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(54) **Cutter head.**

(57) A method of forming a cutter head with an axis of rotation comprises forming a hub; forming at least one ring with integral cutter body arm segments extending from the at least one ring; and connecting the hub to the cutter body arm segments so that the hub and the at least one ring are connected and around the axis of rotation.

NL C 2011994

Dit octrooi is verleend ongeacht het bijgevoegde resultaat van het onderzoek naar de stand van de techniek en schriftelijke opinie. Het octrooischrift komt overeen met de oorspronkelijk ingediende stukken.

CUTTER HEAD

BACKGROUND

Cutter-suction dredgers (“CSD”) are vessels which can be used to cut and
5 loosen material which is at least partly underwater. This cut material can then be
sucked into a suction tube. CSD’s are often used to cut hard surface materials, such as
rock, although they may also be used to excavate gravel or sand.

CSD’s typically use a suction tube with a cutter head at the suction inlet. The
cutter head may be connected to the dredger with a hub that is mounted on an axis with
10 a drive to rotate the cutter head. The axis of rotation is referred to as the axial direction
of the cutter head. The cutter head and suction inlet may be moveable with respect to
the water bed being dredged. In order to draw the material into the suction tube, a wear-
resistant pump may be provided, for example, a centrifugal pump. The material cut by
the cutter head that has been drawn into the suction tube may then be transported away
15 from the CSD, for example, by a floating pipe line to a dumping location.

A typical cutter head includes a base ring around the suction opening and a hub.
The hub and base ring are connected by a plurality of arms extending in an axial
direction. The arms may be curved in a tangential and radial direction such that the
arms spiral toward each other. In other cutter heads, the arms may be curved in the
20 radial direction only, while being axially aligned or at a small angle with respect to the
axial direction. Each arm must be connected to the base ring and to the hub, typically
by welding.

The cutter head may additionally be provided with different excavating tools,
for example, teeth in the shape of chisels or another shape to assist in the excavation.
25 The teeth can be attached to the arms.

WO2011003869 discloses an example of a cutter head for dredging ground
under water. This cutter head is suitable for attachment rotatably around a central axis
to a cutter suction dredger and can be moved through the ground therewith in a lateral
sweeping movement. The cutter head is formed from support arms which extend
30 spirally between a base ring and a hub located at a distance from the base ring. The
support arms are connected to the base ring and to the hub.

SUMMARY

The present invention is directed toward a method of forming a cutter head with an axis of rotation with at least one ring with integral cutter body segments extending from the at least one ring. The method can comprise forming a hub; and connecting the
5 hub to the cutter body arm segments so that the hub and the at least one ring are connected around the axis of rotation.

This method can result in a cutter head which is easier to form due to the location of the connections between cutter body arm segments and the hub.

According to an embodiment, the step of forming at least one ring with integral
10 cutter body arm segments comprises forming a base ring with integral cutter body arm segments.

According to an embodiment, the step of forming a hub comprises forming a hub with hub arm segments. Optionally, the hub arm segments could be formed integral with the hub. Optionally, the embodiment could include connecting the hub
15 arm segments to the hub and/or the cutter body arm segments.

According to an embodiment, the step of forming at least one ring with integral cutter body arm segments comprises forming a supplemental ring with integral cutter body arm segments. Optionally, the step of connecting the hub to the cutter body arm segments comprises connecting the hub to the cutter body arm segments extending
20 from the supplemental ring; and connecting the supplemental ring to the base ring such that the supplemental ring is connected between the base ring and the hub. Optionally, at least a portion of the cutter body arm segments extending from the supplemental ring connect to both the hub and to the base ring. Optionally, these can connect through arm segments connected to and/or formed integrally to the hub and/or the base ring.

According to an embodiment, the hub, hub arm segments and/or at least one
25 ring with cutter body arm segments are connected by welding. Due to the location of the connections being easily accessible, the welding is easier and can result in the use of less materials than past systems.

According to an embodiment, the hub, hub arm segments, cutter body arm
30 segments and/or the at least one ring are connected to loose arm segments.

According to an embodiment, a cutter head with an axis of rotation comprises at least one ring; a hub positioned rotationally symmetric and axially displaced from the at least one ring; and a plurality of arms extending between the at least one ring and the

hub. Each arm comprises a first arm segment extending from and formed integral with the at least one ring. Optionally, each arm can further comprise a second arm segment extending from the hub, wherein the first arm segment is connected to the second arm segment to connect the at least one ring to the hub. Optionally, the second arm segment
5 can be formed integral to the hub. Optionally, each of the plurality of arms further comprises third arm segments.

According to an embodiment, the at least one ring comprises a base ring and/or a supplemental ring.

According to an embodiment, third arm segments extend from and are formed
10 integral with a supplemental ring, and the supplemental ring connects to the first arm segments and/or the second arm segments through the third arm segments. Optionally, the third arm segments extend circumferentially inward from the supplemental and/or the third arm segments extend circumferentially outward from the supplemental ring.

According to an embodiment, the first arm segments, the second arm segments
15 and/or the third arm segments are connected by welding and each of the plurality of arms comprises at least one weld zone.

According to an embodiment, the second arm segments and the hub are formed integrally.

According to an embodiment, the first arm segments, the second arm segments
20 and/or the third arm segments, the hub and/or the at least one ring are connected to loose arm segments.

According to a further aspect, there is provided a vessel comprising a cutter head according to any one of the preceding embodiments.

According to an embodiment, a supplemental ring for a cutter head with a hub,
25 a base ring and an axis of rotation comprises a ring portion with integral cutter body arm segments; and connection surfaces on each of the cutter body arm segments for connecting to arm segments, the hub and/or the base ring. When the cutter body arm segments are connected to the arm segments, the hub and/or the base ring; the hub, the supplemental ring and the base ring are positioned around the axis of rotation with the
30 supplemental ring positioned between the base ring and the hub.

According to an embodiment, the cutter body arm segments extend circumferentially inward from the supplemental ring to connect to arm segments and/or

to the hub and/or the cutter body arm segments extend circumferentially outward from the supplemental ring to connect to arm segments and/or to the base ring.

According to an embodiment, a base ring for a cutter head with a hub and an axis of rotation comprises a base ring with integrally formed cutter body arm segments; and connection surfaces on each of the cutter body arm segments for connecting to additional arm segments, a supplemental ring, and/or the hub. When the cutter body arm segments are connected to additional arm segments, a supplemental ring, and/or the hub, the base ring connects to the hub and is positioned axially rearward from the hub around the axis of rotation.

By forming at least one ring for the cutter with integral arm segments, the cutter is easier to form due to the connection points being more accessible. When welding is used for connection, less materials are required due to the forming of at least one ring with integral arm segments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 schematically illustrates an example vessel with a cutter head.

FIG. 2A shows a schematic perspective view of a first embodiment of a cutter head.

FIG. 2B shows a top view of the cutter head of FIG. 2A.

FIG. 3C shows a cross-sectional view of FIG. 2A.

FIG. 2D shows an exploded view of the cutter head of FIG. 2A.

FIG. 3A shows a perspective view of a second embodiment of a cutter head.

FIG. 3B shows a side view of the cutter head of FIG. 3A.

FIG. 3C shows a top view of the cutter head of FIG. 3A.

FIG. 3D shows a perspective view of a hub with hub arms from the cutter head of FIGS. 3A-3C.

FIG. 3E shows a perspective view of a supplemental ring from the cutter head of FIGS. 3A-3C.

FIG. 3F shows a top view of the supplemental ring of FIG. 3E.

FIG. 3G shows a perspective view of a base ring from the cutter head of FIGS. 3A-3C.

FIG. 3H shows a perspective view of a cutter body arm from the cutter head of FIGS. 3A-3C.

DETAILED DESCRIPTION

FIG. 1 schematically illustrates an example vessel 10 with a cutter head 12 with axis of rotation RA, and suction tube 14. Vessel 10 can be, for example, a cutter-suction dredger.

5 As described in the background, cutter head 12 is connected to suction tube 14, and is used to cut hard surface materials, such as rock. Cutter head 12 has a hub 16 (see FIG. 2) which can be connected to and driven by a drive shaft (not shown) to rotate cutter head 12 around axis of rotation RA. The cut material is then drawn into suction tube 14 and transported away from the cutter head 12.

10 FIG. 2A shows a schematic perspective view of a first embodiment of a cutter head 12, FIG. 2B shows a top view of cutter head 12, FIG. 2C shows a cross-sectional view of cutter head 12, and FIG. 2D shows an exploded view of cutter head 12. Cutter head 12 includes hub 16 with hub diameter D_H , hub arm segments 18, base ring 20 with base ring diameter D_B , cutter body arm segments 22, weld zones 24 and axis of rotation RA. In FIGS. 2A-2D, cutter head 12 is shown with only two cutter body arm segments 22 and two hub arm segments 18 for viewing purposes only. Typical cutter heads 12 would include a plurality of additional arm segments joining hub 16 with base ring 20.

Cutter body arm segments 22 are formed integral to base ring 20, and can be formed through casting or other means. Hub arm segments 18 can be formed
20 separately from hub as loose arm segments and then can be connected to hub 16. In other embodiments, hub arm segments 18 may be formed integrally with hub 16. Hub 16 has a hub diameter D_H which is typically smaller than base ring diameter D_B . Arm segments 22 and 18 typically converge towards the axis of rotation RA in a direction from base ring 20 to hub 16.

25 In the embodiment shown, hub arm segments 18 extend radially and axially outward from hub 16 and are shorter in length than cutter body arm segments 22. Hub arm segments 18 generally extend symmetrically around the axis of rotation RA when connected to hub 16. Cutter body arm segments 22 extend axially and radially inward from base ring 20. In some embodiments, hub arm segments 18 and/or cutter body arm
30 segments 22 may only extend in the axial or radial direction and/or have different shapes, directions and lengths.

Hub arm segments 18 connect to cutter body arm segments 22 to join hub 16 with base ring 20 at weld zone 24, thereby forming cutter head 12. When hub arm

segments 18 connect to cutter body arm segments 22, hub 16 is axially symmetric around the axis of rotation RA and axially displaced in a forward direction from base ring 20.

In the embodiment shown, hub arm segments 18 and cutter body arm segments 22 are joined by welding at weld zone 24. In other embodiments, hub arm segments 18 and cutter body arm segments 22 can be joined by adhesives or other coupling means.

By forming cutter head 12 with hub 16, hub arm segments 18 and base ring 20 with integral cutter body arm segments 18, weld zones 24 of cutter head 12 are easy to reach, making cutter head 12 easier to form than past cutter heads. Typically, past cutter heads were formed by initially forming a hub, a base ring and a plurality of arms to connect the hub to the base ring around the axis of rotation. The arms were individually welded to both the hub and the base ring. This construction required many full or semi-full penetration welds, which was very labour intensive and resulted in having to use a lot of material for the welds. Additionally, the location of the welds made them difficult to perform. By forming base ring 20 and/or hub 16 with integral arm segments 18, 22, weld zones 24 to join arm segments 18, 22 are at a more accessible location, resulting in an easier and less labour-intensive weld. The welds to form cutter head 12 also use fewer materials due to the placement and the forming of cutter body arms 22 integrally with base ring 20.

FIG. 3A shows a perspective view of a second embodiment of cutter head 12, FIG. 3B shows a side view of cutter head 12, and FIG. 3C shows a top view of the cutter head 12. FIGS. 3D-3H show the individual components of cutter head 12, including a perspective view of hub 16 (FIG. 3D), a perspective view of supplemental ring 26 (FIG. 3E), a top view of supplemental ring 26 (FIG. 3F), a perspective view of a base ring 20 (FIG. 3G), and a perspective view of a cutter body arm 18 (FIG. 3H). Similar parts use the same numbers as in FIGS. 2A-2C.

Cutter head 12 of FIGS. 3A-3C includes hub 16 with hub diameter D_H , hub arm segments 18, base ring 20 with base ring diameter D_B , cutter body arm segments 22, weld zones 24, axis of rotation RA and supplemental ring 26 with supplemental ring arms 28a, 28b and supplemental ring diameter D_S .

Hub 16 includes integrally formed hub arms 18. In the embodiment of FIGS. 3A-3C, cutter body arms 22 are not formed integral to base ring 20, and hub 16 and base ring 20 connect through supplemental ring 26 with supplemental arms 28a, 28b.

Supplemental ring 26 is formed integral with supplemental arms 28a, 28b extending circumferentially inward (28b) and circumferentially outward (28a) from supplemental ring 26. Supplemental ring 26 with integral supplemental arms 28a, 28b can be formed by casting or other means. In the embodiment shown, all supplemental
5 arms 28a extend circumferentially outward from supplemental ring 26, and only some supplemental arms 28b extend circumferentially inward from supplemental ring 26.

Cutter body arms 22 connect on one end to base ring 20 and on the other end to supplemental body arms 28a. Supplemental body arms 28b then connect to hub arms 18, thereby connecting base ring 20 to hub 16. Base ring 20, supplemental ring 26 and
10 hub 16 are axially symmetric around the axis of rotation, with supplemental ring 26 positioned axially forward from base ring 20 and hub 16 positioned axially forward from supplemental ring 26. All connections can be formed, for example, by welding at weld zones 24.

As with cutter head 12 of FIGS. 2A-2C, cutter head 12 of FIGS. 3A-3H is
15 easier to form due to the weld zones 24 between hub arms 18 and supplemental arms 28b as well as between supplemental arms 28a and cutter body arms 22. By forming supplemental ring 26 with integral supplemental arms 28a, 28b and optionally forming hub 16 with integral hub arms 18, weld zones 24 are more accessible. This results in cutter body 12 being easier to form and requiring less welding materials than when
20 welding past cutter heads which required individually welding each arm to the hub, base ring and possibly the supplemental ring.

While supplemental ring 26 is shown to have five circumferentially inward supplemental arms 28b and ten circumferentially outward supplemental arms 28a, this is for example purposes only. Other example embodiments could include, but are not
25 limited to, supplemental ring 26 having only circumferentially inward supplemental arms 28b, supplemental ring 26 having only circumferentially outward arms 28a, supplemental ring having only arms which extend both circumferentially inward and outward, and differing numbers, positioning and/or ratios of circumferentially outward arms 28a to circumferentially inward arms 28b. Additionally, the number, direction
30 and/or placement of arms 18, 22, 28a, 28b are shown for example purposes and can vary depending on cutter head 12 needs. For example, arms 18, 22 and/or 28a, 28b can be angled toward the rotational axis RA in a direction from the base ring to the hub

providing a ball-shaped cutter head for cutting capabilities in the radial and axial direction.

While the invention has been described with reference to exemplary embodiments, it will be understood by those skilled in the art that various changes may
5 be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiments disclosed, but that the invention will include all
10 embodiments falling within the scope of the appended claims.

CONCLUSIES:

1. Werkwijze voor het vormen van een snijkop met een rotatie-as, waarbij de werkwijze omvat:
 - 5 het vormen van een hub;
 - het vormen van ten minste één ring met integrale snijlichaamarmsegmenten die zich uitstrekken vanuit de ten minste ene ring; en
 - het verbinden van de hub met de snijlichaamarmsegmenten, zodanig, dat de hub en de ten minste ene ring zijn verbonden rond de rotatie-as.
- 10 2. Werkwijze volgens conclusie 1, waarbij de stap van het vormen van ten minste één ring met integrale snijlichaamarmsegmenten omvat:
 - het vormen van een basisring met integrale snijlichaamarmsegmenten.
- 15 3. Werkwijze volgens een der conclusies 1-2, waarbij de stap van het vormen van een hub omvat:
 - het vormen van een hub met hub-armsegmenten.
- 20 4. Werkwijze volgens conclusie 3, waarbij de hub-armsegmenten integraal zijn gevormd met de hub.
- 25 5. Werkwijze volgens een der conclusies 3-4, waarbij de stap van het verbinden van de hub met de snijlichaamarmsegmenten omvat:
 - het verbinden van de hub-armsegmenten met de snijlichaamarmsegmenten.
- 30 6. Werkwijze volgens willekeurig welke van conclusies 1-4, waarbij de stap van het vormen van ten minste één ring met integrale snijlichaamarmsegmenten omvat:
 - het vormen van een aanvullende ring met integrale snijlichaamarmsegmenten.
7. Werkwijze volgens conclusie 6, waarbij de stap van het verbinden van de hub met de snijlichaamarmsegmenten omvat:
 - het verbinden van de hub met de snijlichaamarmsegmenten die zich uitstrekken vanuit de aanvullende ring; en

het verbinden van de aanvullende ring met de basisring, zodanig, dat de aanvullende ring een verbinding vormt tussen de basisring en de hub.

8. Werkwijze volgens een der conclusies 6-7, waarbij ten minste een gedeelte van
5 de snijlichaamarmsegmenten dat zich uitstrekt vanuit de aanvullende ring is verbonden met de hub en met de basisring.

9. Werkwijze volgens conclusie 8, waarbij het gedeelte van de
snijlichaamarmsegmenten dat is verbonden met de hub en met de basisring, is
10 verbonden met de hub door middel van hub-armsegmenten en/of is verbonden met basisring door middel van snijlichaamarmsegmenten die zich uitstrekken vanuit de basisring.

10. Werkwijze volgens een der voorgaande conclusies, waarbij de hub, de hub-
15 armsegmenten, de snijlichaamarmsegmenten en/of ten minste één ring zijn verbonden door middel van lastechniek.

11. Werkwijze volgens een der voorgaande conclusies, waarbij de hub, de hub-
armsegmenten, de snijlichaamarmsegmenten en/of de ten minste ene ring zijn
20 verbonden met losse armsegmenten.

12. Snijkop met een rotatie-as, waarbij de snijkop omvat:
ten minste één ring;
een hub die rotatione-symmetrisch en axiaal verschoven is gepositioneerd ten
25 opzichte van de ten minste ene ring; en
een veelheid van armen welke zich uitstrekt tussen de ten minste ene ring en de hub, waarbij ieder van de veelheid van armen een eerste armsegment omvat dat zich uitstrekt ten opzichte van, en integraal is gevormd met, de ten minste ene ring.

- 30 13. Snijkop volgens conclusie 12, waarbij ieder van de veelheid van armen verder omvat:
een tweede armsegment dat zich uitstrekt vanuit de hub, waarbij het eerste armsegment is verbonden met het tweede armsegment teneinde de ten minste ene ring

te verbinden met de hub.

14. Snijkop volgens een der conclusies 12-13, en waarbij de ten minste ene ring omvat:

5 een basising.

15. Snijkop volgens een der conclusies 12-13, waarbij de ten minste ene ring een aanvullende ring omvat.

10 16. Snijkop volgens conclusie 15, waarbij ieder van de veelheid van armen verder omvat:

een derde armsegment dat zich uitstrekt vanuit, en integraal is gevormd met, de aanvullende ring, waarbij de aanvullende ring is verbonden met de eerste armsegmenten en/of de tweede armsegmenten door middel van de derde

15 armsegmenten.

17. Snijkop volgens conclusie 16, waarbij de derde armsegmenten zich omtreksgewijs binnenwaarts uitstrekken vanuit de aanvullende ring.

20 18. Snijkop volgens een der conclusies 16-17, waarbij de derde armsegmenten zich omtreksgewijs buitenwaarts uitstrekken vanuit de aanvullende ring.

19. Snijkop volgens een der conclusies 12-18, waarbij de hub, de ten minste ene ring, de eerste armsegmenten, de tweede armsegmenten en/of de derde armsegmenten zijn
25 verbonden door middel van lastechniek en ieder van de veelheid van armen ten minste één laszone omvat.

20. Snijkop volgens een der conclusies 13-19, waarbij de tweede armsegmenten en de hub integraal zijn gevormd.

30

21. Snijkop volgens een der conclusies 12-20, waarbij de tweede armsegmenten korter zijn dan de eerste armsegmenten.

22. Snijkop volgens een der conclusies 13-20, waarbij de tweede armsegmenten en/of de derde armsegmenten losse armsegmenten zijn.
23. Vaartuig, omvattend een snijkop volgens een der conclusies 12-22.
- 5 24. Aanvullende ring voor een snijkop met een hub, een basisring en een rotatie-as, waarbij de aanvullende ring omvat:
- een ringgedeelte met integrale snijlichaamarmsegmenten; en
- verbindingsoppervlakken op ieder van de snijlichaamarmsegmenten voor
- 10 verbinding met armsegmenten, de hub en/of de basisring, waarbij, wanneer de snijlichaamarmsegmenten zijn verbonden met de armsegmenten, de hub en/of de basisring, de hub, de aanvullende ring en de basisring zijn gepositioneerd rond de rotatie-as, waarbij de aanvullende ring tussen de basisring en de hub is gepositioneerd.
- 15 25. Aanvullende ring volgens conclusie 24, waarbij de snijlichaamarmsegmenten zich omtreksgewijs binnenwaarts uitstrekken vanuit de aanvullende ring voor verbinding met armsegmenten en/of met de hub.
26. Aanvullende ring volgens een der conclusies 24-25, waarbij de
- 20 snijlichaamarmsegmenten zich omtreksgewijs buitenwaarts uitstrekken vanuit de aanvullende ring voor verbinding met armsegmenten en/of met de basisring.
27. Basisring voor een snijkop met een hub en een rotatie-as, waarbij de basisring omvat:
- 25 een basisring met integraal gevormde snijlichaamarmsegmenten; en
- verbindingsoppervlakken op ieder van de snijlichaamarmsegmenten teneinde te zijn verbonden met toegevoegde armsegmenten, een aanvullende ring en/of de hub, waarbij, wanneer de snijlichaamarmsegment zijn verbonden met de toegevoegde armsegmenten, de basisring is verbonden met de hub en axiaal achterwaarts is gelegen
- 30 ten opzichte van de hub rond de rotatie-as.

Fig. 1

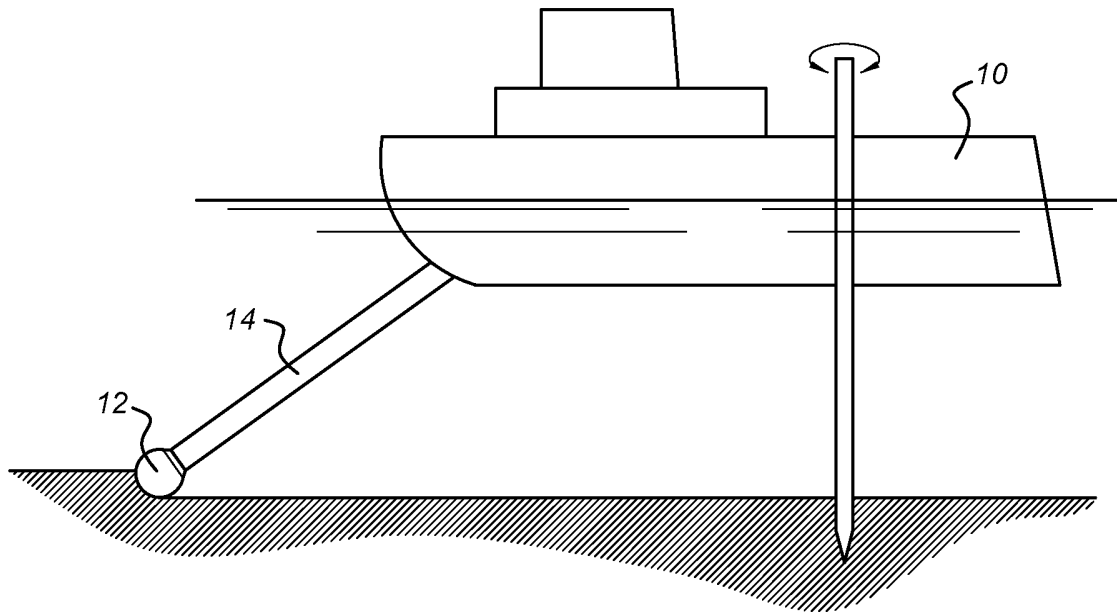


Fig. 2a

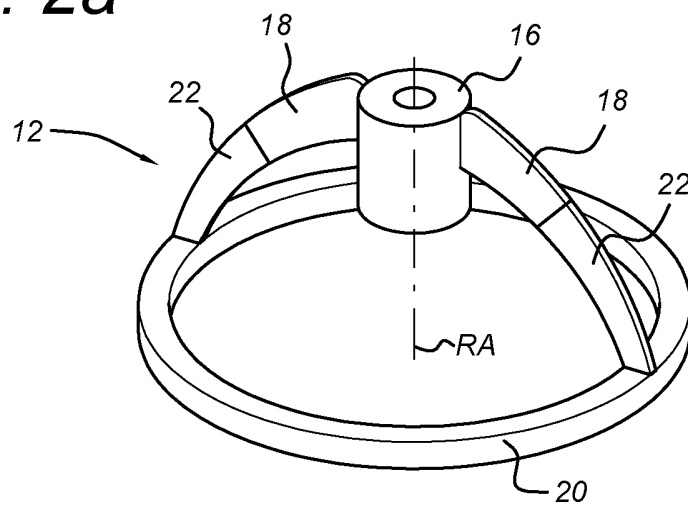


Fig. 2b

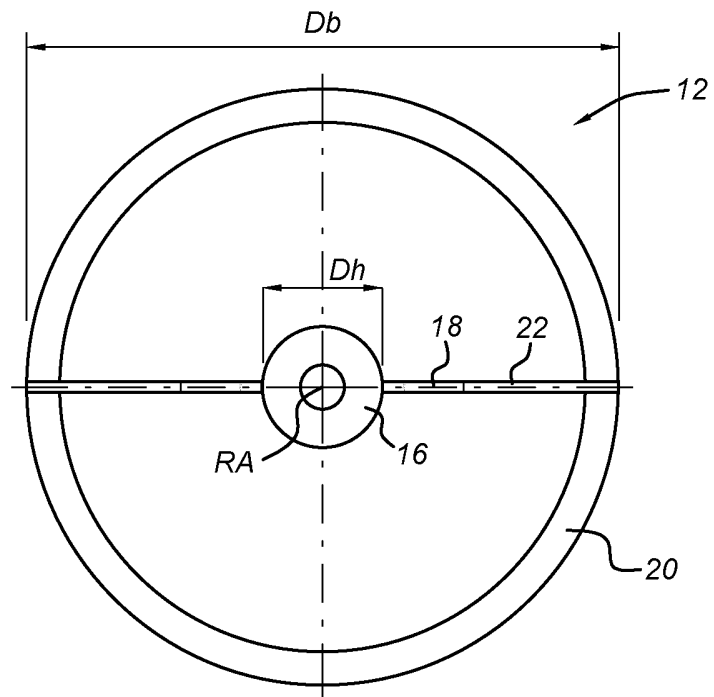


Fig. 2c

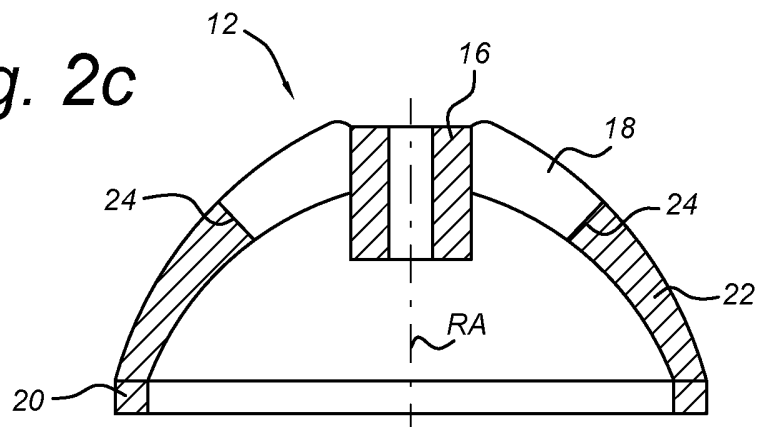


Fig. 2d

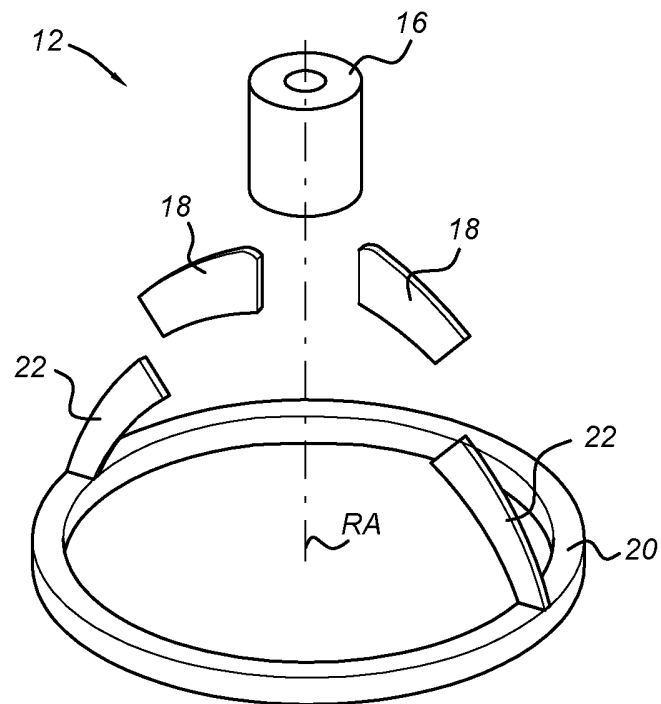


Fig. 3a

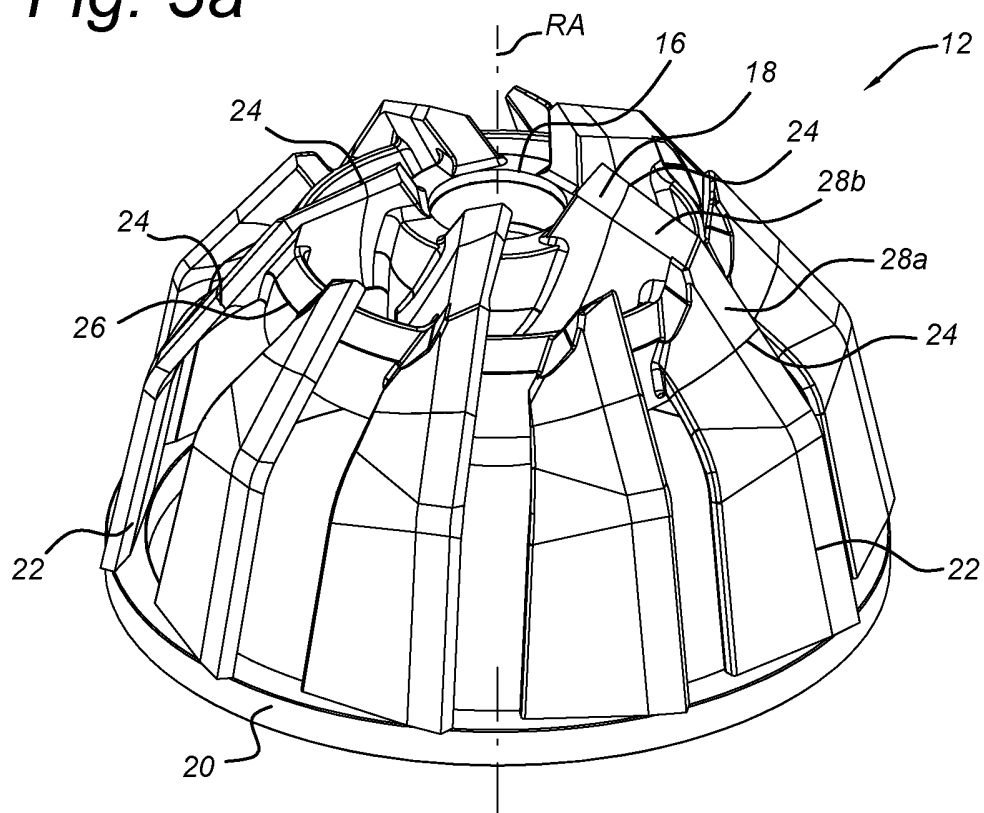


Fig. 3b

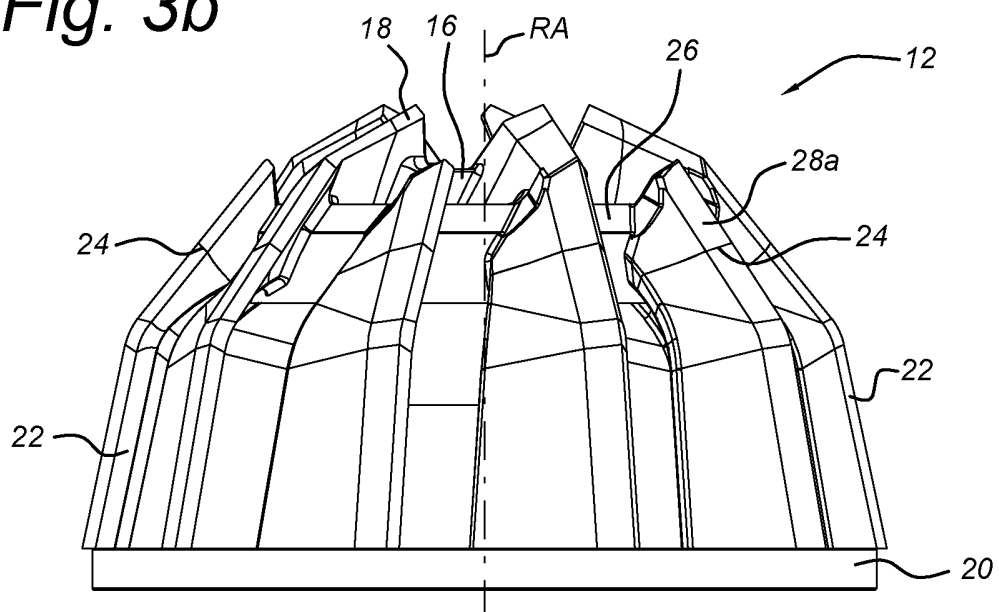


Fig. 3c

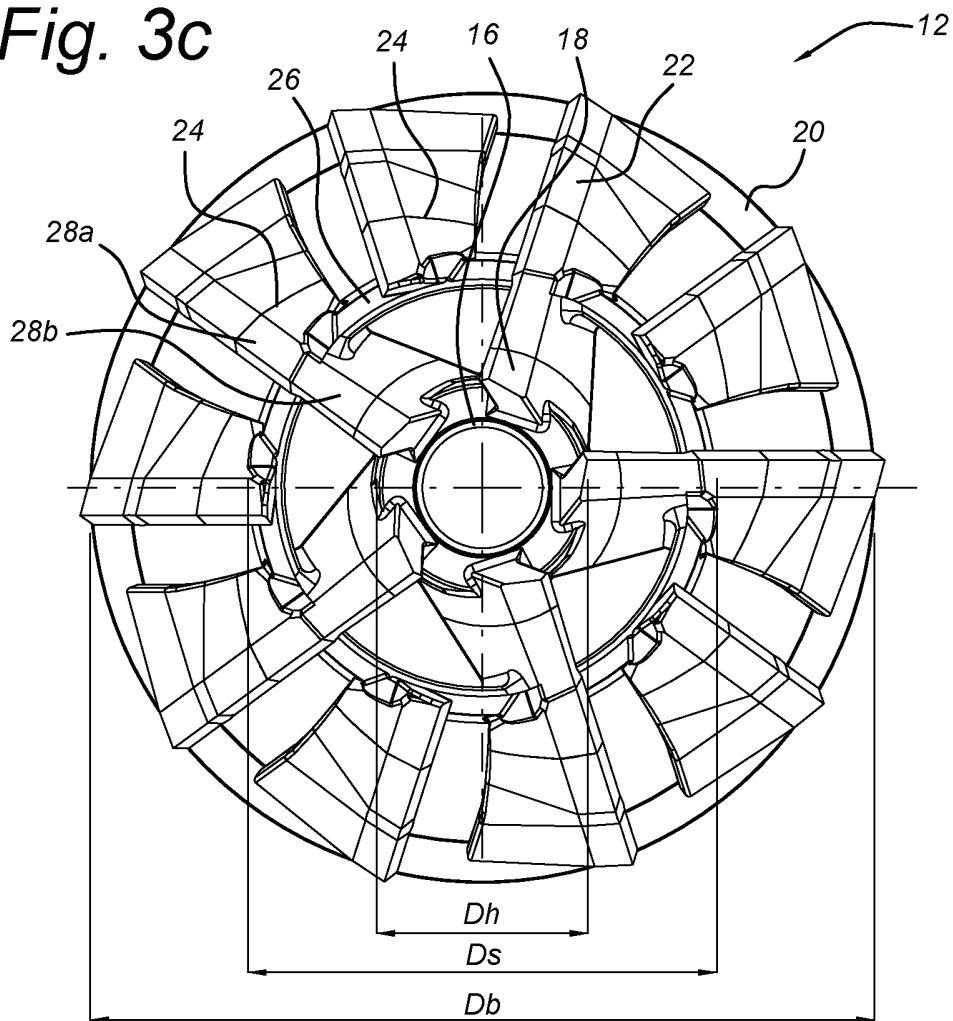


Fig. 3d

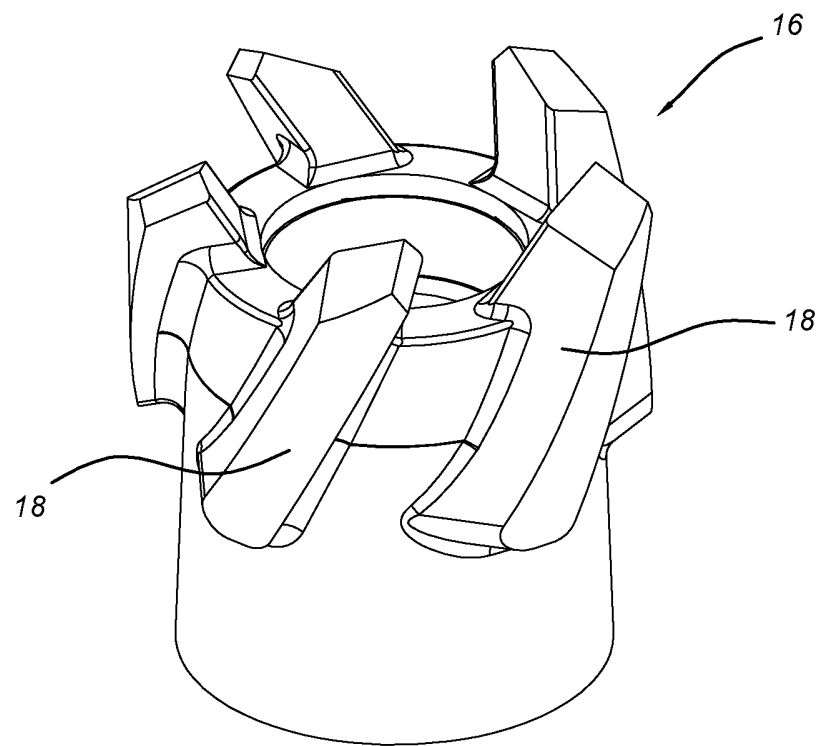


Fig. 3e

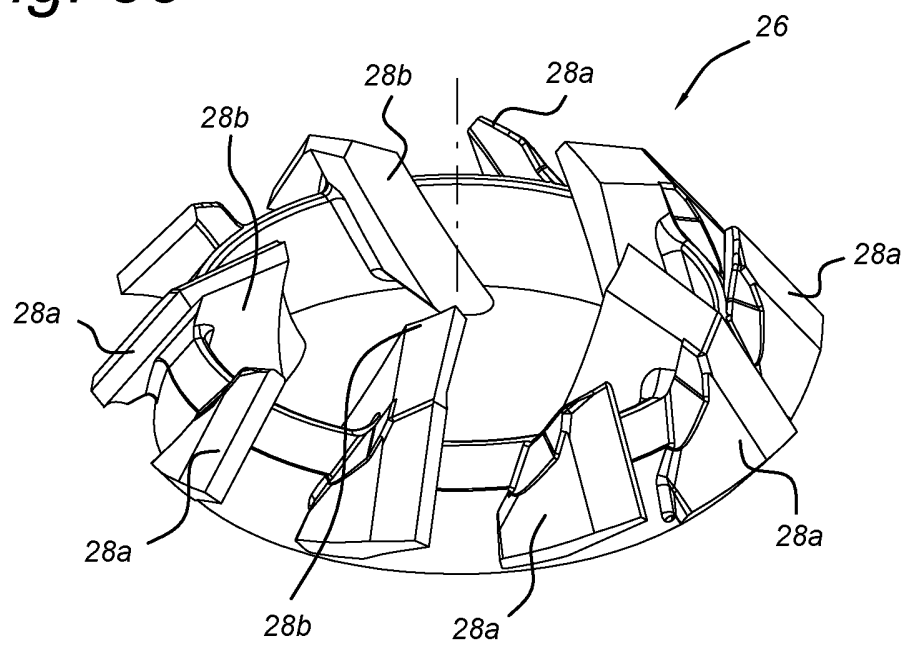


Fig. 3f

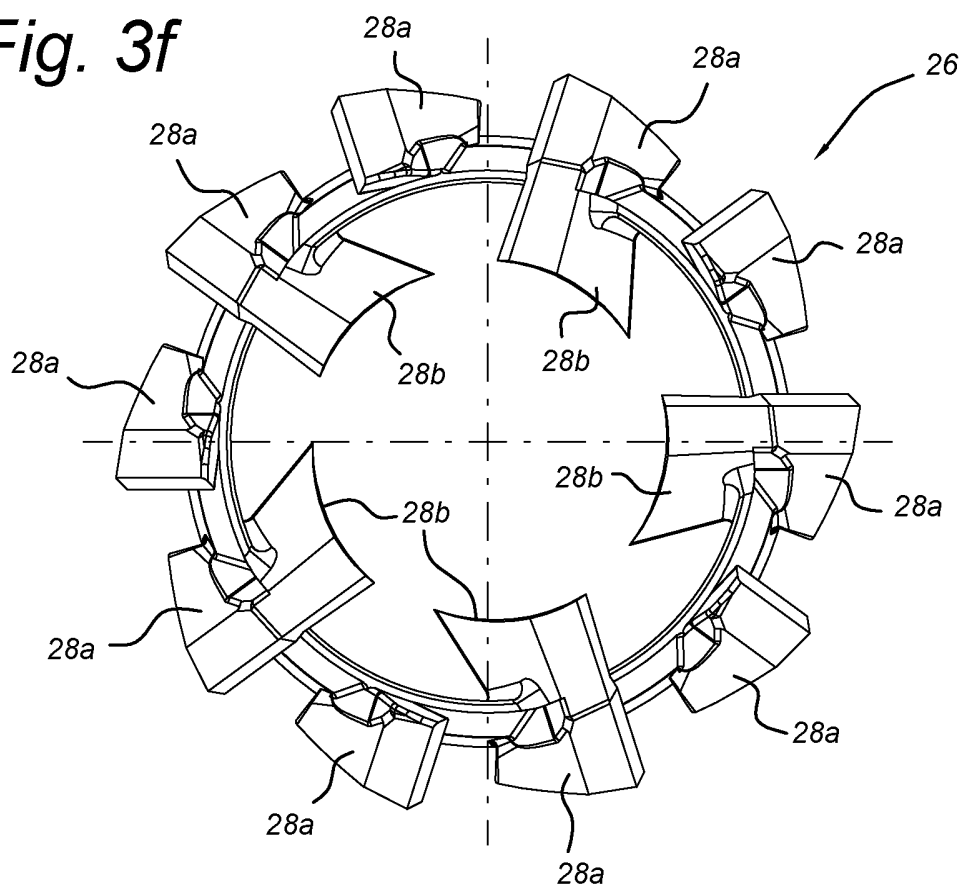


Fig. 3g

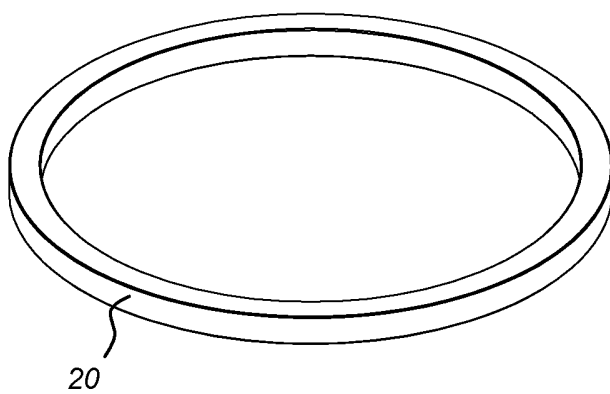
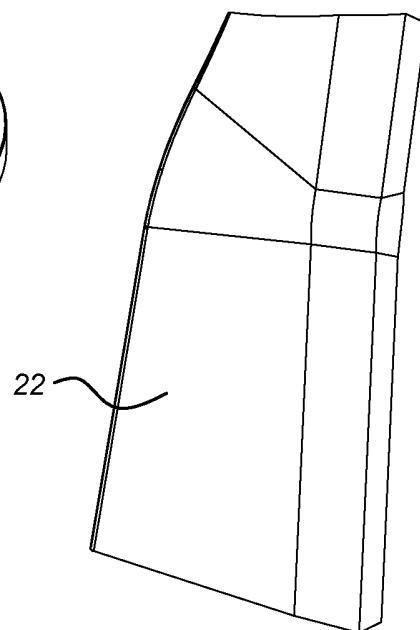


Fig. 3h



SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE		KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE	
		P6048830NL	
Nederlands aanvraag nr.		Indieningsdatum	
2011994		19-12-2013	
		Ingeroepen voorrangsdatum	
Aanvrager (Naam)			
IHC Holland IE B.V.			
Datum van het verzoek voor een onderzoek van internationaal type		Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr.	
08-03-2014		SN 61667	
I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)			
Volgens de internationale classificatie (IPC)			
E02F3/92			
II. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK			
Onderzochte minimumdocumentatie			
Classificatiesysteem		Classificatiesymbolen	
IPC	E02F	E21C	
Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen			
III.	☐	GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES (opmerkingen op aanvullingsblad)	
IV.	☒	GEBREK AAN EENHEID VAN UITVINDING (opmerkingen op aanvullingsblad)	

**ONDERZOEKSRAPPORT BETREFFENDE HET
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Nummer van het verzoek om een onderzoek naar
de stand van de techniek

NL 2011994

A. CLASSIFICATIE VAN HET ONDERWERP

INV. E02F3/92

ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)

E02F E21C

Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)

EP0-Internal, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	EENHEID VAN UITVINDING ONTBREEKT zie aanvullingsblad B ----- US 2 002 749 A (NEVELING SR ALOYS) 28 mei 1935 (1935-05-28) * het gehele document *	1-5,12, 14,23
X	SU 612 031 A1 (GOLBETS MOJSEJ N [SU]; MELAMUT DAVID L; GUREV BORIS G) 25 juni 1978 (1978-06-25) * figuren 1, 2 *	1-5, 10-14, 19-22
A	US 2 530 951 A (ENRIGHT PAUL M) 21 november 1950 (1950-11-21) * figuren 1, 2 *	1,12,27
A	US 4 050 170 A (PROEHL NORMAN P) 27 september 1977 (1977-09-27) * samenvatting; figuren 1-7 *	1,12,27



Verdere documenten worden vermeld in het vervolg van vak C.



Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

° Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvraag vermeld

"E" eerdere octrool(aanvraag), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvraag, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid

10 juli 2014

Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type

Naam en adres van de instantie

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De bevoegde ambtenaar

Bultot, Coralie

GEBREK AAN EENHEID VAN UITVINDING

Octrooiaanvraag Nr.:

SN 61667
NL 2011994

AANVULLINGSBLAD B

De Instantie belast met het uitvoeren van het onderzoek naar de stand van de techniek heeft vastgesteld dat deze aanvraag meerdere uitvindingen bevat, te weten:

1. conclusies: 1-5, 10-14, 19-23, 27

Method to assembly a cutter head and corresponding cutter head or part of it.

1.1. conclusies: 1, 2, 12, 14, 27

To form a base ring with cutter body arm segments; and corresponding apparatus features.

1.2. conclusies: 3-5, 13, 19-22

To form a hub with hub arm segments and to connect them to the cutter body arm segments; and corresponding apparatus features.

1.3. conclusies: 10, 11

The connection between parts of a cutter head is done by welding /or the connection is realised through loose arm segments.

1.4. conclusie: 23

A vessel comprising a cutter head.

2. conclusies: 6-9, 15-18, 24-26

To form a supplemental ring with cutter body arm segments and to connect them so that the supplemental ring is positioned between the base ring and the hub around the axis of rotation of a cutter head; and corresponding apparatus features.

Het vooronderzoek werd tot het eerste onderwerp beperkt.

Preliminary (Clarity):

- Dependent claims 19 and 21, written as appendant to claim 12, defines further the feature " the second arm segments". However the feature "the second arm segments" is first introduced in claim 13. It results in a lack of clarity. We assume for the rest of the argumentation that claim 19 is dependent on claim 13 and claims 14 to 18, if claims 14 and 15 are dependent on claim 13 and that claim 21 is dependent on claim 13 and claims 14 to 20, if claims 14 and 15 are dependent on claim 13.

1. Independent claims 1 and 12 - lack of novelty
D1 discloses in fig. 2 and on page 2, column 1, line 73 - page 2, column 2, line 38:
Werkwijze voor het vormen van een snijkop (15) met een rotatie-as

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De Instantie belast met het uitvoeren van het onderzoek naar de stand van de techniek heeft vastgesteld dat deze aanvraag meerdere uitvindingen bevat, te weten:

(longitudinal axis of shaft 24), waarbij de werkwijze omvat:
het vormen van een hub (35);
het vormen van ten minste één ring (45) met integrale (page 2, column 2, lines 36-38) snijlichaamarmsegmenten (44) die zich uitstrekken vanuit de ten minste ene ring (45); en
het verbinden (through 38, 39, 41, 42 and 43) van de hub (35) met de snijlichaamarmsegmenten (44), zodanig, dat de hub (35) en de ten minste ene ring (45) zijn verbonden rond de rotatie-as. (see fig. 2)
The subject-matter of claim 1 is also disclosed, at least implicitly in D2, fig. 1 and 2, with the hub 4, the ring 6, the arm segments 7 integral with ring 6.

D1 discloses in fig. 2 and on page 2, column 1, line 73 - page 2, column 2, line 38:
Snijkop (15) met een rotatie-as (longitudinal axis of shaft 24), waarbij de snijkop (15) omvat:
ten minste één ring (45);
een hub (35) die rotationeel-symmetrisch en axiaal verschoven is gepositioneerd (fig. 2) ten opzichte van de ten minste ene ring (45); en
een veelheid van armen (38, 44) welke zich uitstrekt tussen de ten minste ene ring (45) en de hub (35), waarbij ieder van de veelheid van armen (38, 44) een eerste armsegment (44) omvat dat zich uitstrekt ten opzichte van (fig. 2), en integraal is gevormd met (page 2, column 2, lines 36-38), de ten minste ene ring (45).
The subject-matter of claim 12 is also disclosed, at least implicitly in D2, fig. 1 and 2 with the hub 4, the ring 6, the arm segments 7 integral with ring 6.

The subject-matter of claims 1 and 12 are therefore not new.

2. Groups of invention

The application contains 4 independent claims 1, 12, 24 and 27. Moreover claims 1 and 12 are not novel and do not contain any novel feature which could be regarded as special technical features. As a result, the independent claims 24 and 27 and the claims directly appendant on claims 1 and 12 are not linked through a common inventive concept (different and non corresponding potential special technical features with different resulting technical effects and/or solving different objective technical problems). This leads to a lack of unity.

The following groups of invention have been identified:

- Claims 1, 2, 12, 14, 27

The potential special technical features of this group can be summarised as: To form a base ring with cutter body arm segments; and corresponding apparatus features. (Note: the feature that the cutter body arm segments are integral to the ring is not new - see point 1 - and this feature is therefore not considered to assess the potential special technical features of this group).

The technical effects associated with the above features are: to design a base ring for efficient assembling of a cutter head.

The objective technical problem solved by this invention could be formulated as: To improve the design of a base ring for efficient

GEBREK AAN EENHEID VAN UITVINDING

Octrooiaanvraag Nr.:

SN 61667

NL 2011994

AANVULLINGSBLAD B

De Instantie belast met het uitvoeren van het onderzoek naar de stand van de techniek heeft vastgesteld dat deze aanvraag meerdere uitvindingen bevat, te weten:

assembly of a cutter head.

- Claims 3-5, 13, 19, 20, 21, 22

The potential special technical features of this group can be summarised as: To form a hub with hub arm segments and to connect them to the cutter body arm segments; and corresponding apparatus features.

The technical effects associated with the above features are: to design a hub for efficient assembly of a cutter head.

The objective technical problem solved by this invention could be formulated as: To improve the design of a hub for efficient assembly of a cutter head.

- Claims 6-9, 15-18, 24-26

The potential special technical features of this group can be summarised as: To form a supplemental ring with cutter body arm segments and to connect them so that the supplemental ring is positioned between the base ring and the hub around the axis of rotation of a cutter head; and corresponding apparatus features. (Note: the feature that the cutter body arm segments are integral to the ring is not new - see point 1 - and this feature is therefore not considered to assess the potential special technical features of this group).

The technical effects associated with the above features are: to design a supplemental ring for a cutter head.

The objective technical problem solved by this invention could be formulated as: To improve the robustness of a cutter head.

- Claims 10, 11

The potential special technical features of this group can be summarised as: The connection between parts of a cutter head is done by welding /or the connection is realised through loose arm segments.

The technical effects associated with the above features are: to have an easy and robust connection between parts of a cutter head.

The objective technical problem solved by this invention could be formulated as: To improve the assembly and robustness of a cutter head.

- Claim 23

The potential special technical features of this group can be summarised as: A vessel comprising a cutter head.

The objective technical problem solved by this invention could be formulated as: to operate efficiently a cutter head.

The potential special technical features of the above 5 groups of invention are neither the same nor corresponding (see different and non corresponding potential special technical features with different resulting technical effects and/or solving different objective technical problems). Thus, the application lacks unity (Article 82 and Rule 44 EPC).

According to the lack of unity a posteriori of this application and the search expenses involved, the partial search report has been drawn for the first, second, fourth and fifth inventions (Claims 1-5, 10-14, 19-23 and 27).

**ONDERZOEKSRAPPORT BETREFFENDE HET
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar
de stand van de techniek

NL 2011994

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
US 2002749	A	28-05-1935	GEEN
SU 612031	A1	25-06-1978	GEEN
US 2530951	A	21-11-1950	GEEN
US 4050170	A	27-09-1977	CA 1046092 A1 09-01-1979 US 4050170 A 27-09-1977

WRITTEN OPINION

File No. SN61667	Filing date (<i>day/month/year</i>) 19.12.2013	Priority date (<i>day/month/year</i>)	Application No. NL2011994
International Patent Classification (IPC) INV. E02F3/92			
Applicant IHC Holland IE B.V.			

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the application
- ☒ Box No. VIII Certain observations on the application

	Examiner Bultot, Coralie
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WRITTEN OPINION

Application number

NL2011994

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ on paper
 - ☐ in electronic form
 - c. time of filing/furnishing:
 - ☐ contained in the application as filed.
 - ☐ filed together with the application in electronic form.
 - ☐ furnished subsequently for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

WRITTEN OPINION

Application number

NL2011994

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step, or to be industrially applicable have not been examined in respect of

- ☐ the entire application
- ☒ claims Nos. 6-9, 15-18, 24-26

because:

- ☐ the said application, or the said claims Nos. relate to the following subject matter which does not require a search (*specify*):
- ☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):
- ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed (*specify*):
- ☒ no search report has been established for the whole application or for said claims Nos. 6-9, 15-18, 24-26
- ☐ a meaningful opinion could not be formed as the sequence listing was either not available, or was not furnished in the international format (WIPO ST25).
- ☐ a meaningful opinion could not be formed without the tables related to the sequence listings; or such tables were not available in electronic form.
- ☐ See Supplemental Box for further details.

Box No. IV Lack of unity of invention

1. The requirement of unity of invention is not complied with for the following reasons:

see separate sheet

2. This report has been established in respect of the following parts of the application:

- ☐ all parts.
- ☒ the parts relating to claims Nos. (see Search Report)

WRITTEN OPINION

Application number

NL2011994

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes: Claims	27
	No: Claims	1-5, 10-14, 19-23
Inventive step	Yes: Claims	27
	No: Claims	1-5, 10-14, 19-23
Industrial applicability	Yes: Claims	1-5, 10-14, 19-23, 27
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the application

see separate sheet

Re Item VIII

Certain observations on the application

- 1 Dependent claims 19 and 21, written as appendant to claim 12, defines further the feature " the second arm segments". However the feature "the second arm segments" is first introduced in claim 13. It results in a lack of clarity. We assume for the rest of the argumentation that claim 19 is dependent on claim 13 and claims 14 to 18, if claims 14 and 15 are dependent on claim 13 and that claim 21 is dependent on claim 13 and claims 14 to 20, if claims 14 and 15 are dependent on claim 13.

- 2 In several claims, claims 10, 11, 24 and 27, a list is formulated with the separator "and/or", such as in independent claim 27 for instance: " (...) for connecting to additional arms segments, a supplemental ring and/or the hub (...)". We consider here that the list is to be read as "(...) for connecting to additional arms segments and/or a supplemental ring and/or the hub (...)". All the possible alternatives implied by the formulation of the claims are not supported by the description and the drawings. It results therefore in a lack of clarity.

Furthermore, this list in claim 27 is in contradiction with the remaining features that "when the cutter body arm segments are connected to additional arm segments, the base ring connects to the hub and is positioned axially rearward from the hub around the axis of rotation". With this feature, there is only the case of connection to additional arm segments and not to a supplemental ring and/or the hub and it is an attempt to define the feature through its result to be achieved. It results in a further lack of clarity for claim 27.

Re Item IV

Lack of unity of invention

Reference is made to the following documents:

- | | |
|----|--|
| D1 | US 2 002 749 A (NEVELING SR ALOYS) 28 mei 1935
(1935-05-28) |
| D2 | SU 612 031 A1 (GOLBETS MOJSEJ N [SU]; MELAMUT DAVID
L; GUREV BORIS G) 25 juni 1978 (1978-06-25) |

1 Independent claims 1 and 12 - lack of novelty

D1 discloses in fig. 2 and on page 2, column 1, line 73 - page 2, column 2, line 38:

Werkwijze voor het vormen van een snijkop (15) met een rotatie-as (longitudinal axis of shaft 24), waarbij de werkwijze omvat:

het vormen van een hub (35);

het vormen van ten minste één ring (45) met integrale (page 2, column 2, lines 36-38) snijlichaamarmsegmenten (44) die zich uitstrekken vanuit de ten minste ene ring (45); en

het verbinden (through 38, 39, 41, 42 and 43) van de hub (35) met de snijlichaamarmsegmenten (44), zodanig, dat de hub (35) en de ten minste ene ring (45) zijn verbonden rond de rotatie-as. (see fig. 2)

The subject-matter of claim 1 is also disclosed, at least implicitly in D2, fig. 1 and 2, with the hub 4, the ring 6, the arm segments 7 integral with ring 6.

D1 discloses in fig. 2 and on page 2, column 1, line 73 - page 2, column 2, line 38:

Snijkop (15) met een rotatie-as (longitudinal axis of shaft 24), waarbij de snijkop (15) omvat:

ten minste één ring (45);

een hub (35) die rotatione-symmetrisch en axiaal verschoven is gepositioneerd (fig. 2) ten opzichte van de ten minste ene ring (45); en een veelheid van armen (38, 44) welke zich uitstrekt tussen de ten minste ene ring (45) en de hub (35), waarbij ieder van de veelheid van armen (38, 44) een eerste armsegment (44) omvat dat zich uitstrekt ten opzichte van (fig. 2), en integraal is gevormd met (page 2, column 2, lines 36-38), de ten minste ene ring (45).

The subject-matter of claim 12 is also disclosed, at least implicitly in D2, fig. 1 and 2 with the hub 4, the ring 6, the arm segments 7 integral with ring 6.

The subject-matters of claims 1 and 12 are therefore not new.

2 Groups of invention

The application contains 4 independent claims 1, 12, 24 and 27. Moreover claims 1 and 12 are not novel and do not contain any novel feature which could be regarded as special technical features. As a result, the independent claims 24 and 27 and the claims directly appendant on claims 1 and 12 are not linked through a common inventive concept (different and non corresponding potential special technical features with different resulting technical effects and/or solving different objective technical problems). This leads to a lack of unity.

The following groups of invention have been identified:

- Claims 1, 2, 12, 14, 27

The potential special technical features of this group can be summarised as: To form a base ring with cutter body arm segments; and corresponding apparatus features. (Note: the feature that the cutter body arm segments are integral to the ring is not new - see point 1 - and this feature is therefore not considered to assess the potential special technical features of this group).

The technical effects associated with the above features are: to design a base ring for efficient assembling of a cutter head.

The objective technical problem solved by this invention could be formulated as: To improve the design of a base ring for efficient assembling of a cutter head.

- Claims 3-5, 13, 19, 20, 21, 22

The potential special technical features of this group can be summarised as: To form a hub with hub arm segments and to connect them to the cutter body arm segments; and corresponding apparatus features.

The technical effects associated with the above features are: to design a hub for efficient assembling of a cutter head.

The objective technical problem solved by this invention could be formulated as: To improve the design of a hub for efficient assembling of a cutter head.

- Claims 6-9, 15-18, 24-26

The potential special technical features of this group can be summarised as: To form a supplemental ring with cutter body arm segments and to connect them so that the supplemental ring is positioned between the base ring and the hub around the axis of rotation of a cutter head; and corresponding

appartus features. (Note: the feature that the cutter body arm segments are integral to the ring is not new - see point 1 - and this feature is therefore not considered to assess the potential special technical features of this group).

The technical effects associated with the above features are: to design a supplemental ring for a cutter head.

The objective technical problem solved by this invention could be formulated as: To improve the robustness of a cutter head.

- Claims 10, 11

The potential special technical features of this group can be summarised as: The connection between parts of a cutter head is done by welding /or the connection is realised through loose arm segments.

The technical effects associated with the above features are: to have an easy and robust connection between parts of a cutter head.

The objective technical problem solved by this invention could be formulated as: To improve the assembling and robustness of a cutter head.

- Claim 23

The potential special technical features of this group can be summarised as: A vessel comprising a cutter head.

The objective technical problem solved by this invention could be formulated as: to operate efficiently a cutter head.

The potential special technical features of the above 5 groups of invention are neither the same nor corresponding (see different and non corresponding potential special technical features with different resulting technical effects and/or solving different objective technical problems). Thus, the application lacks unity.

According to the lack of unity a posteriori of this application and the search expenses involved, the partial search report has been drawn for the first, second, fourth and fifth inventions (Claims 1-5, 10-14, 19-23 and 27).

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Independent claim 1

D1 and D2 disclose the subject-matter of claim 1 (see point IV, 1), which is therefore not new.

2 Independent claim 12

D1 and D2 disclose the subject-matter of claim 12 (see point IV, 1), which is therefore not new.

3 Independent claim 27

D2 discloses in fig. 1 and 2

Basisring (6) voor een snijkop met een hub (4) en een rotatie-as (longitudinal axis of 5), waarbij de basisring (6) omvat:
een basisring (6) met integraal gevormde snijlichaamarmsegmenten (7);
en
verbindingsoppervlakken (surfaces in contact between parts 3 and 7 in fig. 1) op ieder van de snijlichaamarmsegmenten (7) teneinde te zijn verbonden met toegevoegde armsegmenten (3), waarbij, wanneer de snijlichaamarmsegment (7) zijn verbonden met de toegevoegde armsegmenten (3), de basisring (6) is verbonden met de hub (4) en axiaal achterwaarts is gelegen ten opzichte van de hub (4) rond de rotatie-as (fig. 1).

The subject-matter of claim 27 is therefore not new.

4 Dependent claims

Dependent claims 2-5, 10, 11, 13, 14, 19-23 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of novelty.

- Claims 2, 14

see D1, fig. 2 (base ring 45) and D2 (base ring 6).

- Claim 3

see D1, fig. 2 (with hub arm segments 38) and D2 (hub arm segments 3).

- Claims 4

see D1 (fig. 2 and page 2, column 2, lines 12-19) and D2 (fig. 1).

- Claim 5

see D1 (fig. 2, connection through 39, 41, 42 and 43) and D2 (fig. 1).

- Claims 10, 19

see D2, fig. 1, it is implicit for fig. 1 that 3 and 7 are welded together.

- Claims 11, 22

see D2, fig. 1

- Claim 13

see D2, fig. 1.

- Claim 20

see D2 (fig. 1)

- Claim 21

see D1, fig. 2, along the longitudinal axis of rotation of the cutter head, the projected length of arm segments 38 (without blade 40) is shorter than the projected length of arm segments 44.

- Claim 23

see D1, fig. 1, dredge or vessel 10 with hull 11.