

Description

This invention pertains to water jet cutting devices wherein high pressure water is entrained with particulate abrasive material for cutting or abrading hard substances.

Nozzle assemblies for abrasive-entrained water jet cutting are subjected to substantial wear forces by the entrained abrasive material. A typical nozzle assembly uses a mounted jewel element, having a small diameter orifice, to form the initial water jet stream from a source of high pressure water. Downstream of the jewel element, particulate abrasive material is introduced to the water jet stream. The combined water/abrasive jet stream is then directed through an elongated nozzle element wherein the abrasive material becomes distributed throughout the jet before leaving the assembly. If the jewel mounting or the jewel orifice is not centered exactly, the initial water stream may be off center with respect to the nozzle element. Likewise, if the nozzle element is not centered exactly in the assembly, the nozzle element may be off center with respect to the water stream. In either case, when abrasives are added to the water stream, accelerated erosion of the nozzle element will occur, resulting in much reduced life of the nozzle element. Moreover, out-of-center alignment within the assembly may also result in degrading the jet stream itself to such an extent that the cutting ability of the abrasive/water jet is markedly reduced.

EP 0 221 236 discloses a nozzle attachment for abrasive fluid-jet cutting systems. The nozzle assembly includes a main body in which means for defining a first orifice is fitted for directing a jet along a generally axial path. A second conduit discharging means is fixed to the body into which the jet is directed. The body includes alignment means for adjusting the first orifice defining means so that the jet may be accurately directed at the fixed second conduit means. The alignment means comprises either opposing threaded members, or, what the specification describes as a ball and socket joint. EP 0 221 236 does not disclose the use of an outlet conduit which is adjustable with respect to the jet. EP 0 221 236 therefore has the disadvantage of being more complicated when worn parts need to be replaced. EP 0 221 236 does not disclose the use of rings with eccentric bores, not the use of rollers to act between the rings and the body of the outlet conduit.

A primary object of the present invention is to provide a nozzle assembly with a nozzle element centring mechanism. By the use of such a mechanism alignment of the nozzle element and the jewel element can be attained notwithstanding assembly or manufacturing errors or imperfections. A further

object is to provide such a centring mechanism that can be manually adjusted while the nozzle is operating, whereby the results of the adjustment can be observed during the adjustment phase.

Another object is to provide such a centring mechanism in the nozzle assembly at a location such that the nozzle element can be replaced when worn without interference with the centring mechanism.

The water jet cutting assembly of this invention comprises a nozzle body for receiving a water jet forming element, an elongate nozzle element, a nozzle element mounting means for mounting means for mounting the elongate nozzle element in said nozzle body and including a nozzle element collet for receiving and holding said nozzle element,

characterized in that a nozzle element centring means is carried by the nozzle body, the nozzle element centring means being externally manipulatable for shifting the mounting means transversely to the longitudinal axis of the nozzle assembly whereby the position of said nozzle element is adjustable relative to the position of the water jet forming element. In that the collet has an outer surface in contact with the nozzle centring means whereby manipulation of the centring means will effect lateral movement of said collet, and in that the nozzle centring means includes a pair of centring rings encircling said nozzle body, each ring having a circular inner periphery eccentric to the nozzle assembly longitudinal axis, the nozzle centring means further includes a multiple roller means mounted in the nozzle body in contact with the inner surfaces of the centring rings and with an exterior surface of the collet whereby rotation of a centring ring will cause transverse adjustment of the collet.

In one embodiment, the nozzle body includes a plurality of apertures, within each of which, one of said roller means is positioned, in that the nozzle body includes an interior chamber within which the collet is positioned, and in that the nozzle element centring means includes a fastener for securing said collet in the chamber whilst permitting transverse movement of the collet within the chamber.

The collet fastener may include an external peripheral extension from which the centring rings are supported in an encircling relationship to the nozzle body.

According to another embodiment the nozzle body includes an interior chamber within which the collet is positioned, and in that the nozzle element centring means includes fastening means for securing the collet in the chamber and permitting transverse movement of the collet in the chamber.

Preferably, the nozzle body comprises a cylinder including an upper chamber relatively up-

stream of the collet chamber within which the water jet forming element is to be contained, a web extending between the two chambers and having a fluid passage therethrough for passage of a water jet from the jet forming element to said nozzle element and in that the collet is seated against the underside of the web by the collet fastener.

The centring mechanism permits the position of the nozzle element to be shifted transversely to the axis of the nozzle assembly in an "X" direction, a "Y" direction or in any combination of X and Y coordinates, as desired by the operator. Consequently, a variety of adjustment directions can be tried to find the best alignment possible given the condition of the elements and their assembly that the operator has at hand.

Figure 1 is an elevation view of nozzle assembly of this invention with the left half shown in cross-section; and

Figure 2 is a cross-section taken along the line 2-2 in Figure 1 and rotated 90 degrees.

The body 10 of the nozzle assembly is a machined cylinder comprised of an upper half 12 and a lower half 14. The two halves are separated by an internal circular web 16 through which is provided an axial fluid passage 18 that connects the halves. The upper half 12 contains an axial cylindrical chamber open at the top, the upper side wall of which is threaded at 20 to receive a jewel-mounting element 22. The lower half 14 also contains an axial cylindrical chamber open at the bottom, the lower side wall of which is threaded at 24 to receive a nozzle mounting 26. Around the periphery of body 10, the nozzle element centering mechanism 28 is carried such that it may be manually adjusted to reposition the nozzle element transversely of the vertical longitudinal axis of the nozzle assembly.

The jewel-mounting element 22 comprises a machined cylindrical member providing an internal annular rim 30 on which a jewel and its mounting 32 is seated. The jewel contains an axial aperture intended to be aligned with the vertical axis of body 10 and passage 18. It is this jewel aperture that forms the water jet stream from high pressure water entering the nozzle assembly from a source indicated in dotted outline 34. The upper chamber in body 10 is formed such that a mixing cavity 36 exists between the bottom of jewel-mounting element 22 and web 16. A passage in the side wall of body 10 provides an entry for particulate abrasive material into the mixing cavity 36. As high pressure water passes through the mixing cavity 36 in the form of a high velocity jet and through passage 18, a vacuum is created within mixing cavity 36. This vacuum draws the particulate abrasive material into the cavity and it becomes entrained in the jet stream and exits through passage 18 with the jet

stream.

The nozzle mounting 26 comprises a nozzle element-holding collet 38, a collet nut 40 and a retaining nut 42. An elongated nozzle element 44 is fitted within an elongated passage in collet 38 and secured therein by collet nut 40. Collet 38 is a machined cylindrical member having a circular disk at its upper end that seats against the underside of web 16. The upper circular disk of collet 38 is provided with an axial passage 46 of the same diameter as passage 18. The elongated passage within which nozzle element 44 is positioned is also axially aligned so that the elongated passage 50 through nozzle element 44 is aligned with passages 18 and 46. Retaining nut 42 is screwed onto the lower threaded portion 24 of body 10 and retains collet 38 in the position shown. A shim plate 52 is fitted between the upper edge of nut 42 and the underside of the upper disk portion of collet 38. An annular O-ring fits in an annular groove in the upper surface of the collet circular disk as a seal between the adjacent surfaces as shown.

The nozzle centering mechanism 28 comprises an upper centering ring 54 and a lower centering ring 56 and two pair of position-transmitting balls 58 and 60. The rings 54 and 56 encircle the lower half of body 10, such lower half being machined to provide a reduced diameter section and an external annular ring-seating rim 62. Two pair of passages are bored through the side wall of the lower half of body 10 for the ball pairs 58 and 60. The passages for ball pair 58 are diametrically opposite one another and are overlaid by upper ring 54. The passages for ball pair 60 are also diametrically opposite one another, but at 90 degrees rotation from ball pair 58, and are overlaid by lower ring 56. The balls of each pair are large enough to protrude from the passages within which they are positioned so that they may contact the outer side of the collet upper disk and the inner side of their respective rings 54 or 56. The collet upper disk has sufficient height to provide contact surface for both pairs of balls, as shown.

The centering rings 54 and 56 have an inner circular periphery that is circular about an eccentric axis. Consequently, as each ring is rotated, the ball pair associated with that ring will shift laterally in the direction of movement of that ring's eccentric axis. Since the ball pairs are positioned at 90 degrees with respect to each other, one ring's axis will be shifted along an "X" coordinate and the other will be shifted along a "Y" coordinate. If only one ring is rotated at a time, the collet 38 will be shifted along that "X" or "Y" coordinate, depending on which ring is rotated. If both rings are rotated simultaneously, the collet axis will be shifted in a direction that is a function of both coordinates and the respective degrees of ring rotations. The cylin-

drical chamber in the lower half of body 10 has a large enough diameter to provide enough room for collet 38 to shift back and forth and around, as required to establish correct alignment. The shim plate 52 provides a bearing surface on which collet 38 slides as it is moved back and forth and around.

Centering rings 54 and 56 are positioned as shown, with synthetic bearing rings positioned at 64, 66 and 68 to permit frictionless turning. These bearing rings may be fabricated of a material such as Delrin. The retaining nut 42 is provided with an outer annular rim 43 that contacts the lower bearing ring 68. When retaining nut 42 is tightened, the composite ring assembly is confined between the upper rim 62 on body 10 and the lower rim 43 on retaining nut 42. The Delrin rings are somewhat compressible so that retaining nut 42 need not be overly tightened to insure correct positioning of either collet 38 or the centering rings 54 and 56. The centering rings are provided with outer peripheries that extend outward beyond the body 10 and that have knurled outer surfaces to provide gripable surfaces that can be grasped between the thumb and fingers of an operator for rotation.

The various machined parts of the nozzle assembly are preferably fabricated from the following metals: centering rings 54 and 56 and collet nut 40, brass; nozzle element 44, tungsten carbide steel; bearing rings 64, 66 and 68, Delrin plastic; all other parts, stainless steel.

While a preferred embodiment of the centering nozzle assembly of this invention has been described, certain changes may be made without departing from the scope of the invention. Consequently, the scope of the invention is only to be delimited by the appended claims herein.

Claims

1. A water jet cutting assembly comprising
 - a nozzle body for receiving a water jet forming element 22, 32,
 - an elongate nozzle element 44,
 - a nozzle element mounting means 26 for mounting the elongate nozzle element 44 in said nozzle body and including a nozzle element collet 38 for receiving and holding said nozzle element 44,
 - characterized in that a nozzle element centring means 28 is carried by the nozzle body, the nozzle element centring means being externally manipulatable for shifting the mounting means 26 transversely to the longitudinal axis of the nozzle assembly whereby the position of said nozzle element 44 is adjustable relative to the position of the water jet forming element 22, 32, in that the collet 38 has an outer surface in contact with the nozzle centring means 28

whereby manipulation of the centring means 28 will effect lateral movement of said collet 38, and in that the nozzle centring means 28 includes a pair of centring rings 54, 56 encircling said nozzle body, each ring having a circular inner periphery eccentric to the nozzle assembly longitudinal axis, the nozzle centring means 28 further includes multiple roller means 58, 60 mounted in the nozzle body in contact with the inner surfaces of the centring rings 54, 56 and with an exterior surface of the collet 38 whereby rotation of a centring ring 54, 56 will cause transverse adjustment of the collet 38.

2. The nozzle assembly according to claim 1 characterised in that nozzle body includes a plurality of apertures within each of which, one of said roller means is positioned, in that the nozzle body includes an interior chamber within which the collet 38 is positioned, and in that the nozzle element centring means includes a fastener for securing said collet 38 in the chamber whilst permitting transverse movement of the collet 38 within the chamber.
3. The nozzle assembly according to claim 2 characterised in that the nozzle body further comprises a cylinder including an upper chamber relatively upstream of the collet chamber in which the water jet forming element 22, 23 is to be contained and a web extending between the two chambers with a fluid passage therethrough for passage of a water jet from said jet forming element 22, 32 to said nozzle element 44, and in that the collet 38 is seated against the underside of the web by the collet fastener.
4. The nozzle assembly according to claim 3 characterised in that the collet fastener includes an external peripheral extension from which the centring rings 54, 56 are supported in an encircling relationship to the nozzle body.
5. The nozzle assembly according to claim 1 characterised in that the nozzle body includes an interior chamber within which the collet 38 is positioned, and in that the nozzle element centring means 28 includes fastening means for securing the collet 38 in the chamber and permitting transverse movement of the collet in the chamber.
6. The nozzle assembly according to claim 5 characterised in that the nozzle body comprises a cylinder including an upper chamber relatively upstream of the collet chamber within which the water jet forming element 22, 32 is



dricl chamber in the lower half of body 10 has a large enough diameter to provide enough room for collet 38 to shift back and forth and around, as required to establish correct alignment. The shim plate 52 provides a bearing surface on which collet 38 slides as it is moved back and forth and around.

Centering rings 54 and 56 are positioned as shown, with synthetic bearing rings positioned at 64, 66 and 68 to permit frictionless turning. These bearing rings may be fabricated of a material such as Delrin. The retaining nut 42 is provided with an outer annular rim 43 that contacts the lower bearing ring 68. When retaining nut 42 is tightened, the composite ring assembly is confined between the upper rim 62 on body 10 and the lower rim 43 on retaining nut 42. The Delrin rings are somewhat compressible so that retaining nut 42 need not be overly tightened to insure correct positioning of either collet 38 or the centering rings 54 and 56. The centering rings are provided with outer peripheries that extend outward beyond the body 10 and that have knurled outer surfaces to provide gripable surfaces that can be grasped between the thumb and fingers of an operator for rotation.

The various machined parts of the nozzle assembly are preferably fabricated from the following metals: centering rings 54 and 56 and collet nut 40, brass; nozzle element 44, tungsten carbide steel; bearing rings 64, 66 and 68, Delrin plastic; all other parts, stainless steel.

While a preferred embodiment of the centering nozzle assembly of this invention has been described, certain changes may be made without departing from the scope of the invention. Consequently, the scope of the invention is only to be delimited by the appended claims herein.

Claims

1. A water jet cutting assembly comprising
 - a nozzle body for receiving a water jet forming element 22, 32,
 - an elongate nozzle element 44,
 - a nozzle element mounting means 26 for mounting the elongate nozzle element 44 in said nozzle body and including a nozzle element collet 38 for receiving and holding said nozzle element 44,
 - characterized in that a nozzle element centring means 28 is carried by the nozzle body, the nozzle element centring means being externally manipulatable for shifting the mounting means 26 transversely to the longitudinal axis of the nozzle assembly whereby the position of said nozzle element 44 is adjustable relative to the position of the water jet forming element 22 32, in that the collet 38 has an outer surface in contact with the nozzle centring means 28

whereby manipulation of the centring means 28 will effect lateral movement of said collet 38, and in that the nozzle centring means 28 includes a pair of centring rings 54, 56 encircling said nozzle body, each ring having a circular inner periphery eccentric to the nozzle assembly longitudinal axis, the nozzle centring means 28 further includes multiple roller means 58, 60 mounted in the nozzle body in contact with the inner surfaces of the centring rings 54, 56 and with an exterior surface of the collet 38 whereby rotation of a centring ring 54, 56 will cause transverse adjustment of the collet 38.

2. The nozzle assembly according to claim 1 characterised in that nozzle body includes a plurality of apertures within each of which, one of said roller means is positioned, in that the nozzle body includes an interior chamber within which the collet 38 is positioned, and in that the nozzle element centring means includes a fastener for securing said collet 38 in the chamber whilst permitting transverse movement of the collet 38 within the chamber.
3. The nozzle assembly according to claim 2 characterised in that the nozzle body further comprises a cylinder including an upper chamber relatively upstream of the collet chamber in which the water jet forming element 22, 23 is to be contained and a web extending between the two chambers with a fluid passage therethrough for passage of a water jet from said jet forming element 22, 32 to said nozzle element 44, and in that the collet 38 is seated against the underside of the web by the collet fastener.
4. The nozzle assembly according to claim 3 characterised in that the collet fastener includes an external peripheral extension from which the centring rings 54, 56 are supported in an encircling relationship to the nozzle body.
5. The nozzle assembly according to claim 1 characterised in that the nozzle body includes an interior chamber within which the collet 38 is positioned, and in that the nozzle element centring means 28 includes fastening means for securing the collet 38 in the chamber and permitting transverse movement of the collet in the chamber.
6. The nozzle assembly according to claim 5 characterised in that the nozzle body comprises a cylinder including an upper chamber relatively upstream of the collet chamber within which the water jet forming element 22, 32 is



to be contained, a web extending between the two chambers and having a fluid passage therethrough for passage of a water jet from the jet forming element 22, 32 to said nozzle element 44, and in that the collet 38 is seated against the underside of the web by the collet fastener.

7. The nozzle assembly according to claim 6 characterized in that the collet fastening includes a peripheral extension from which the centring rings 54, 56 are supported in encircling relationship to the nozzle body.

Patentansprüche

1. Eine mit einem Wasserstrahl arbeitende Schneidanordnung umfaßt

einen Düsenkörper zur Aufnahme eines einen Wasserstrahl bildenden Elements 22, 32, ein verlängertes Düsenelement 44 und

ein Düsenelementmontagemittel 26 zum Befestigen des verlängerten Düsenelements 44 in dem Düsenkörper mit einer Düsenelementhülse 38 zur Aufnahme und zum Halten des Düsenelements 44,

dadurch gekennzeichnet, daß von dem Düsenkörper ein Düsenelementzentriermittel 28 gehalten wird, daß das Düsenelementzentriermittel zum Verschieben des Montagemittels 26 transversal zu der Längsachse der Düsenanordnung von außen bedienbar ist, wodurch die Position des Düsenelements 44 relativ zu der Position des einen Wasserstrahl bildenden Elements 22, 32 einstellbar ist, daß die Hülse 38 eine das Düsenzentriermittel 28 berührende äußere Oberfläche aufweist, wodurch ein Bedienen der Zentriermittel 28 eine seitliche Bewegung der Hülse 38 bewirkt, und daß das Düsenzentriermittel 28 zwei von den Düsenkörper umgebenden Zentrierringen 54, 56 aufweist, jeder Ring einen kreisförmigen inneren Umfang exzentrisch zu der Längsachse der Düsenanordnung aufweist und das Düsenzentriermittel 28 weiterhin mehrere in dem Düsenkörper angeordnete, die inneren Oberflächen der Zentrierringe 54, 56 und eine äußere Oberfläche der Hülse 38 berührende Rollmittel 58, 60 aufweist, wodurch eine Drehung eines Zentrierringes 54, 56 eine transversale Einstellung der Hülse 38 bewirkt.

2. Düsenanordnung nach Anspruch 1, dadurch gekennzeichnet, daß der Düsenkörper eine Vielzahl von Öffnungen aufweist, in welchen jeweils eines der Rollmittel angeordnet ist, daß der Düsenkörper eine innere Kammer aufweist, in der die Hülse 38 angeordnet ist und daß das

Düsenelementzentriermittel eine Halterung zum Befestigen der Hülse 38 in der Kammer aufweist, während es eine transversale Bewegung der Hülse 38 innerhalb der Kammer zuläßt.

3. Düsenanordnung nach Anspruch 2, dadurch gekennzeichnet, daß der Düsenkörper weiterhin einen Zylinder umfaßt, der relativ zu der Hülsenkammer stromaufwärts eine obere Kammer, in der das einen Wasserstrahl bildende Element 22, 23 aufzunehmen ist, und einen Flansch aufweist, der sich zwischen den beiden Kammern mit einem durch ihn hindurchführenden Durchgang für Fluida zum Durchgang eines Wasserstrahls von dem einen Strahl bildenden Element 22, 32 zu dem Düsenelement 44 erstreckt, und daß die Hülse 38 mittels der Hülsenhalterung gegen die Unterseite des Flansches festgesetzt ist.

4. Düsenanordnung nach Anspruch 3, dadurch gekennzeichnet, daß die Hülsenhalterung am Umfang einen äußeren Fortsatz aufweist, von dem die Zentrierringe 54, 56 in umgebender Beziehung zu dem Düsenkörper gehalten werden.

5. Düsenanordnung nach Anspruch 1, dadurch gekennzeichnet, daß der Düsenkörper eine innere Kammer aufweist, in der die Hülse 38 angeordnet ist, und daß das Düsenelementzentriermittel 28 Haltemittel zum Befestigen der Hülse 38 in der Kammer aufweist und eine transversale Bewegung der Hülse in der Kammer zuläßt.

6. Düsenanordnung nach Anspruch 5, dadurch gekennzeichnet, daß der Düsenkörper einen Zylinder umfaßt, der relativ zu der Hülsenkammer stromaufwärts eine obere Kammer, in der das einen Wasserstrahl bildende Element 22, 32 aufzunehmen ist, und einen Flansch aufweist, der sich zwischen den beiden Kammern mit einem durch ihn hindurchführenden Durchgang für Fluida zum Durchgang eines Wasserstrahls von dem einen Strahl bildenden Element 22, 32 zu dem Düsenelement 44 erstreckt, und daß die Hülse 38 mittels der Hülsenhalterung gegen die Unterseite des Flansches festgesetzt ist.

7. Düsenanordnung nach Anspruch 6, dadurch gekennzeichnet, daß die Hülsenhalterung am Umfang einen Fortsatz aufweist, von dem die Zentrierringe 54, 56 in umgebender Beziehung zu dem Düsenkörper gehalten werden.



Revendications

1. Ensemble de découpe par jet d'eau comprenant
un corps d'ajutage pour recevoir un élément de formation de jet d'eau (22, 32)
un élément d'allongement d'ajutage (44).
des moyens de montage d'élément d'ajutage (26) pour monter l'élément d'allongement d'ajutage (44) dans ledit corps d'ajutage et comprenant une pince de serrage (38) pour recevoir et maintenir l'élément d'ajutage (44), caractérisé en ce que des moyens de centrage de l'élément d'ajutage (28) sont supportés par le corps d'ajutage, les moyens de centrage de l'élément d'ajutage pouvant être manipulés de l'extérieur pour décaler les moyens de montage (26) transversalement à l'axe longitudinal de l'ensemble d'ajutage où la position dudit élément d'ajutage (44) est réglable par rapport à la position de l'élément de formation de jet d'eau (22, 32), en ce que la pince de serrage (38) possède une face extérieure en contact avec les moyens de centrage de l'ajutage (28) au moyen de laquelle une manipulation des moyens de centrage (28) aura un effet sur le déplacement latéral de ladite pince de serrage (38), et en ce que les moyens de centrage de l'ajutage (28) comportent une paire d'anneaux de centrage (54, 56) entourant ledit corps d'ajutage, chaque anneau ayant une périphérie intérieure circulaire excentrée par rapport à l'axe longitudinal de l'ensemble d'ajutage, les moyens de centrage de l'ajutage (28) comprenant en outre des moyens de roulement multiples (58, 60) montés dans le corps d'ajutage en contact avec les faces intérieures des anneaux de centrage (54, 46) et avec une face extérieure de la pince de serrage (38) au moyen desquelles une rotation d'un anneau de centrage (54, 56) provoquera un réglage transversal de la pince de serrage (38).
2. L'ensemble d'ajutage conformément à la revendication 1, caractérisé en ce que le corps d'ajutage comporte une pluralité d'ouvertures dans chacune desquelles est positionné l'un desdits moyens de roulement, en ce que le corps d'ajutage comporte une chambre intérieure à l'intérieur de laquelle est positionnée la pince de serrage (38), et en ce que les moyens de centrage de l'élément d'ajutage comprennent une attache pour fixer ladite pince de serrage (38) dans la chambre tout en permettant un déplacement transversal de la pince de serrage (38) à l'intérieur de la chambre.
3. L'ensemble d'ajutage conformément à la revendication 2, caractérisé en ce que le corps d'ajutage comprend en outre un cylindre comportant une chambre supérieure relativement en amont de la chambre de la pince de serrage dans laquelle l'élément de formation de jet d'eau (22, 32) doit être contenu, et une âme s'étendant entre les deux chambres et traversée par un passage de fluide pour le passage d'un jet d'eau en provenance dudit élément de formation de jet d'eau (22, 32) vers ledit élément d'ajutage (44), et en ce que la pince de serrage (38) est logée contre la surface inférieure de l'âme par l'attache de pince de serrage.
4. L'ensemble d'ajutage conformément à la revendication 3, caractérisé en ce que l'attache de pince de serrage comporte un prolongement périphérique extérieur à partir duquel les bagues de centrage (54, 56) sont supportées dans une relation d'encerclement avec le corps d'ajutage.
5. L'ensemble d'ajutage conformément à la revendication 1, caractérisé en ce que le corps d'ajutage comporte une chambre intérieure à l'intérieur de laquelle est positionnée la pince de serrage (38), et en ce que les moyens de centrage de l'élément d'ajutage (28) comprennent des moyens de fixation pour fixer la pince de serrage (38) dans la chambre et pour autoriser un déplacement transversal de la pince de serrage dans la chambre.
6. L'ensemble d'ajutage conformément à la revendication 5, caractérisé en ce que le corps d'ajutage comporte un cylindre comprenant une chambre supérieure relativement en amont de la chambre de la pince de serrage à l'intérieur de laquelle l'élément de formation de jet d'eau (22, 32) doit être contenu, une âme s'étendant entre les deux chambres et traversée par un passage de fluide pour le passage d'un jet d'eau en provenance dudit élément de formation de jet d'eau (22, 32) vers ledit élément d'ajutage (44), et en ce que la pince de serrage (38) est logée contre la surface inférieure de l'âme par l'attache de pince de serrage.
7. L'ensemble d'ajutage conformément à la revendication 6, caractérisé en ce que la fixation de la pince de serrage comporte un prolongement périphérique à partir duquel les anneaux de centrage



(54, 56) sont supportés dans une relation d'encerclement avec le corps d'ajutage.

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