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54 **Filter coupling unit for a breathing protection mask.**

57 In a respiratory protective mask (1) with releasably mounted filters (3 and 4), at least the coupler (5) between two filters (3 and 4) is constructed as a sort of bayonet coupler with radially outwardly protruding lock protrusions (27) and lock pockets (12) protruding radially inwardly from an axial flange (11), one filter (4) being formed with two axially protruding sealing beads (17,18) which cooperate with a sealing bead (26) protruding radially outwardly from the other filter (3). When inserting the lock protrusions (27), they are guided by the inner side of the axial flange (11), so that the sealing bead (26) hits the space between the sealing beads (17 and 18).

This provides efficient and reliable sealing without the use of loose sealing rings and the like.

In an amended embodiment, an inserted end bottom (20) in the filter (3) shown on the right of the drawing may be made of a somewhat softer material than the other parts, and sealingly cooperate with a further sealing bead (28) in the filter (4) shown on the left of the drawing.

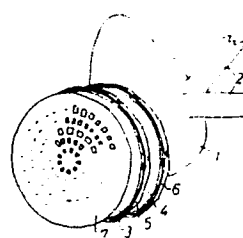


Fig.1

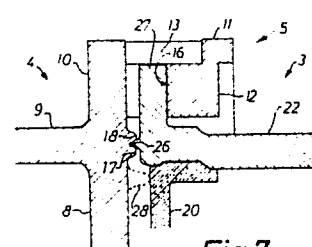


Fig.7

**A releasable coupler for a respiratory protective mask with replaceable filter units, a coupling part in such a coupler, and filter units and respiratory protective masks incorporating such a coupling part.**

The invention relates to a releasable, fluid-tight coupler for a respiratory protective mask with replaceable filter units, the said coupler being of the type more precisely described in the introductory portion of claim 1.

A number of couplers of this type are known, all of them subject to some sort of inconveniences, e.g. that they are difficult to couple and release, or that they necessitate the use of loose sealing rings or the like, which can easily disappear when the coupler is in a non-assembled state, without the user realizing when he assembles it that an important part of the coupler is missing.

In view of this, the object of the invention is to provide the construction of a coupler of the type referred to in the introductory paragraph, which is not subject to the aforesaid inconveniences, and which is inexpensive to manufacture and convenient to use and free from the risk that any vital part of the coupler might be missing when it is to be assembled.

The stated object is achieved by a coupler which, according to the invention, is characterized by the construction and arrangement defined in the characterising portion of claim 1. In this way it is achieved that the sealing means, shaped integrally with the coupling part in question, cannot be lost, and that due to their special mutual shape the sealing means in the two coupling parts are brought together sufficiently accurately to exert the desired sealing function during the assembly process.

Claims 2 and 3 concern expedient embodiments of the coupler according to the invention, which have been tested in practice.

The invention also concerns a coupling part for a coupler according to the invention, and this coupling part, which forms part of a filter unit as described in the introductory portion of claim 4, is characterized according to the invention by the construction and arrangement defined in the characterizing portion of claim 4.

The invention also relates to a filter unit and a respiratory protective mask, and according to the invention they are characterized by the construction described in claims 5 and 6, respectively.

The invention will be described in more detail below, with reference to the example of an embodiment of a respiratory protective mask and a releasable coupler therefor according to the invention, where

fig. 1 shows schematically in perspective the respiratory protective mask with two filters mounted,

fig. 2 shows the rearmost of the filter units shown in fig. 1, seen from in front,

fig. 3 is a section along the line III-III in fig. 2,

fig. 4 shows the foremost of the filter units shown in fig. 1, seen from the rear,

fig. 5 is a fragmentary view showing as seen from the side and partially in section the coupled filter units shown in figs. 2 and 4 in a coupled state,

fig. 6 shows the function of the clamping means of the coupler, and

fig. 7 is a greatly enlarged, partially sectional view through the upper parts of the coupled filter units shown in fig. 5.

The respiratory protective mask 1 shown - schematically in fig. 1, held fluid-tightly fastened by means of straps 2 to the lower part of the user's face, is provided with a plurality of air filters at the front, in the shown example two air filters 3 and 4, of which the foremost filter 3 may for instance be constructed to retain dust particles, while the rearmost filter 4 may be a so-called chemical filter constructed to retain certain gases or vapours, in keeping with current needs in the individual case. The foremost filter 3 is coupled with the rearmost filter 4 by means of a releasable fluid-tight coupler 5; the filter 4 is in turn coupled with the protective mask 1 proper by means of a further releasable, fluid-tight coupler 6. For this purpose, the protective mask 1 is here provided with a funnel-shaped widening (not shown in fig. 1). Each of the filters 3 and 4 is in a known manner shaped as a circular case with pierced end bottoms, of which only the one end bottom 7 of the one air filter 3 can be seen on fig. 1. The filter material proper is placed in a known manner between the two end bottoms in such a way that all air flowing through each filter passes through the filter material. The cartridges of the air filters can be expediently manufactured by pressure moulding in two parts, of which one part constitutes the casing and the one end bottom, and the other part constitutes the second end bottom, which can be fastened to the free end of the casing.

Figs. 2 to 7 show in more detail the embodiment of a releasable, fluid-tight coupler corresponding e.g. to the coupler 5 shown in fig. 1, with fig. 2 showing the rearmost filter 4 seen from the front prior to coupling, and fig. 4 showing the foremost filter 3 seen from the rear prior to coupling.

The "fixed" end bottom 8 in the filter 4 extends radially past the filter casing 9 into a radial flange 10, which merges into an axial flange 11 at its circumference.

A plurality of lock pockets 12, six in the example shown, and open at one side, viz. the anti-clockwise side shown in fig. 2, protrude radially inwards from the axial flange 11. In the shown embodiment the axial flange 11 is formed with a through opening 13 in alignment with each lock pocket 12. Each lock pocket 12 is provided with a grip and inlet part 14, which extends at a comparatively great distance from the radial flange 10 obliquely towards it and inwardly towards the bottom of pocket 12. The grip and inlet part 14 merges into a transitional part 15, which, in the shown example, extends as a flattened S from the grip and inlet part to a retainer part 16, which extends in parallel with or at an angle of a few degrees with the radial flange 10.

Two sealing beads 17 and 18 protrude from the transitional area between the "fixed" end bottom 8 and the radial flange 10.

In the "fixed" end bottom 8, flow openings 19 are provided in a known manner. Only some of them are shown in the drawing.

The rearmost part of the air filter 3 shown in fig. 4 includes a "loose" end bottom 20, in which are provided flow openings 21, only some of which are shown in the drawing. The boundary between the end bottom 20 and the casing 22 of the filter 3 is marked as 23 in fig. 4. The end bottom of the casing 22 continues in the end facing the viewer in fig. 4 in a radial flange 24, which is provided with a plurality of notches 25, six in the shown example. Within the notches 25, a sealing bead 26 is provided, whose radius corresponds to the radius in the space between the two sealing beads 17 and 18 provided in the filter 4.

Due to the notches 25, the radial flange 24 is divided into a plurality of radially outwardly protruding lock protrusions 27, six in the shown example.

When the air filter 3 is to be coupled with the air filter 4, the air filter 3 is placed with its end bottom 20 facing the end bottom 8 in the air filter 4, with the lock protrusions 24 on the air filter 3 being inserted into the axial flange of the air filter 4 between the lock pockets 12, so that the latter will be received by the notches 25, and the ends of the lock protrusions 27 facing clockwise (as shown in fig. 2) are aligned with the grip and inlet parts 14 in the lock pockets 12. Now the filter 3 is turned clockwise in relation to the filter 4, causing the lock protrusions 27, as indicated in fig. 6a, first to move towards the grip and inlet part 14 and then additional turning in the same direction will cause them to pass the transitional parts 15 to engage with the retainer parts 16.

As the radially outwardly directed faces of the lock protrusions 27 are located on a radius which is only slightly smaller than the radius at the radially inwardly directed face of the axial flange 11, the

lock protrusions 27, and hence the sealing bead 26, are guided so accurately in relation to the lock protrusions 17 and 18 on the air filter 4 that the sealing bead 26, as shown in fig. 7, fits precisely between the sealing beads 17 and 18, where it forms a fluid-tight seal due to the force exercised by the retainer parts 16 on the lock protrusions 20. In the shown example, there is only one sealing bead on the filter 3 and two on the filter 4, but within the scope of the invention, the number of sealing beads can be greater. However, in practice it has been found to be sufficient to have one sealing bead on the one filter and two on the other, and it should also be taken into consideration that with the same engaging force from the retainer parts 16, the engaging force between the sealing beads is reduced the more there are of these.

A feasible modification is indicated in fig. 7, where an additional sealing bead 28 is placed on the end bottom 8 and constructed to engage with the end bottom 20 located opposite it; said end bottom 20 is in this case assumed to consist of a somewhat softer material than the other parts.

The openings 13 in the axial flange 11 are not strictly necessary for the function, but are preferred to permit visual inspection when the lock protrusions 27 engage the bottom of the lock pockets 12, cf. fig. 6b. In addition, any dirt or dust accumulating within the axial flange 11 or in the lock pockets 12, can be easily removed, e.g. be blown off, through the openings 13.

In the shown and preferred example of a releasable, fluid tight coupler between two filters 3 and 4, the construction is such that the axial flange 11 is outermost and the radial flange 24 inside it. However, within the scope of the invention it is also possible to construct the coupler in such a way that the axial flange of the one coupling part is located innermost with the lock pockets facing outwards, while the radial flange of the other coupling part faces radially inwards.

A suitable material in the shown filter cartridge is a comparatively hard plastics material; the "loose" end bottoms -cf. the end bottom 20 in fig. 7 -can be made of a somewhat softer but yet fairly rigid plastics material.

The coupler 6 between the protective mask 1 proper and the filter 4 can be constructed in the same way as the coupler between the filters 3 and 4 shown in figs. 2 to 7; it may also be of the type where the edge of the funnel-shaped extension at the front of the mask is formed with a retaining and sealing lip which can be folded in over the rearmost part of the casing 9 in the filter 4 and in this way connect it fluid-tightly with the mask 1. If the rearmost end of the filter 4 is constructed with a radial flange 24 divided into a plurality of lock protrusions 27, as is the case with the rearmost

end of the filter 3 shown in fig. 4, this feature will not prevent coupling it with such a retaining and sealing lip, as the said lip will simply protrude forwards past the radial flange and sealingly engage the external side of the casing 9.

Provided that the flow resistance does not become excessive, more than two filters can be placed in succession in the manner shown in fig. 1. If, in order to protect the chemical filters against dust, it is necessary to place the dust filter foremost, its foremost end can be constructed without the coupling part which is provided at the foremost end of the air filter 4, as shown in figs. 2 to 7. This results in some economies and reduces the risk of the foremost filter getting stuck in a protrusion or the like; moreover, it becomes easier to distinguish the dust filter from the other filters.

### Claims

1. A releasable, fluid-tight coupler for respiratory protective masks with replaceable filter units of the type that includes:

a) clamping means (12,27) placed on a first and a second coupling part, with which each coupling part can be connected with another coupling part, and

b) sealing means (17,18,26) placed in or on the first and/or the second coupling part, said sealing means being constructed to form an externally fluid-tight connection between the flow areas (19,21) of the two coupling parts under the influence of the force exercised by the clamping means (12,27), **characterized** in that

c) the clamping means are shaped as a so-called bayonet coupler with

c1) a plurality of radially outwardly or inwardly protruding lock protrusions (27) provided on the said first side, and

c2) a circular-cylindrical flange (11) provided on the said second side, the radius of said flange on the side facing the lock protrusions (27) corresponding essentially to the radius in the circumscribed or inscribed circular-cylindrical face, respectively, for the limiting faces disposed radially outermost or innermost, respectively, of the lock protrusions - (27), with a number of lock pockets (12) equal to the number of lock protrusions (27), said lock pockets being inwardly or outwardly directed, respectively, from the circular-cylindrical flange (11), said lock pockets being open at the one side in the same peripheral direction, and

d) that the sealing means include

d1) at least one circular first annular bead (26) protruding in the axial direction from the said first or second coupling part, and

d2) at least two second annular beads (17,18)

protruding in the axial direction from the said second or first coupling part, the radial size of which annular beads being so adapted to the radial size of the first annular bead(s) (26) that when the bayonet coupler is assembled, the first annular bead or each of the first annular beads protrudes some distance in between and sealingly engages two of the second annular beads (17,18,26), and

e) at least the annular beads (17,18,26) and the lock protrusions (27) and/or the lock pockets - (27) consist of a material of a hardness corresponding to horn or comparatively hard plastics.

2) A coupler according to claim 1, **characterized** in that the inner walls of the lock pockets (12) facing away from the annular bead or beads - (17,18,26) are provided with

a) a grip and inlet part (14) extending obliquely and roundedly from an external end at a comparatively great, first distance from the annular bead or beads to an internal end at a smaller, second distance from the bead or beads,

b) a retaining part (16) extending at a third distance which does not exceed the said second distance from the annular bead or beads, said third distance preferably being marginally reduced in a direction away from the grip and inlet part (14), and

c) an optional transitional area (15) between the grip and inlet part (14) and the retaining part - (16) extending obliquely and/or roundedly between the said two parts.

3. A coupler according to claim 1 or 2, **characterized** in that the lock protrusions (27) protrude radially outwardly and extend with their sector-shaped external limiting faces extending so far in the peripheral direction that the tangential angular distance between them is a few degrees, at most, larger than the external tangential angular extension of the lock pockets (12).

4. A coupling part for a coupler according to one or more of the claims 1-3, which constitutes part of a filter unit consisting of a short cylinder with a fluid-tight casing and two fluid-permeable end bottoms, of which at least one (20) is constructed as a separate part in relation to the remaining part of the filter unit, with the filter material being placed inside the casing (22) between the two end bottoms, **characterized** in that at least one end bottom (20) thus separately provided consists of a material of a hardness slightly less than that of the remaining parts of the filter unit and so placed in relation to the clamping means (12,27) and the annular beads (17,18,26) that when the bayonet coupler is correctly assembled, the non-fluid-permeable rim part of the end bottom (20) engages sealingly a corresponding rim part or sealing bead (28) constructed in one piece with or

connected with another bayonet coupling part without preventing the sealing engagement between the annular beads (17,18,26).

5. A filter unit (3,4) for respiratory protective masks (1), **characterized** in that it has at least one coupling part according to claim 4 or at least one coupling part from a coupling according to one or more of the claims 1-3.

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6. A respiratory protective mask (1) of the type adapted for releasable coupling with at least one filter unit (3,4), **characterized** in that it has at least one coupling part according to claim 4 or at least one coupling part from a coupling according to one or more of the claims 1-3.

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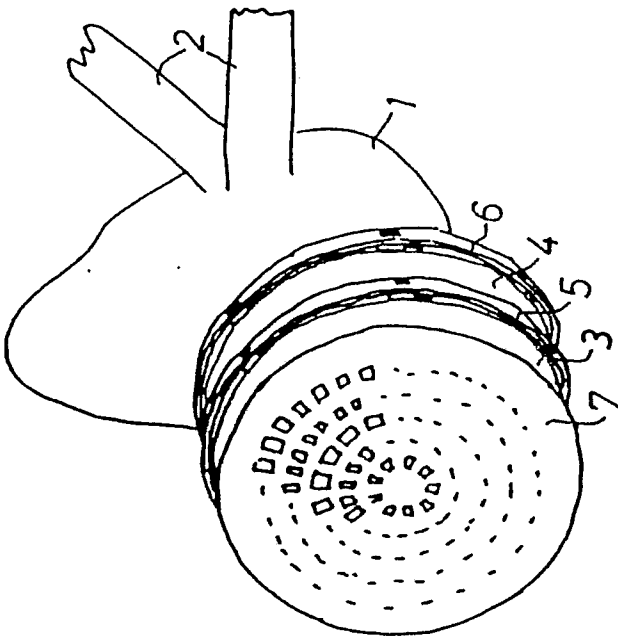


Fig. 1

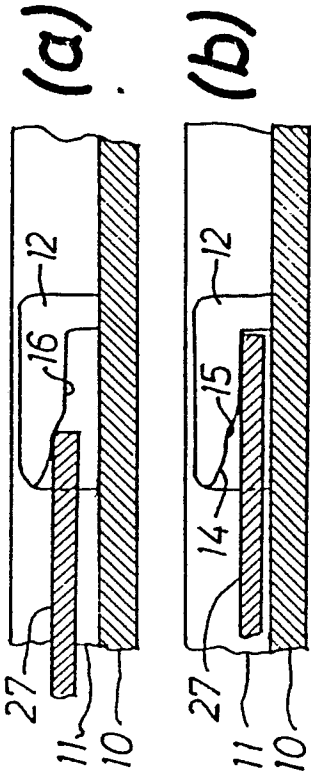


Fig. 6

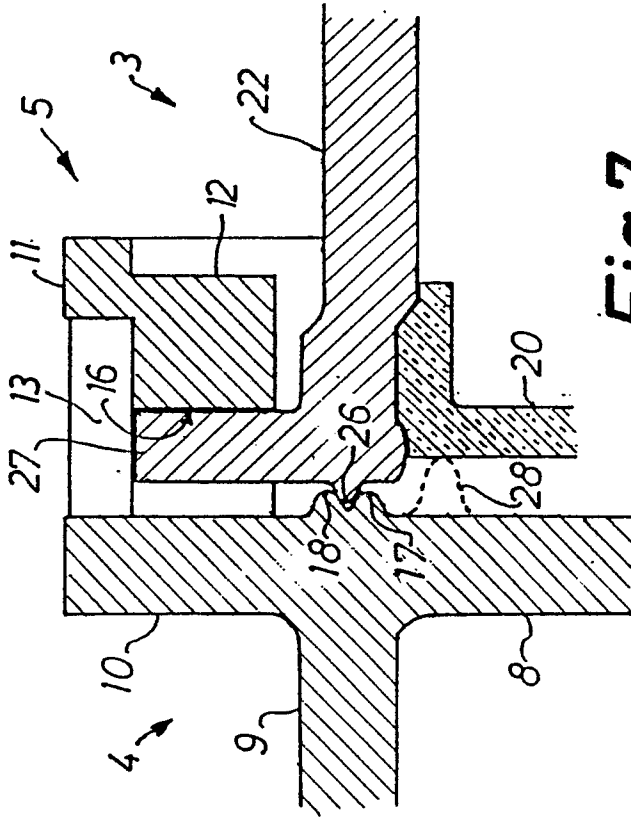


Fig. 7

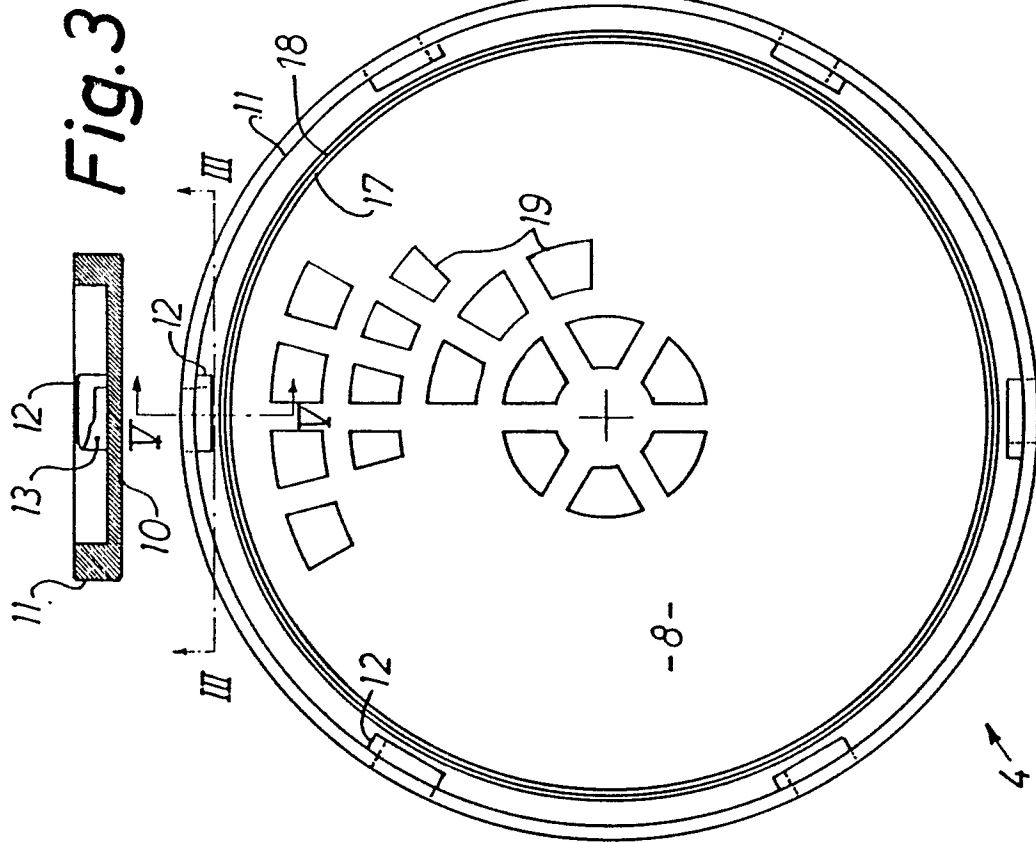


Fig. 2

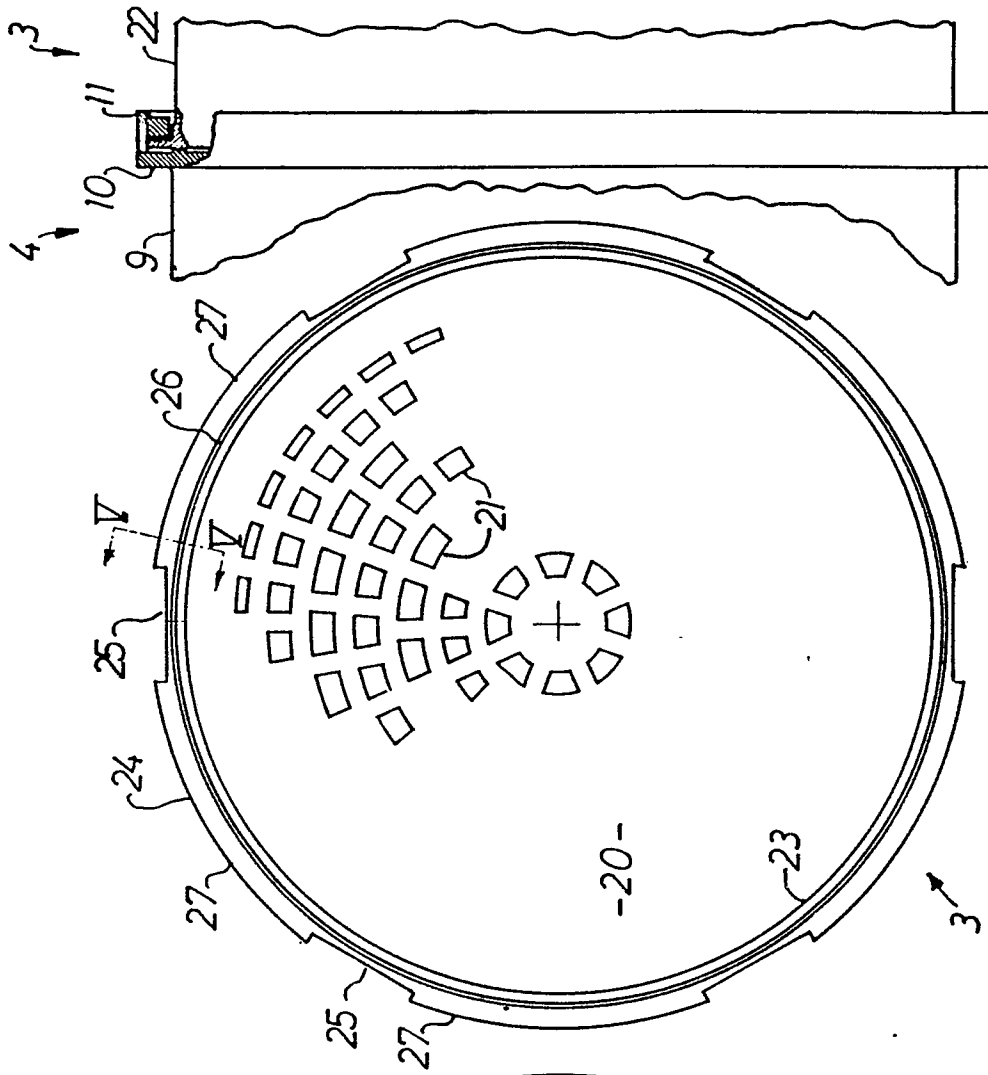


Fig. 4

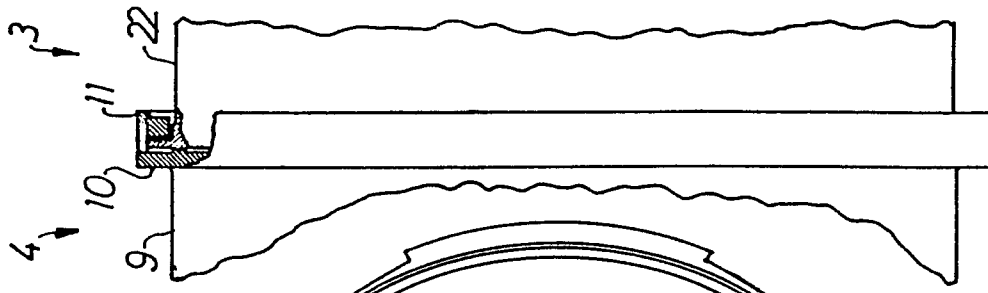


Fig. 5