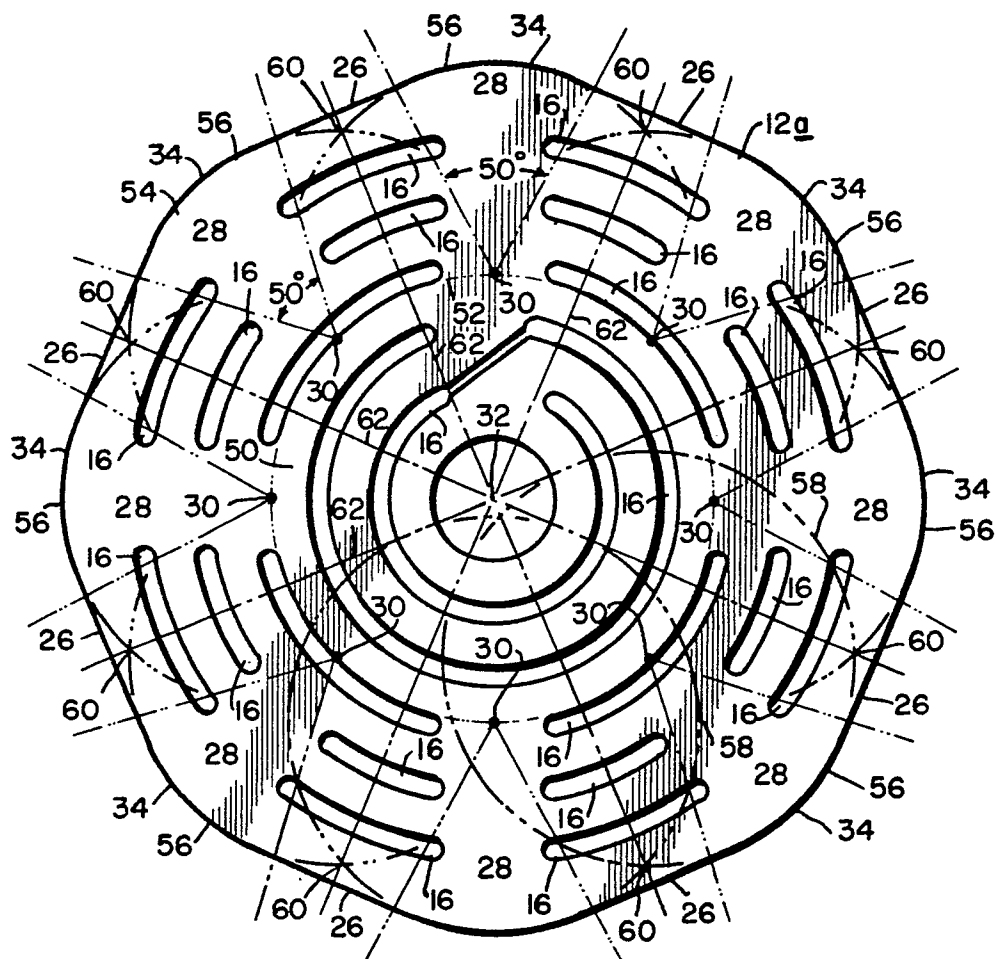


FIG. 7

