

(19) **DANMARK**



Patent- og
Varemærkestyrelsen

(12)

Oversættelse af europæisk patentskrift

(10) **DK/EP 2744598 T3**

-
- (51) Int.Cl.: **B 05 B 1/26 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2021-07-26**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2021-06-23**
- (86) Europæisk ansøgning nr.: **12824246.8**
- (86) Europæisk indleveringsdag: **2012-08-10**
- (87) Den europæiske ansøgnings publiceringsdag: **2014-06-25**
- (86) International ansøgning nr.: **US2012050372**
- (87) Internationalt publikationsnr.: **WO2013025517**
- (30) Prioritet: **2011-08-17 US 201113211518**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
- (73) Patenthaver: **Spraying Systems Co., North Avenue and Schmale Road , P.O. Box 7900, Wheaton, IL 60187-7901, USA**
- (72) Opfinder: **THOMAS, Lawrence Eric, 621 Hampton Course, West Chicago, IL 60185, USA**
CARO, Jahir Leonardo, 200 N. Jefferson Street, Apt. 601, Chicago, IL 60661, USA
- (74) Fuldmægtig i Danmark: **Plougmann Vingtoft A/S, Strandvejen 70, 2900 Hellerup, Danmark**
- (54) Benævnelse: **LUFTINDUKTIONSSPRØJTEDYSEANORDNING MED FLERE UDLEDNINGER**
- (56) Fremdragne publikationer:
BE-A- 525 630
FR-A- 1 528 046
JP-A- 2004 351 361
JP-Y1- S4 833 069
NZ-A- 227 972
SU-A1- 1 139 514
SU-A2- 1 563 772
US-A1- 2008 087 745
US-B2- 7 380 732
US-B2- 7 472 843
US-B2- 7 861 946
None

DESCRIPTION

FIELD OF THE INVENTION

[0001] The present invention relates generally to spray nozzle assemblies, and more particularly, to a liquid spray system particularly adapted for spraying a field of plant foliage with agricultural chemicals.

BACKGROUND OF THE INVENTION

[0002] Agricultural sprayers typically have a spray boom with a plurality of spray nozzles which are adapted for spraying liquid chemicals from overhead the plants. In wheat crops, for example, at a certain stage in growth toward maturity, the plants are susceptible to a fungus. While there are fungicides effective for combating and preventing such fungi, the coverage of the plant must be very complete. Because the heads of wheat plants are so vertically oriented, it is difficult to completely cover the plant head by overhead spraying typical of conventional agricultural sprayers. It also can be difficult to effectively cover the wheat plant heads without excessive and costly chemical wastage.

[0003] NZ 1989022792 discloses a spray nozzle assembly which has a hollow nozzle body and a nozzle tip at the discharge end of the body defining a discharge orifice. The nozzle tip has a deflector flange downstream of the discharge orifice and arranged transverse to the direction of the travel of the pre-atomized liquid from the discharge orifice. The deflector flange has a cup shaped recess in axial alignment with the discharge orifice for causing further breakdown and atomization of the liquid which is then directed by the deflector flange transversely in a flat spray pattern.

[0004] US 2007/0069047 discloses a spray trip for discharging a controlled liquid spray distribution. The spray tip includes a spray tip body having an inlet end for connection to a pressurized liquid supply. The spray tip body includes a first fluid chamber having a first longitudinal axis and a second fluid chamber in fluid communication with the first fluid chamber and having a second longitudinal axis that extends transversely relative to the first longitudinal axis. A pair of discharge orifices are formed in the spray tip body. Each discharge orifice has a downstream side with a deflector surface for directing liquid discharging from the chamber. Each discharge orifice intersects the second fluid chamber adjacent a respective end thereof so as to define a pocket extending downstream of the deflector surface.

OBJECTS AND SUMMARY OF THE INVENTION

[0005] According to the invention there is provided a liquid spray system adapted to spray a

field of plant foliage and having all of the features of claim 1 of the appended claims.

[0006] It is an object of the present invention to provide a spray nozzle assembly adapted for spraying agricultural chemicals onto difficult to spray crops with more complete coverage.

[0007] Another object is to provide a spray nozzle assembly as characterized above which is adapted for directing sprays from different locations and angles onto crops during a single passage of the sprayer for a more effective chemical coverage of the plant.

[0008] A further object is to provide a spray nozzle assembly of the foregoing type which more efficiently effects complete plant spray coverage with less chemical waste.

[0009] Still another object is to provide a spray nozzle assembly of the above kind that is relatively simple in construction and lends itself to economical manufacture

[0010] Another object is to provide an improved method of spraying fungicides onto wheat crops.

[0011] Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Figure 1 is a vertical section of an illustrative spray nozzle assembly in accordance with the invention;

FIG. 2 is an enlarge vertical section of the outer nozzle body of the illustrated spray nozzle assembly;

FIGS. 3 and 4 are enlarged fragmentary sections of the outer nozzle body taken in the planes of 3 and 4 of FIG. 2; and

FIG. 5 is an enlarged fragmentary section of one of the liquid discharge orifices of the illustrated outer nozzle body, taken in the plane of line 5-5 in FIG. 3.

[0013] While the invention is susceptible of various modifications and alternative constructions, a certain illustrative embodiment thereof has been shown in the drawings and will be described below in detail. It should be understood, however, that there is no intention to limit the invention to the specific form disclosed, but on the contrary, the intention is to cover all modifications, alternative constructions, and equivalents falling within the scope of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Referring now more particularly to the drawings, there is shown an illustrative spray nozzle assembly 10 in accordance with the invention mounted on a liquid supply boom 11, such as the boom of an agricultural sprayer. The boom 11 in this instance has a tubular configuration through which the liquid is directed from a supply tank. Each spray nozzle assembly 10 is mounted on a respective liquid supply stem 12 fixed in depending fluid communication on the boom 11. A cylindrical strainer 15 in this instance is mounted within the stem 12 in a conventional manner. For removably securing the spray nozzle assembly 10 on the stem 12, a retention cap 14 is provided which may be of the type disclosed in Butterfield et al., U.S. Patent No. 4,527,745, assigned to the same assignee as the present application. It will be understood that a plurality of such spray nozzle assemblies 10 are supported in laterally-spaced relation along the boom 11 for travel through the field in the direction of movement of the boom as indicated by the arrow 16 in Figure 1.

[0015] The illustrated spray nozzle 10 basically has a two-part construction, comprising an outer body 20 and an inner body insert 21. The outer nozzle body 20 is formed with an annular retaining flange 22 which is secured to the liquid inlet stem 12 of the boom 11 with an annular sealing gasket 24 interposed therebetween. The inner body insert 21 in this case has an annular construction that is positionable within a cavity 25 in an upstream end of the outer body 20 and defines a liquid passage 27 communicating with the liquid supply stem 12.

[0016] The liquid passage 27 defined by the inner body insert 21 includes a nozzling zone which includes a metering orifice 28 in which the liquid stream is and a downstream expansion chamber 27 including a first cylindrical chamber section 27a immediately downstream of the nozzling zone 28, and outwardly flared conical passage sections 27b, 27c, downstream thereof. The inner body insert passage 27 in turn communicates with a cylindrical manifold expansion chamber 29 within the outer body 20. The inner body insert 21 in this instance has an outwardly extending annular flange 30 intermediate its ends and an inwardly tapered downstream end portion 31 which are adapted for press fit sealing engagement within the internal cavity 25 of the outer nozzle body 20.

[0017] In accordance with one aspect of the invention, the spray nozzle assembly has a pair of discharge orifices adapted to spray liquids onto agricultural crops from different elevations and positions and at different angles to the central vertical axis of the spray nozzle assembly during a single passage of the spray boom through the field. More particularly, the spray nozzle assembly has a pair of discharge orifices adapted for directing separate leading and trailing spray patterns at different angles onto front and rear sides of the plant foliage during passage of the spray boom through a field. To this end, in the illustrative embodiment, the outer nozzle body 20 has a first or leading liquid spray discharge orifice 35 communicating with the manifold expansion chamber 29 for directing liquid onto a deflector surface 36 oriented at a relatively small angle α , such as about 30° , to the vertical axis of the nozzle assembly 10 in the direction

of travel, i.e., leading direction, of the spray boom 11. The illustrated deflector surface 36 includes a curved surface section 36a and a flat lip section 36b that defines the angle of the spray discharge. The leading discharge orifice 35 in this case is defined by a horizontal passage 38 that communicates with a vertical passage 39, which in turn communicates with the expansion chamber 29. The horizontal passage 38 comprises a first passage section 38a that communicates between the vertical passage 39 and an inwardly tapered conical section 38b that in turn communicates with a smaller diameter passage section 38a. To facilitate injection molding, a plug 40 closes the end of the horizontal passage opposite the discharge orifice 35.

[0018] In carrying out the invention, the outer nozzle body 20 has a second liquid spray discharge orifice 45 and deflector surface 46 for directing a liquid spray in a trailing direction relative to movement of the boom and at a different angle to the vertical than the first discharge orifice 35 and deflector 36 for effectively covering an opposite side of plant foliage. The second discharge orifice 45, which in this case also is located at a higher elevation than the first discharge orifice 35, is defined by a vertical passage 48 that communicates between the manifold chamber 29 on a side opposite that of the vertical passage 39 and into tangential relation with the deflector surface 46 which has a curved section 46a and a flat lip section 46b extending rearwardly in relation to the direction of travel. The lip section 46b in this case extends at a substantially greater angle $\varnothing$ to the vertical axis of the spray nozzle assembly than the deflector surface lip section 36b, such as 75° , in the leading direction.

[0019] It will be seen that as the spray boom 11 is moved through the field in a direction of travel 16 the discharge spray from the second or trailing discharge orifice 45 will impinge upon an opposite side of the plant foliage and at a different angle relative to the vertical than the spray discharge from the first or leading discharge orifice 35 effecting substantially complete coverage of the foliage, and particularly the vertically extending heads of wheat plants.

[0020] In keeping with one embodiment, the passages 38,39 and 48 that communicate between the expansion chamber 29 and which define the leading and trailing discharge orifices 35,45 have effective flow areas such that the leading and trailing sprays have substantially equal liquid distribution. In this case, the passages 38,39 that communicate with and define the first or leading discharge orifice 35 are sized larger than the shorter length passageway 48 that defines the second or trailing discharge orifice 45 such that a substantially equal liquid distribution is discharged from the leading and trailing discharge orifices. The vertical passageway 48 that defines the trailing discharge orifice 45 in this case has a cylindrical configuration that communicates tangentially with the deflector flange surface 46 and horizontal passage 38 defines the leading discharge orifice 35 has a cylindrical side wall 50a section with a flat 50b, as depicted in FIG. 5, that extends tangentially with the deflector surface 36.

[0021] In accordance with a further aspect of the illustrated embodiment, the spray nozzle assembly 10 has venturi air inlets 55 that communicate between ambient air and the nozzling zone of the inner body insert 21, in this case, the passage section 27a immediately

downstream of the metering orifice 28, such that ambient air is drawn into the liquid flow stream and entrained in the liquid spray particles ultimately generated and discharged from the leading and trailing discharge orifices 35,45. Due to the pressure drop resulting from the liquid passage through the nozzling zone and the entrainment of air in the liquid spray particles, extremely fine liquid particles that otherwise are subject to drift and difficult to direct onto the plant foliage are substantially eliminated from the discharging spray patterns. To this end, in the illustrated embodiment, the nozzle body insert 21 has a plurality of venturi passages 58 communicating transversely with the liquid inlet passage section 27a immediately downstream of the metering orifice 28. The venturi passages 58 in this case each communicate with an annular air flow passage 59 disposed in surrounding relation to the nozzle body insert 21, which in turn communicate with ambient air through the plurality of air inlet passages 55 extending radially through the outer nozzle body member 20. The annular air passageway 59 in this instance is defined between the inner perimeter of the outer body member cavity 25 and the outer perimeter of the nozzle body insert 21. It will be seen that as pressurized liquid is directed through the nozzling zone 28 and into the passage section 27a, the resulting high velocity flow stream generates a negative pressure at the venturi air passageways 58, drawing ambient air through the annular passage 59 and ambient air inlets 55 for intermixing with the liquid flow stream, which is entrained into the liquid spray particles as they are discharge from the leading and trailing discharge orifices 35,45 for more reliable direction onto the plant foliage without undesirable drifting and chemical waste.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- [NZ1989022792](#) [0003]
- [US20070069047A](#) [0004]
- [US4527745A](#) [0014]

Patentkrav

1. Væskesprøjtesystem indrettet til at sprøjte et område af planteløv omfattende:

- en væskeforsyningsbom (11) til bevægelse i en bevægelsesretning,
- en flerhed af sprøjtedyseanordninger (10) monteret på en respektiv
- 5 væskeforsyningsstamme (12) fastgjort i afhængig fluidforbindelse på nævnte bom (11),
- hvor nævnte flerhed af dyseanordninger (10) er støttet i lateralt med afstand anbragt forhold langs nævnte bom (11) til bevægelse i bevægelsesretningen af bommen (11),
- 10 hvor hver af nævnte væskesprøjtedyseanordninger (10) har et dyselegeme med et væskeindløb i fluidforbindelse med nævnte væskeforsyningsbom (11) og en væskestrømningspassage (27) der strækker sig langs en akse af nævnte dyselegeme,

kendetegnet ved, at,

- 15 nævnte dyselegeme har:
 - en første væskeudledningsåbning (35) til udledning af tryksat væske fra nævnte væskestrømningspassage (27) og til at rette væske over på en første deflektorflangeoverflade (36) orienteret ved en relativt lille vinkel α til en vertikal akse af dyseanordningen (10) i
 - 20 bevægelsesretningen af sprøjtebommen (11);
 - hvor nævnte første deflektorflangeoverflade (36) har en læbedel (36b) til at rette tryksat væske udledende fra nævnte første udledningsåbning (35) ved nævnte første vinkel α til nævnte dyselegemeakse i en fremadretning i forhold til bevægelse af
 - 25 nævnte bom (11); og
 - en anden udledningsåbning (45) til udledning af tryksat væske fra nævnte væskestrømningspassage (27) og en anden deflektorflangeoverflade (46) til at rette udledningsvæske fra nævnte anden udledningsåbning (45) i en bageste retning i forhold
 - 30 til nævnte bevægelse af nævnte bom (11) og ved en anden vinkel φ til nævnte dyselegemeakse forskellig fra nævnte første vinkel α .

- 2.** Væskesprøjtesystemet ifølge krav 1 i hvilket nævnte dyselegeme er monteret i afhængigt forhold til væskeforsyningsbommen (11) med den nævnte dyselegemeakse vertikalt orienteret.
- 5 **3.** Væskesprøjtesystemet ifølge krav 2 i hvilket nævnte første vinkel α er omkring 30° og nævnte anden vinkel φ er omkring 75° .
- 4.** Væskesprøjtesystemet ifølge krav 1 i hvilket nævnte første deflektorflangeoverflade (36) inkluderer et krumt overfladeafsnit (36a) og nævnte
10 læbedel (36b) er flad og orienteret ved nævnte første vinkel α , og nævnte anden deflektorflangeoverflade (46) inkluderer et krumt afsnit (46a) og et fladt læbeafsnit (46b) orienteret ved nævnte anden vinkel φ til dyselegemeaksen.
- 5.** Væskesprøjtesystemet ifølge krav 1 i hvilket nævnte væskestrømningspassage
15 (27) inkluderer en doseringsåbning (28) til at accelerere tryksat væske rettet igennem nævnte dyselegeme og et ekspansionskammer (29) nedstrøms deraf, og nævnte første (35) og anden (45) udledningsåbninger hver er i fluidforbindelse med nævnte ekspansionskammer (29).
- 20 **6.** Væskesprøjtesystemet ifølge krav 5 i hvilket nævnte dyselegeme inkluderer et yderlegeme (20) og en inderlegemeindsats (21) anbragt i nævnte yderlegeme (20), som definerer en del af nævnte væskestrømningspassage (27) inkluderende nævnte doseringsåbning (28).
- 25 **7.** Væskesprøjtesystemet ifølge krav 5 i hvilket nævnte første udledningsåbning (35) er defineret af en horisontalt orienteret passage (38), og nævnte horisontalt orienterede passage (38) kommunikerer med nævnte ekspansionskammer (29) igennem en første vertikalt orienteret passage (39).
- 30 **8.** Væskesprøjtesystemet ifølge krav 7 i hvilket nævnte anden udledningsåbning (45) er defineret af og kommunikerer med nævnte ekspansionskammer (29) igennem en anden vertikalt orienteret passage (48) parallel med nævnte første vertikalt orienterede passage (39).

9. Væskesprøjtesystemet ifølge krav 5 i hvilket nævnte ekspansionskammer (29) er defineret i nævnte yderdyselegeme (20) umiddelbart nedstrøms af nævnte inderlegemeindsats (21).

5 **10.** Væskesprøjtesystemet ifølge krav 2 i hvilket nævnte første udledningsåbning (35) er lokaliseret ved en anden højde end nævnte anden udledningsåbning (45).

11. Væskesprøjtesystemet ifølge krav 10 i hvilket nævnte første udledningsåbning (35) er lokaliseret ved en lavere højde end nævnte anden udledningsåbning (45).

10

12. Væskesprøjtesystemet ifølge krav 1 i hvilket nævnte væskestrømningspassage (27) inkluderer en dysezone med relativt lille diameter til at accelerere væskestrømningsstrømmen rettet igennem nævnte dyselegeme og skaber et trykfald deri forud for udledning fra nævnte udledningsåbninger (35; 15 45), hvor nævnte dyselegeme har en omgivende luftpassage (59) med et indløb (55) i kommunikation med omgivende luft uden for nævnte dyseanordning (10), hvor nævnte omgivende luftpassage (59) inkluderer en venturipassage (58) som kommunikerer med nævnte dysezone således at en tryksat væskestrømningsstrøm, som passerer igennem nævnte dysezone, tiltrækker 20 omgivende luft i nævnte omgivende luftindløb (55) og venturipassage (58) for blanding med væskestrømningsstrømmen forud for udledning fra nævnte udledningsåbninger (35; 45).

13. Væskesprøjtesystemet ifølge krav 12 i hvilket nævnte dyselegeme inkluderer 25 et ekspansionskammer (29) i nedstrøms fluidforbindelse med nævnte dysezone i hvilket væskestrømningsstrømmen passerer og ekspanderer forud for udledning fra nævnte udledningsåbninger (35; 45), og nævnte første og anden udledningsåbninger (35; 45) er i fluidforbindelse med nævnte ekspansionskammer (29).

30

FIG. 2

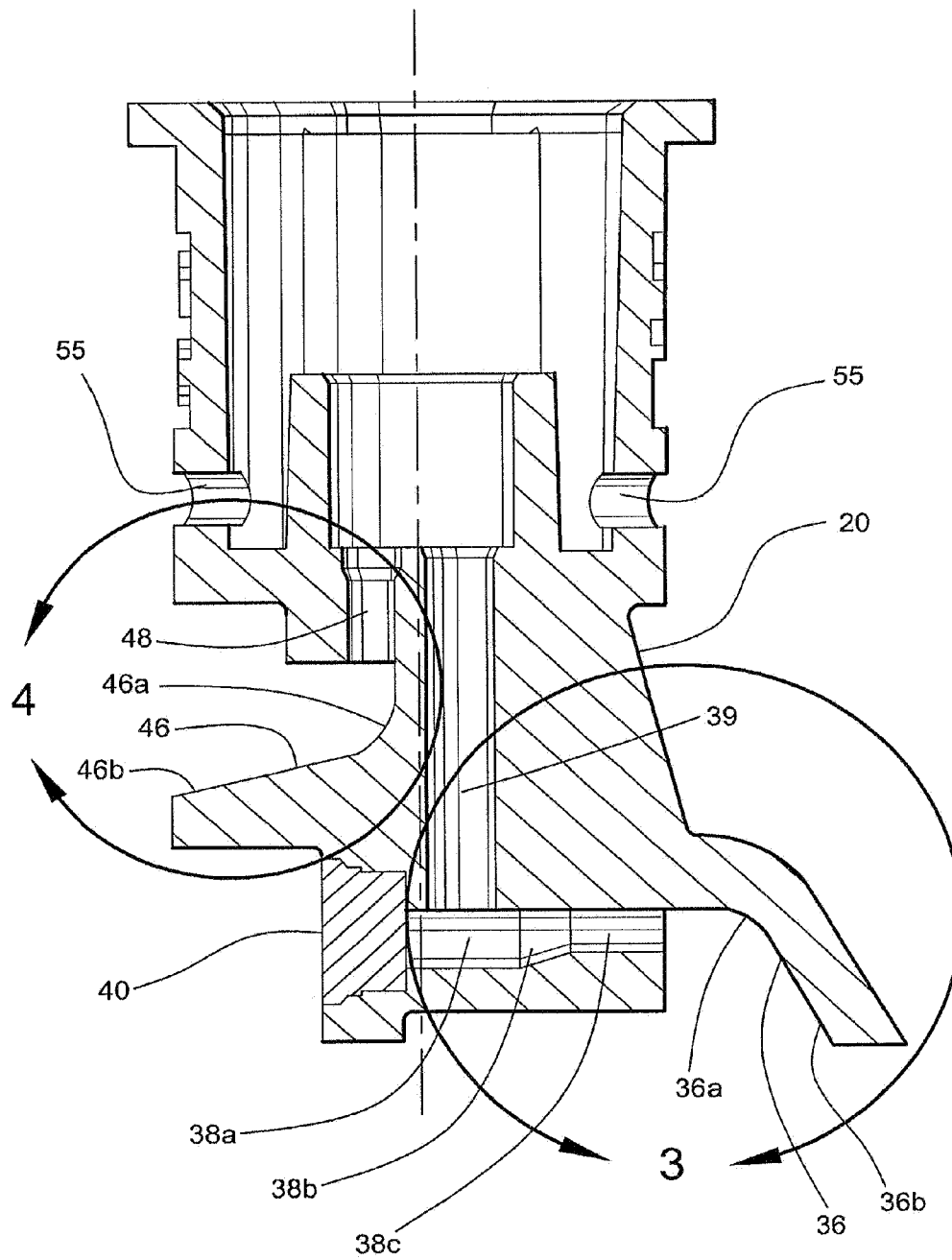


FIG. 3

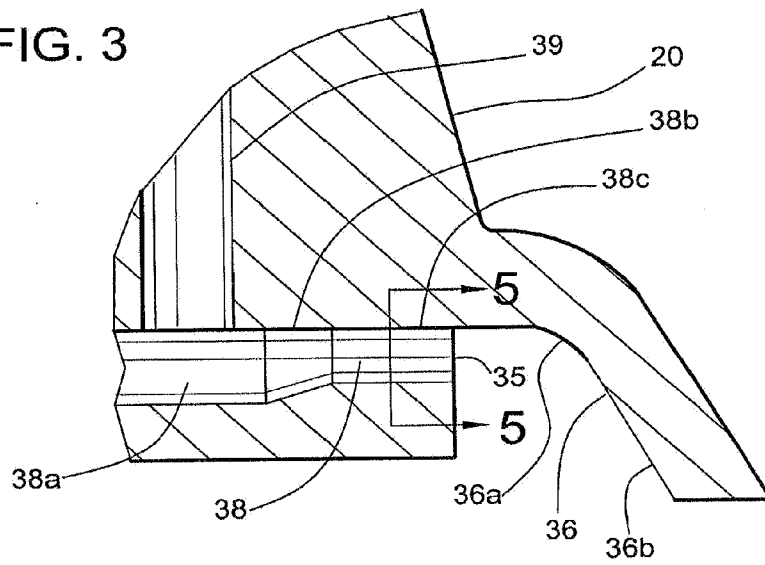


FIG. 4

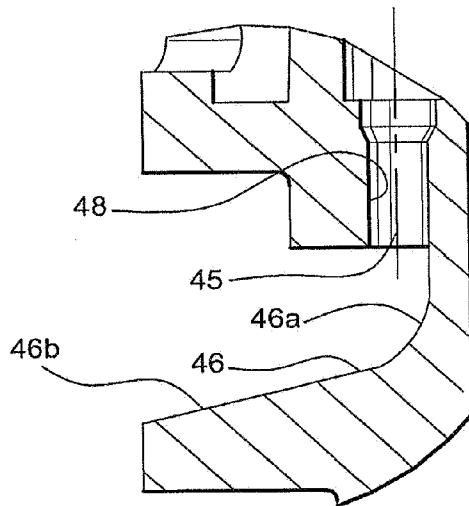


FIG. 5

