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[54] **GAS-BLAST SWITCH**

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[51] **Int. Cl.**[2] **H01H 33/70**

[58] **Field of Search** ..... 200/148 R, 148 B, 148 G, 200/148 A

[56] **References Cited**

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3,824,360 7/1974 Slamecka et al. ..... 200/148 A

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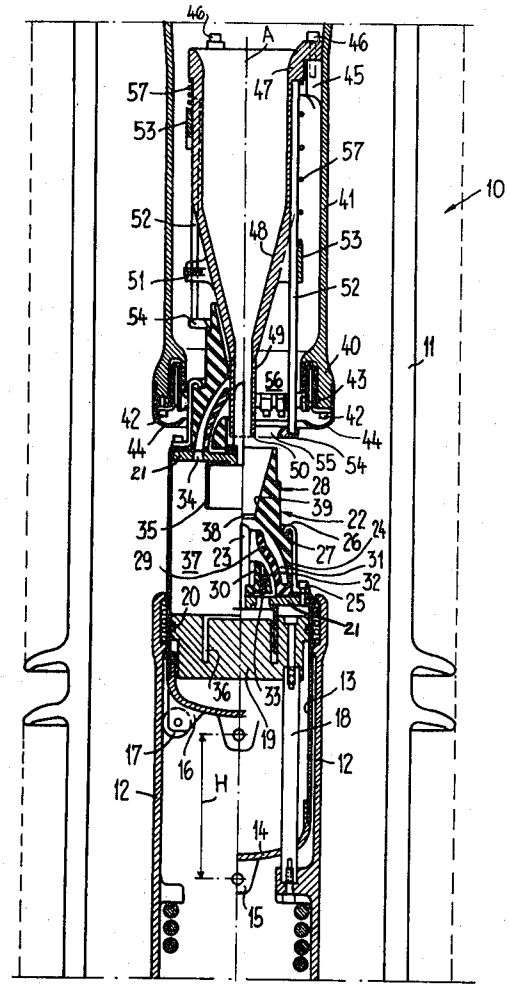
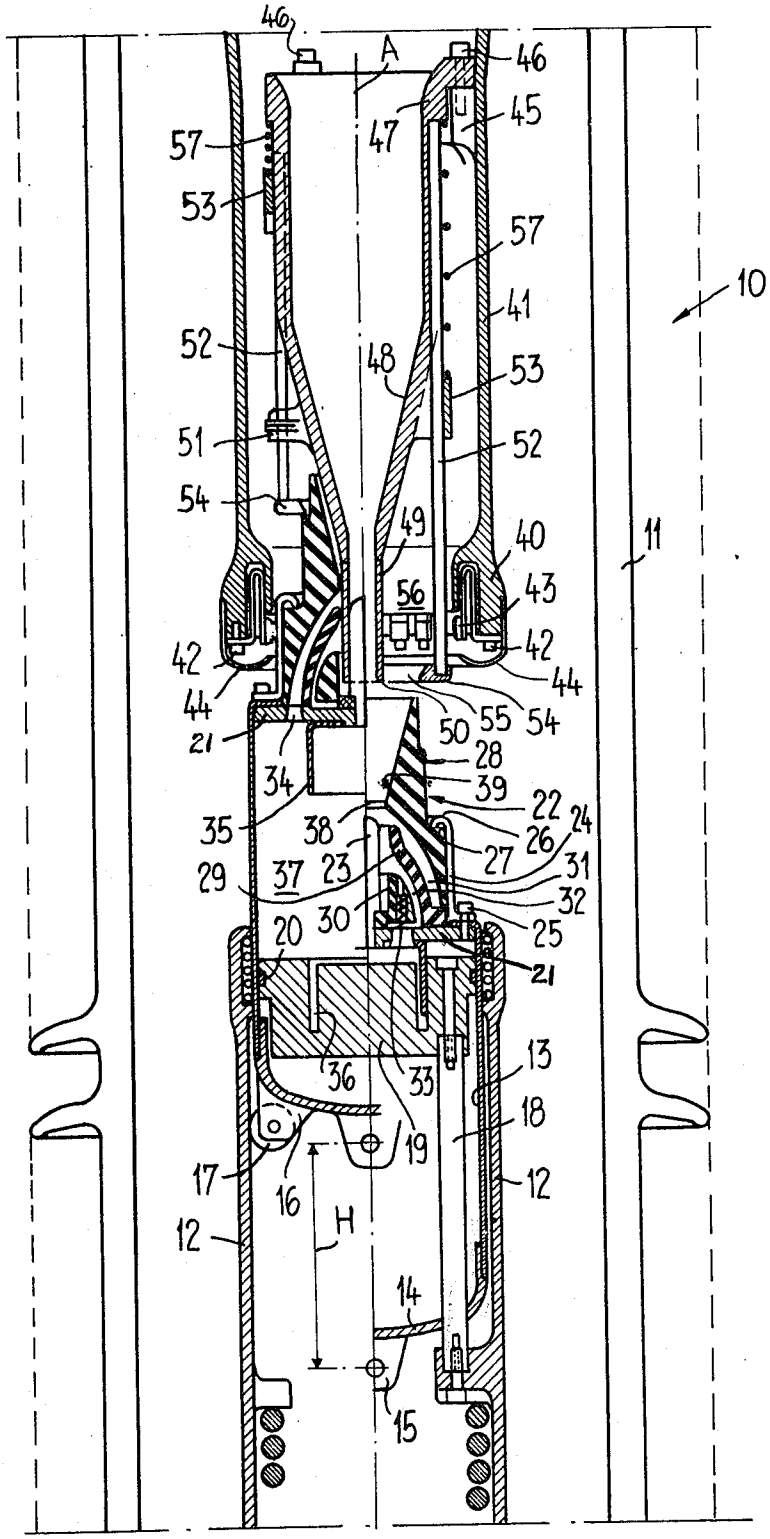
[57] **ABSTRACT**

A gas-blast switch embodying a stationary contact element, a movable contact element which is surrounded by an entrainably movable blast nozzle, the inlet side of the blast nozzle being in flow communication with a compression compartment for an extinguishing gas, the compression compartment can be pressurized by the cut-off movement of the switch. Further, there is provided an electrically conductive screening body which is guided along the stationary contact element, the screening body can be shifted out of its cut-off position where it surrounds the stationary contact element by means of the blast nozzle during the cut-on movement. Between the stationary contact element and the screening body in the cut-off position there is provided a through-blowable jacket compartment, the inlet side-internal diameter of which is practically aligned with a blast cone formed by an outlet diffuser of the blast nozzle.

9 Claims, 1 Drawing Figure

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GAS-BLAST SWITCH

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved construction of gas-blast switch of the type embodying a stationary or fixed contact element, a movable contact element, the movable contact element being surrounded by an entrainably movable blast nozzle, the inlet side of the blast nozzle being in flow communication with a compression compartment for an extinguishing gas and which compression compartment can be placed under pressure during the cut-off movement, and further embodying an electrically conductive screening body which is guided along the stationary contact element, the screening body being displaceable via the blast nozzle during the cut-on movement out of its position where it surrounds the fixed or stationary contact element in the cut-off position.

According to a prior art gas-blast switch of this type, for instance, as disclosed in German patent publication No. **2,140,284,** the screening body is of sleeve-like configuration and is formed at its end confronting the movable contact element in such a way that in the cut-off position of the switch it surrounds the free end of the tubular-shaped stationary contact element which is open at both ends in the manner of a rounded cup without any floor.

In the cut-off position the screening body with its smooth outer surface supplements the stationary contact element in the manner of a type of electrode which no longer possesses any sharpedged projections which, in turn, —during the recurring voltage which arises after extinguishing of the arc— results in such local high field intensity at the prevailing field that there could be brought about a renewed ignition of the arc.

On the other hand, in the switch-on or cut-on position, with the known switch, the screening body is retained by the blast nozzle in a position which is retracted or shifted back relative to the stationary contact element. At the start of the cut-off movement the spring-loaded screening body thus follows the movement of the blast nozzle which is carried out along with the movable contact element until it assumes its previously described position. During this time it is supposed to improve the sealing of the blast nozzle with respect to the stationary contact element, so that the action of the compression of the extinguishing gas in the compression compartment which arises during the cut-off movement should be improved.

During the second phase of the cut-off movement, that is to say, after the screening body has already reached its cut-off position, there then occurs the blowing of the arc, with the result that the ionized switching gases are axially ejected through the tubular-shaped stationary contact element.

Especially owing to the essentially axially blowing of the arc and owing to the axial ejection of the switching gases through the stationary contact element the arc is displaced from the stationary contact element to the screening body which snugly surrounds such stationary contact element. Consequently, it is particularly the screening body, the function of which, among other things, is to prevent virtue of its smooth outer surfaces the formation of field intensities which exceed the dielectric strength of the prevailing gases, which so to speak becomes a "burning-off electrode" and its outer surfaces, already after a few cut-off operations, no longer satisfy the intended function because such outer surfaces are then partially covered by scale or melted droplets respectively.

According to another comparable prior art gas-blast switch as disclosed in German Pat. No. **1,665,182,** the "screening body" is composed of an insulating material and sealingly yet displaceably surrounds the shaft of the stationary or fixed contact element. With this switch the screening body only functions as a closure stopper for the blast nozzle which seals such blast nozzle at the starting phases of the cut-off movement in order to improve upon the action of the pre-compression within the compression compartment or chamber. The screening body of this switch therefore cannot fulfill any "screening"-function with regard to the electrical field which prevails during the cut-off operation. On the other hand, it is formed of an electrically conductive material then there would result practically the same technological behavior as for the first described prior art gasblast switch.

SUMMARY OF THE INVENTION

Hence, it is a primary object of the present invention to provide an improved construction of gas-blast switch which is not associated with the aforementioned drawbacks and limitations of the prior art proposals.

Another and more specific object of the present invention aims at the provision of a new and improved construction of gasblast switch of the previously mentioned type in which the arc, which so to speak cannot be avoided during the cut-off operation, as before can be extinguished by blowing, but however until it is extinguished automatically remains limited to the path between the stationary and the movable contact elements and cannot be displaced to the screening body, so that the latter, when assuming its cutoff position still prevents the formation of high field intensities which favor the re-ignition of the arc.

Now in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the invention proposes a new and improved construction of gas-blast switch of the previously mentioned type which according to significant aspects of this development is manifested by the features that there is provided a through-blowable jacket or shell compartment between the stationary contact element and the screening body, the inlet-inner diameter of such jacket compartment practically being in alignment with a blast cone formed by a discharge or outlet diffuser of the blast nozzle.

Moreover, the screening body can possess at least one ring which is coaxially arranged with respect to the stationary contact element, this ring being suspended at rods which extend away from the movable contact element. In the cut-off position this ring together with the free end of the stationary contact element can advantageously be located in a plane, or can be arranged forwardly thereof, depending upon the shape and the course which is intended to be imparted to the electrical field at the switch after reaching its cut-off position.

Furthermore, the ring advantageously possesses a crosssectional profile which is rounded at all sides and which is extended in its plane, and wherein the inside of the ring which forms the inner surface of such ring possesses the same or a greater divergence than the outlet diffuser of the blast nozzle.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawing wherein the single FIGURE illustrates a longitudinal sectional view through a portion of the gas-blast switch of this development, the left-hand portion of the drawing showing the gas-blast switch in its switch-in or cut-on position and the right-hand of the FIGURE showing the gas-blast switch in its cut-off position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawing, it is to be understood that as a matter of convenience in illustration only the more essential components needed for fully comprehending the invention have been portrayed at the illustrated gas-blast switch **10**, whereas, for instance, the connections, the drive mechanism and the support construction (for instance the carriage) have been conveniently omitted from the showing of the drawing, particularly since such details are not necessary for understanding the basic concepts of this development.

Referring now to the showing of the gas-blast switch **10** depicted in the drawing there will be recognized a guide cylinder **12** arranged in a cylindrical switch housing **11**, the guide cylinder **12** serving to guide a pump cylinder **13** carrying the movable switch elements. At its lower end the pump cylinder **13** is closed by means of a suitably accommodated floor or base **14** at which there is formed a hinge eyelet **15** or equivalent structure with which engages a drive rod which has not been particularly shown. Additionally, bearing eyelets **16** with therein rotatably mounted rollers **17** are provided at the pump cylinder floor **14**, and which rollers bear against the inner wall of the guide cylinder **12**. Internally of the pump cylinder **13** there is arranged a pump piston **19** which is supported via columns **18** at the guide cylinder **12**. The pump piston **19** sealingly bears via a piston ring **20** at the inside or inner wall of the pump cylinder **13**. The upper end of the pump cylinder **13** is closed by means of a metallic flange **21** upon which there is secured a multi-part blast-nozzle **22**. The blast-nozzle **22** in turn surrounds a central contact pin **23** which is likewise secured to the flange **21** and furthermore is surrounded by a contact sleeve **24** which is anchored by means of bolts **25** or the like at the flange **21**. The inwardly flexed upper end **26** of the contact sleeve **24** engages over a shoulder **27** formed at the outer periphery of the blast nozzle **22**.

As also best recognized by referring to the drawing blast nozzle **22** is essentially composed of three insulated body members. It possesses an outer nozzle body **28**, an intermediate nozzle body **29** and an internal nozzle body **30**, which collectively form two coaxial nozzle channels **31, 32** which converge in the direction of the contact pin **23**. The inner situated nozzle channel **32** is connected via a number of check valves **33** with the side of the flange **21** which confronts the pump piston **19**, whereas the outer nozzle channel **31** is connected via a number of openings **34** with such side of the flange. The flange **21** carries, at its side which confronts the pump piston **19**, a cup-shaped downwardly open skirt **35**. This skirt **35** at the end of the compression stroke of the pump cylinder **13**, i.e. at the end of the switch-off or cut-off movement, engages into a ring-shaped groove **36** formed at the end face of the pump piston **19** and thus subdivides the compression compartment or chamber **37** of the pump cylinder **13** into two sections or portions, of which, owing to the presence of check valve **33**, the inner portion is safeguarded against impingement by ionized switching gases if prior to extinguishing of the arc the gas pressure in the blast nozzle **22** should momentarily exceed the pressure in the compression compartment or chamber **37**.

The narrowest location or throat **38** of the blast nozzle **22** follows the end of both nozzle channels **31, 32** and is arranged immediately forward of the tip of the contact pin **23**. An outlet diffuser **39** which is only delimited by the outer nozzle body **28** merges with the narrowest location or throat **38** of the blast nozzle **22**, the diffuser **39** being decisive for guiding the gases flowing through the nozzle channels **31, 32** past the contact pin **23** and through the narrowest location or throat **38**, so as to thus form an outflowing blast cone. The throat **38** may advantageously possess an inner diameter which practically corresponds to the outer diameter of the stationary contact member or bushing **49** to be discussed more fully hereinafter.

The heretofore described movable components of the switch **10** are coaxially arranged with respect to the stationary contact components or portions. At the enlarged lower end **40** of a conductor tube or pipe **41**, which is stationarily secured in the switch housing **11** by any suitable and therefore not particularly illustrated means, there are anchored by means of bolts **42** or the like resilient power contacts **43** which, as best seen by referring to the left-hand portion of the drawing, come into engagement with the jacket or shell surface of the contact sleeve **24** in the cut-on position. This lower end **40** of the conductor tube **41** is additionally also covered by means of a screening sheet metal member **44**.

Internally of the conductor tube **41** there is attached to projections **45**, by means of bolts **46** or the like, the one end **47** of a contact element or piece **48**. This contact element **48** terminates towards its lower end in a funnel-shaped manner in a contact bushing or sleeve **49**, the free end **50** of which is arranged forwardly of the power contacts **43** and the screening sheet metal member **44** in the direction of the contact pin **23** and the contact sleeve **24** respectively.

Now at bearing eyelets **51**, which are formed at the outer jacket or shell surface of the contact element **48**, there is lengthwise displaceably guided a respective rod **52**. The upper ends of the rods **52** are held together by means of a ring member **53** which is soldered therewith, this ring member simultaneously serving as the counter support for a pressure spring **57** which strives to shift the rods **52** downward. A screening body in the form of a ring electrode **54** is suspended at the rods **52** at their other ends. As particularly well seen by referring to the left-hand portion of the drawing such ring electrode **54** possesses a cross-sectional configuration which is rounded at all sides and which is lengthwise extended or elongated in its plane, and wherein the outlet or discharge-side, stepped outer diameter of the nozzle body **28** approximately corresponds to its inner diameter and such is shaped in a manner that it aligns with the cone of the outlet diffuser **39**.

Between the inner diameter of the ring electrode 54 (in the cut-off position at the right of the drawing) and the free end 50 of the contact bushing 49 there thus remains free an annular or ring-shaped gap 55 which leads to a jacket or shell compartmant 56 which, in turn, can be blown through by the blast cone formed by the diffuser 39.

It is to be observed that in the cut-off position of the switch for the illustrated embodiment the ring electrode 54 and the free end 50 of the contact bushing 49 are located in a plane, since the ring 53 at the same time serves as an impact or stop ring which cooperates with the bearing eyelets 51, which stop ring limits the downward movement of the rods 52 which occurs during the cut-off movement and, as will be described more fully hereinafter, which downward movement follows the blast nozzle 22, and also thereby limits the movement of the ring electrode 54. With this arrangement, but also as would be the case if the ring electrode 54 were to protrude somewhat past the free end 50 of the contact bushing 49, or would be reset or recessed with respect thereto, there is provided at the cut-off position by virtue of the recurring voltage a very uniform electrical field which does not possess any such high field intensity gradients which could bring about a local collapse of the field and together therewith re-ignition. In particular owing to the ring electrode 54 there is screened in a much better manner the relatively sharp edged power contacts 43 with regard to the contact sleeve 24 than would be possible by merely using the screening sheet metal member 44 alone.

During the cut-off movement, which as is known occurs in a sudden manner, and considering the switch-on position depicted at the left-hand portion of the drawing, there occur the following operations. The blast nozzle 22 and together therewith the movable contact elements 24 and 23 descend, with the result that the ring or annular electrode 54, under the action of the compression or pressure spring 57, follows the discharge end of the blast nozzle 22. After about one-quarter of the stroke of the switch, as conveniently designated by reference character H, the contact sleeve 24 disengages from the power contacts 43. Starting from this time the current flow only occurs from the contact pin 23 to the contact bushing 49 which is completely filled thereby. The narrowest location or throat 38 of the blast nozzle 22 now practically sealingly surrounds the jacket or shell surface of the contact bushing 49 and in the compression compartment 37 there has already occurred a pre-compression of the therein prevailing extinguishing gas which may be, for instance, sulphur hexafluoride. This extinguishing gas cannot, however, escape in any appreciable quantity through the openings 34 or through the check valves 33. After somewhat less than one-half of the stroke H the switching pin 23 also comes out of engagement with the contact bushing 49 and the resulting arc, at this moment of time, is intensively blown or extinguished by the extinguishing gas which flows through the nozzle channels 32 and 31, the extinguishing gas initially being withdrawn axially through the bushing or sleeve 49. Directly thereafter the narrowest location or throat 38 of the blast nozzle 22 frees the free end 50 of the contact bushing 49, and the gas current now likewise wipes the outer jacket surface of the contact bushing 49 and thereby prevents displacement of the arc to the power contacts 43 and to the ring electrode 54 which is still supported at the blast nozzle. Since the compression compartment 37 always becomes smaller as a function of the downward movement of the pump cylinder 13, there occurs a continuous blowing action, whereby the portion of the extinguishing gas which wipingly moves past the outside of the contact bushing or sleeve 49 increasingly becomes greater. Already prior to reaching the cut-off position (at the right of the drawing) the ring electrode 54 reaches its terminal or end position due to impact of the ring 53 against the bearing eyelets, whereas the blast nozzle is still moved downwardly further through a short path. The powerful blast current through the ring gap 55 into the jacket or shell compartment 56 not only prevents displacement of the arc at the ring electrode 54 as already mentioned, but also insures for an optimum withdrawal of heat.

Although with the illustrated exemplary embodiment the screening body is essentially formed by the rods 52 which form a cage and the lower ring electrode 54, it should be readily understood that such screening body also could be formed by a cylindrical displaceably guided sleeve, the lower end of which is flanged or upset in accordance with approximately the cross-sectional shape of electrode 54. However, in this instance the sleeve must possess at the jacket or shell surface sufficiently wide bores which permit the outflow of the hot switching gases.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto, but may be otherwise variously embodied and practiced within the scope of the following claims. ACCORDINGLY,

What is claimed is:

1. A gas-blast switch comprising a stationary contact element, a movable contact element, a blast nozzle movable along with the movable contact element and surrounding said movable contact element, said blast nozzle having an inlet side and an outlet diffuser, means defining a compression compartment for an extinguishing gas, the inlet side of the blast nozzle being in flow communication with the compression compartment for the extinguishing gas and which compression compartment can be placed under pressure by a cut-off movement of the switch, an electrically conductive screening body guided along the stationary contact element, said electrically conductive screening body being displaceable by means of the blast nozzle during a cut-on movement of the switch out of its position where it surrounds the stationary contact element in the switch cut-off position, a jacket compartment through which extinguishing gas can be blown through in the switch cut-off position provided between the stationary contact element and the screening body, said jacket compartment having an inlet side possessing an inner diameter which practically aligns with a blast cone formed by the outlet diffuser of the blast nozzle.

2. A gas-blast switch comprising a stationary contact element, a movable contact element, a blast nozzle movable along with the movable contact element and surrounding said movable contact element, said blast nozzle having an inlet side and an outlet diffuser, means defining a compression compartment for an extinguishing gas, the inlet side of the blast nozzle being in flow communication with the compression compartment for the extinguishing gas and which compression compartment can be placed under pressure by a cut-off move-

ment of the switch, an electrically conductive screening body guided along the stationary contact element, said electrically conductive screening body being displaceable by means of the blast nozzle during a cut-on movement of the switch out of its position where it surrounds the stationary contact element in the switch cut-off position, a jacket compartment through which extinguishing gas can be blown through in the switch cut-off position provided between the stationary contact element and the screening body, said jacket compartment having an inlet side possessing an inner diameter which practically aligns with a blast cone formed by the outlet diffuser of the blast nozzle, the screening body possessing at least one ring member which is substantially coaxially arranged with respect to the stationary contact element, a plurality of rods which extend away from said movable contact element, said ring member being suspended at said rods.

3. The gas-blast switch as defined in claim **2,** wherein the stationary contact element includes a free end, the ring member in the switch cut-off position together with the free end of the stationary contact element being substantially located in one plane.

4. The gas-blast switch as defined in claim **2,** wherein the stationary contact element includes a free end, the blast nozzle having a free end confronting the free end of the stationary contact element, and wherein in the cut-off position of the switch the plane of the ring member is located between the free end of the stationary contact element and the confronting free end of the blast nozzle.

5. The gas-blast switch as defined in claim **2,** wherein the ring member possesses a cross-sectional shape which is rounded at all sides and which is extended in its plane, said ring member having an inside portion which forms the inner surface of the ring member, said inside portion possessing substantially the same divergence as said outlet diffuser of the blast nozzle.

6. The gas-blast switch as defined in claim **2,** wherein the ring member possesses a cross-sectional shape which is rounded at all sides and which is extended in its plane, said ring member having an inside portion which forms the inner surface of the ring member, said inside portion possessing a greater divergence than said outlet diffuser of the blast nozzle.

7. The gas-blast switch as defined in claim **2,** wherein said blast an outlet side, the inner diameter of the ring member is greater than the largest inner member of said outlet diffuser but smaller than the external diameter of the outlet side of the blast nozzle.

8. The gas-blast switch as defined in claim **1,** wherein the blast nozzle possesses a throat portion, said throat portion of the blast nozzle being arranged forwardly of the movable contact element in the direction of the stationary contact element, said throat portion having an inner diameter which practically corresponds to the outer diameter of the stationary contact element.

9. The gas-blast switch as defined in claim **2,** wherein the blast nozzle possesses a nozzle body having an outer diameter which is stepped to a diameter substantially corresponding to the inner diameter of the ring member in order to form a stop and entrainment shoulder for said ring member.

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