(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 154 843 B2**

(12) **NEW EUROPEAN PATENT SPECIFICATION**
After opposition procedure

(45) Date of publication and mention of the opposition decision:
09.09.2009 Bulletin 2009/37

(45) Mention of the grant of the patent:
08.01.2003 Bulletin 2003/02

(21) Application number: **00902279.9**

(22) Date of filing: **24.01.2000**

(51) Int Cl.:
B01F 5/06 *(2006.01)*

(86) International application number:
PCT/SE2000/000137

(87) International publication number:
WO 2000/044486 (03.08.2000 Gazette 2000/31)

(54) **APPARATUS FOR INTRODUCING A FIRST FLUID INTO A SECOND FLUID, PREFERABLY INTRODUCTION OF STEAM INTO FLOWING CELLULOSE PULP**

APPARAT ZUR EINLEITUNG EINES ERSTEN FLUIDES IN EIN ZWEITES FLUID, VORZUGSWEISE ZUR EINLEITUNG VON DAMPF IN FLIESSENDEN ZELLSTOFFBREI

APPAREIL SERVANT A INTRODUIRE UN PREMIER FLUIDE DANS UN DEUXIEME, ET DE PREFERENCE A INTRODUIRE DE LA VAPEUR DANS UN FLUX DE PATE DE CELLULOSE

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

(30) Priority: **26.01.1999 SE 9900221**

(43) Date of publication of application:
21.11.2001 Bulletin 2001/47

(73) Proprietor: **GLV Finance Hungary Kft., Luxembourg branch**
5365 Munsbach (LU)

(72) Inventor: **EKHOLM, Rolf**
S-653 50 Karlstad (SE)

(74) Representative: **Hano, Christian**
v. Füner Ebbinghaus Finck Hano
Postfach 95 01 60
81517 München (DE)

(56) References cited:
EP-B1- 1 023 119
CH-A- 581 493
DE-A1- 3 325 969
GB-A- 1 164 448
US-A- 5 479 792
WO-A1-92//16288
DE-A1- 3 325 969
FI- - 92 417
SE- - 468 341

EP 1 154 843 B2

Description

TECHNICAL FIELD

[0001] The invention concerns an apparatus for introducing a first fluid into a second fluid which is flowing in a pipe, which apparatus consists of a pipe-shaped body with a through-flow channel for the said second fluid of essentially constant cross-sectional area, one or more chambers which extend round at least the majority of the circumference of the through-flow channel along at least a part of its longitudinal extent, a connection for supplying the first fluid to the said chambers from a pressure source, in which a series of through-holes is arranged in the said pipe-shaped body in the region of the said one or more chambers, through which holes the first fluid can be directed into the second fluid which is flowing through the said through-flow channel under the influence of the difference in pressure between the said chambers and the said through-flow channel.

[0002] The invention is advantageously applied to the admixing of steam into a flow of cellulose pulp.

BACKGROUND OF THE INVENTION

[0003] Apparatuses of the type mentioned above are known, see for example SE 468 341 and SE 502 393. The apparatus described in SE 502 393 is used primarily as a mixer in the bleaching departments in the cellulose factories for the admixing of steam into a pulp suspension in order to raise its temperature to a level which is required to ensure that a specific reaction takes place with the desired speed in a subsequent bleaching step. The apparatus can give good admixing of steam into the suspension, but it is difficult to control the quantity of steam needed for temperature control without reducing the effectiveness of the admixing at the same time. The steam admixing is regulated conventionally by means of a valve in the steam pipe to the said chamber. However, as the steam supply is throttled to reduce the steam introduction, the pressure in the chamber also falls and hence also the pressure difference between the inside of the chamber and the pulp suspension in the pipe. This implies, in turn, a reduction in the speed of the steam, as it enters the pulp through-flow pipe, and thereby also the penetration of the steam into the pulp suspension.

[0004] A characterizing feature of SE 468 341 is that the through-flow pipe is made as a narrow, ring-shaped passage for the second fluid, which is considered to promote a good admixing effect. However, without taking a position on whether this idea is correct or not, or whether the possibility only applies under certain conditions, it can be observed in practice that the construction entails certain problems. This is probably due to the fact that the first fluid, when it is injected at high speed into the second fluid flowing through the narrow space, interacts with the constricting body installed in the through-flow channel and that, probably due to resonance phenomena, serious vibration can occur in the apparatus.

[0005] Moreover, another disadvantage with existing apparatuses is that an uneven temperature distribution in the pulp suspension after steam injection can arise. Sometimes temperature variations of about 10°C have been recorded between the upper and lower points in a cross section of the downstream pipe. Large temperature differences are obviously a major disadvantage when working with bleaching chemicals which are often very temperature sensitive, as for example hydrogen peroxide. Further, apparatuses of the existing type are relatively heavy. Since the material normal used is high-quatity stainless steel, and, in addition, as the apparatus is relatively difficult to manufacture, the total cost for the apparatus is correspondingly high.

BRIEF ACCOUNT OF THE INVENTION

[0006] The purpose of the invention is to provide Apparatus which is not burdened with the limitations or disadvantages mentioned above: more precisely, the invention aims to provide Apparatus which gives good admixing of the first medium into the second medium and to ensure that good heat distribution is obtained in the downstream pipe, i.e. that very small temperature differences are obtained in an arbitrarily chosen cross section of the downstream pipe.

[0007] Another positive effect of the apparatus is the generation of relatively little vibrations and provision of a good facility for adjustable and controllable admixing of a first medium into a second medium.

[0008] These and other aims can be reached with Apparatus characterized by the disclosures in the subsequent patent Claims. Further characteristics, aspects and advantages of the invention are presented in the following description of a preferred embodiment.

BRIEF DESCRIPTION OF THE FIGURES

[0009] In the following description of a preferred embodiment reference is made to the appended drawings, in which:

Figure 1. shows Apparatus according to the invention mounted in a pipe, and
Figure 2. shows selected parts of a side view of the apparatus, partly in cross section and with certain parts omitted.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0010] The apparatus, which shall be described in the following, is developed and designed to be used for the admixing of steam into a suspension of cellulose fibres (pulp) in a pipe conveying the pulp into a cellulose factory bleaching department in order to preheat the pulp to a specified temperature suitable for a subsequent bleaching stage. However, the principle of the invention can be

used also for equipment for the admixing of fluids other than steam into a second fluid, e.g. admixing of gases, such as oxygen, chlorine gas and possibly also ozone, or for admixing of a liquid, such as e.g. a pH adjusting liquid, chlorine dioxide or other treatment liquid or diluting liquid into the said second fluid, which need not necessarily be a pulp suspension.

[0011] Referring firstly to Figure 1, an apparatus according to the invention is labelled generally with the number 1. This is arranged in a pipe 2 for a pulp suspension, which, in the example as shall be described here, has a fibre content of medium consistency, MC i.e. a dry substance content of 5-20%, preferably 8-16%. The conveying pipe 2 extends from an MC pump (not shown) to a treatment vessel (not shown) in a bleaching department. The example shows a peroxide step. The task to be carried out by means of the apparatus 1 is to preheat the pulp suspension by means of steam in the conveying pipe 2 to a temperature suitable for the bleaching process, for example about 100°C. The flow rate of the pulp in the pipe 2 is about 5-15 m/s. A steam injection pipe labelled 4 brings steam under pressure from a pressure source (not shown) into the apparatus 1. There is a throttle valve 5 in pipe 4.

[0012] A central, first element in the apparatus is labelled 10. This first element 10 consists of a circular cylindrical, pipe-shaped part referred to as pipe body in the following. The pipe body has the same internal diameter as the upstream pipe 2A to which the pipe body is joined. The inside of the pipe body, defined by the inner walls, forms a through-flow channel for the pulp which is being conveyed in the pipe 2. For installing the apparatus 1 in pipe 2 a first flange 11, and a second flange 12 are provided respectively. The first flange butts against a downstream wall 13 of a chamber 14 for the steam, which chamber is described in more detail in the following. The other flange 12 butts against flange 16 which is located in the upstream end of the pipe body 10. Flange 11 and wall 13, as well as flange 12 and flange 16 respectively are joined to each other with bolts in the conventional way.

[0013] Figure 2 shows that the chamber 14 extends round the rear and central parts of the pipe body 10. It is formed by the rear back end wall 13, a front, ring-shaped end wall 17 and a cylindrical casing 18. The front end wall 17 is joined to both the cylindrical casing 18 and the pipe body 10 by welding. Together the back wall 13, the front wall 17 and the cylindrical casing 18 form a housing, which encloses the surrounded chamber 14. A connection stud to the chamber 14 is labelled 19. The steam pipe 4 is connected to the stud 19, and hence to the chamber 14, via a flanged joint, generally labelled 21.

[0014] In the present example, the pipe body 10 has an inner diameter of, for example, 100 mm. In the region of the rear part of the chamber 14, the pipe body 10 has slits 28 which extend through the wall of the pipe body 10 and which are evenly distributed round the circumference of pipe body 10. In the example described, each slit has a length of about 10-50 mm and a whidth of about 4-12 mm. The distance between each slit is about 5mm. Further, the slits are formed obliquely so that they form an acute angle of about 30° with the direction of the pulp flow.

[0015] A sleeve-shaped screen 32 bears against the pipe body 10 with a good fit. The screen 32 can be displaced from a forward position, where the whole area of each slit is exposed, and forms an open passage between the chamber 14 and the inside of the pipe body 10, to a backward position, as shown in Figure 2, in which position the slits 28 are covered by screen 32. However, the screen 32 can be moved also to a position between the completely forward position and the completely backward position to expose a desired area of each slit 28.

[0016] In order to effect the movement of screen 32, there is a movement member, preferably a pneumatic cylinder 34 outside the apparatus 1. The cylinder has a piston rod 35. This is connected via a yoke 36 to two rods 37, which extend through the end wall 17 into the chamber 14 where they are joined to the screen 32 as indicated in Figure 2. Sealing rings 38 are located in grooves in the bores through the end wall 17 and are made to have a tight fit around the rods 37.

[0017] The movements of the piston in the pneumatic cylinder 34 and its positioning in the cylinder are suitably regulated in the manner described in our application 9703732-9, i.e. depending on the temperature which is measured in the pipe 2 downstream of apparatus 1, the measured value is sent to an IP transducer in order to adjust, in a known way, the positioning of the piston and piston rod 35 for regulation of the quantity of steam admixed, so that the temperature is maintained at a set desired value. Normally medium pressure steam is used which is available at about 12 bar. Nevertheless, the use of high-pressure steam at 17-18 bar, and, in certain cases, also low-pressure steam can be envisaged. It is essential though to ensure that there is a pressure difference of at least 0.5 bar between the pressure in the chamber 14 and that in the pipe 2, and hence also in the pipe body 10. This pressure difference, in combination with the positioning of the screen 32, depending in turn on the desired steam flow, makes the steam flow through the holes 28 at very high speed. This ensures that the steam penetrates deeply into the pulp suspension which flows through the through-flow channel 9 in pipe body 10, so that an effective admixing of the steam into the pulp and hence good heat transfer, or as appropriate good admixing of other gases or fluids, is achieved. The steam has a speed of over 100 m/s and is normally up to or over 200 m/s.

[0018] Irrespective of the position of screen 32, the steam is injected into the pulp with a speed which is optimally high considering the pressure difference avaliable between the available steam pressure and the pressure in the through-flow channel 9.

[0019] Further, it is shown that downstream pipe 2B has a significantly larger diameter than the upstream pipe

2A. The increase in area relative to the through-flow channel 9 should be at least about 50%. As seen in Figure 2, the increase in area can advantageously be about 400%. (Note that Figure 2 shows the apparatus seen in a view from the side but from another direction than in Figure 1 i.e. from behind.) Thus, according to Figure 2, it is shown that the downstream pipe 2B has a diameter which is approximately twice as large as the inside diameter of the through-flow channel 9. This implies, in the example given, that the diameter of the through-flow channel is 100 mm and that the downstream pipe has a diameter of 200 mm.

[0020] As is also seen in Figure 2, the holes/slits 28 are positioned near the rear end of the through-flow channel 9. With the aim of eliminating the need for an excess amount of material between the inner side of flange the 13 and the pipe body 10, a ring-shaped connection piece 7 is located at the rear end of the pipe body and is arranged to fit closely to both the pipe body 10 and the flange 13, suitably by means of welding. In Figure 2, it can be seen that the distance from the front edge of the slits 28 to the rear edge of the through-flow channel 9 is less than the diameter, i.e. less than 100 mm. Due to the sudden increase in area immediately after the through-flow channel 9, turbulence is created which leads to additional admixing of the added steam, thereby ensuring that an even distribution of the heat supplied to the pulp is obtained in the downstream pipe 2B.

[0021] The sudden increase in area is effected preferably in a single stage, as shown in Figure 2. If desired, the increase in area can be effected in successive stages, but it is essential that the increase in area takes place within a length which is well below the diameter of the pipe 10. The sudden increase in area acts as a retardation zone for the pulp flow, in which zone there is time for the distribution of the steam into the pulp to take place, and the turbulence created ensures good admixing.

[0022] The steam, which is introduced to the pulp, penetrates into the pulp in the form of narrow, high-speed jets, which jets are diverted by the pulp flow. By means of the sudden increase in area, the probability of the steam reaching the wall of the channel 2B is reduced, which would otherwise result in rapid cooling and impingement, which impingement would create noise.

[0023] The combination of the distribution of the holes 28 close to the rear edge 7 of the through-flow channel 9, and that the increase in area is effected in only one stage and by at least 50% of the area of the through-flow channel, prevents the generation of noise, created by the impact of steam against the walls of the channel in an effective way.

[0024] At the same time, good and even admixing of the steam into the pulp flow is obtained.

[0025] As shown in Figure 1, the downstream pipe 2B is a separate unit in relation to the apparatus 1 and thus forms the pipe to the next apparatus in the process sequence. However, it is feasible for this turbulence zone to consist of a separate, delimited pipe section, or a unit integrated with the apparatus, which unit can advantageously be adapted so that it can be connected to any desired downstream pipe, which pipe generally has the same diameter as the inlet pipe 2A.

[0026] It should be noted that the invention can be varied within the scope defined by the following patent Claims. It has already been mentioned that the fluids which are to be admixed can be fluids other than steam and a pulp suspension, whereby, in general, properties other than temperature are to be controlled by means of regulating the admixing conditions of the first fluid into the second fluid. An example could be the admixing of chemicals into the pulp flow. Further, it is obvious that devices other than a pneumatic piston cylinder can be used for displacing the screen 32, such as, for example, an hydraulic piston cylinder or an electrical motor cooperating with a control device etc. Further, other forms of motion for the movement of the screen other than purely axial, e.g. helical, can be envisaged. An additional modification concerns the orientation of the apparatus 1. In the example shown, the second medium, the pulp suspension, flows from left to right in Figure 1 and from right to left in figure 2. However, the apparatus 1 can be used in the opposite direction, so that the screen 32 in its completely open position is located upstream of the holes 31 and 28. In this case, if the screen 32 is displaced from its completely open position to a position where one series of holes is only partly covered, so that the stream of the first fluid through the holes in this series of holes is throttled, this could result in the fluid flowing through these holes giving a reduced penetration depth into the second fluid, the effect of the flow in the following downstream orientated holes is eliminated.

[0027] Those skilled in the art understand also that the pipe-shaped body and pipes can have other cross sections than the purely circular cylindrical shown above, for example rectangular. Further, it is understood that there is the possibility of using more than one connection for introduction of the fluid. In addition, it is understood that, instead of slits as shown above, circular holes can be used. Similarly, it is understood that the orientation of the slits can be altered to positions other than what is shown in Figure 2. Moreover, it is understood that more than one row of slits can be arranged.

Claims

1. Apparatus for introducing steam into a flow of a cellulose pulp having a fibre content of medium consistency, i.e. a dry substance content of 5-20%, which medium consistency cellulose pulp is flowing in a pipe (2A,2B), which apparatus consists of a pipe-shaped body (10) with a through-flow channel (9) for the cellulose pulp of essentially constant cross-sectional area, one or more chambers (14) which extend round at least the majority of the circumference of the through-flow channel along at least a part of its

longitudinal extent, a connection (19) for supplying the steam to the said chamber(s) from a pressure source, in which a series of through-holes (28) is arranged in the said pipe-shaped body (10) in the region of the said one or more chambers (14), through which holes the steam can be directed into the flow of cellulose pulp which is flowing through the said through-flow channel (9) under the influence of the difference in pressure between the said chamber(s) and the said through-flow channel, **characterized in that** downstream of the through-flow channel and in direct contact with it there is a downstream pipe section (2B) with a cross-sectional area which is significantly larger than that of the through-flow channel, so that an increase in area of 200 to 600% is obtained close to the connection for supply of steam, the increase in area being effected within a distance which is less than the diameter of the through-flow channel (9) reckoned from the through-holes (28) and viewed in the direction of flow of the cellulose pulp.

2. Apparatus according to Claim 1, **characterized in that** the increase in area is effected in a single stage.

3. Apparatus according to Claim 1, **characterized in that** the said holes (28) are formed as long narrow slits.

4. Apparatus according to Claim 3, **characterized in that** the said slits are oblique.

5. Apparatus according to Claim 3, **characterized in that** a moveable screen (32) is arranged on the outside of the pipe-shaped body (10), which screen (32) can control how large are the parts of the slits which are exposed.

6. Apparatus according to Claim 1, **characterized in that** the said through-flow channel (9) has a circular cross section.

7. Apparatus according to Claim 6, **characterized in that** at least a significant amount of the said holes (28) are located round the pipe-shaped body (10) within a distance from the rear edge of the pipe-shaped body which is less than 200 mm and is preferably less than 100 mm.

8. Apparatus according to Claim 6, **characterized in that** the said downstream pipe section (2B) is formed as an integrated part of the apparatus.

9. Apparatus according to Claim 6, **characterized in that** the said connecting pipe section (2B) is formed as a separate part.

10. Apparatus according to Claim 6, **characterized in that** the said connecting pipe section (2B) forms a part section of the downstream pipe having the same dimension.

Patentansprüche

1. Vorrichtung zur Einleitung von Dampf in einen Zellstoffstrom mit einem Fasergehalt mittlerer Konsistenz, d.h. einem Trockensubstanzgehalt von 5-20%, wobei der Zellstoff mit mittlerer Konsistenz in einem Rohr (2A, 2B) strömt, wobei die Vorrichtung aus einem rohrförmigen Körper (10) mit einem Durchflusskanal (9) für den Zellstoff mit im Wesentlichen konstanter Querschnittsfläche, eine oder mehrere Kammern (14), die sich um mindestens den Hauptteil des Umfangs des Durchflusskanals entlang mindestens einem Teil seiner Längserstrekkung erstrecken, und einem Anschluss (19) zur Zuführung des Dampfes zu der (den) Kammer(n) von einer Druckquelle besteht, wobei eine Reihe von Durchgangslöchern (28) im rohrförmigen Körper (10) im Bereich der einen oder mehreren Kammern (14) angeordnet ist, wobei der Dampf unter dem Einfluss der Druckdifferenz zwischen der (den) Kammer (n) und dem Durchflusskanal durch diese Löcher in den durch den Durchflusskanal (9) strömenden Zellstoffstrom geleitet werden kann, **dadurch gekennzeichnet, dass** stromabwärts des Durchflusskanals und in direktem Kontakt damit ein stromabwärtiger Rohrabschnitt (2B) mit einer Querschnittsfläche angeordnet ist, die bedeutend größer ist als die des Durchflusskanals, so dass eine Flächenvergrößerung im Bereich von 200 bis 600% nahe dem Anschluss für die Zufuhr des Dampfes erhalten wird, wobei die Flächenvergrößerung innerhalb eines Abstands durchgeführt wird, der kleiner ist als der Durchmesser des Durchflusskanals (9) bei Berechnung von den Durchgangslöchern (28) und bei Betrachtung in Richtung des Zellstoffstroms.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Flächenvergrößerung in einer einzigen Stufe durchgeführt wird.

3. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Löcher (28) als lange, schmale Schlitze ausgebildet sind.

4. Vorrichtung nach Anspruch 3, **dadurch gekennzeichnet, dass** die Schlitze schräg verlaufen.

5. Vorrichtung nach Anspruch 3, **dadurch gekennzeichnet, dass** außerhalb des rohrförmigen Körpers (10) ein beweglicher Schirm (32) angeordnet ist, der die Größe der freigelegten Schlitzteile steuern kann.

6. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** der Durchflusskanal (9) einen kreisrunden Querschnitt aufweist.

7. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet, dass** mindestens eine bedeutende Anzahl der Löcher (28) um den rohrförmigen Körper (10) herum in einem Abstand vom hinteren Rand des rohrförmigen Körpers angeordnet ist, der kleiner als 200 mm und vorzugsweise kleiner als 100 mm ist.

8. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet, dass** der stromabwärtige Rohrabschnitt (2B) als ein integrierter Teil der Vorrichtung ausgebildet ist.

9. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet, dass** der Anschlussrohrabschnitt (2B) als ein getrenntes Teil ausgebildet ist.

10. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet, dass** der Anschlussrohrabschnitt (2B) einen Teilabschnitt des stromabwärtigen Rohrs mit der gleichen Abmessung bildet.

Revendications

1. Appareil servant à introduire de la vapeur dans un courant de pâte de cellulose ayant un contenu en fibres de consistance moyenne, à savoir un contenu en substance sèche de 5-20%, laquelle pâte de cellulose de consistance moyenne s'écoule dans un tuyau (2A, 2B), lequel appareil se compose d'un corps en forme de tuyau (10) avec un canal d'écoulement traversant (9) pour ladite pâte de cellulose, de section transversale essentiellement constante, d'une ou de plusieurs chambres (14) qui s'étendent autour d'au moins la majorité de la circonférence du canal d'écoulement traversant le long d'au moins une partie de son étendue longitudinale, d'une connexion (19) pour alimenter ladite ou lesdites chambres avec ladite vapeur à partir d'une source de pression, dans laquelle une série de trous traversants (28) sont prévus dans ledit corps en forme de tuyau (10) dans la région de ladite ou desdites une ou plusieurs chambres (14), ladite vapeur pouvant être dirigée à travers ces trous dans le courant de pâte de cellulose qui s'écoule à travers ledit canal d'écoulement traversant (9) sous l'effet de la différence de pression entre ladite ou lesdites chambres et ledit canal d'écoulement traversant, **caractérisé en ce qu'**en aval du canal d'écoulement traversant et en contact direct avec lui, il est prévu une section de tuyau aval (2B) de section transversale considérablement plus grande que celle du canal d'écoulement traversant, de sorte qu'une augmentation de surface de 200% à 600% soit obtenue à proximité de la connexion pour l'alimentation en vapeur, l'augmentation de surface étant effectuée dans une distance qui est inférieure au diamètre du canal d'écoulement traversant (9), à partir des trous traversants (28) et vue dans la direction d'écoulement de la pâte de cellulose.

2. Appareil selon la revendication 1, **caractérisé en ce que** l'augmentation de surface est effectuée en une seule étape.

3. Appareil selon la revendication 1, **caractérisé en ce que** lesdits trous (28) sont en forme de longues fentes étroites.

4. Appareil selon la revendication 3, **caractérisé en ce que** lesdites fentes sont obliques.

5. Appareil selon la revendication 3, **caractérisé en ce qu'**un écran mobile (32) est disposé sur l'extérieur du corps en forme de tuyau (10), lequel écran (32) peut contrôler la taille des parties des fentes qui sont exposées.

6. Appareil selon la revendication 1, **caractérisé en ce que** ledit canal d'écoulement traversant (9) a une section transversale circulaire.

7. Appareil selon la revendication 6, **caractérisé en ce qu'**au moins un nombre significatif desdits trous (28) sont situés autour du corps en forme de tuyau (10) à une distance du bord arrière du corps en forme de tuyau qui est inférieure à 200 mm, et de préférence inférieure à 100 mm.

8. Appareil selon la revendication 6, **caractérisé en ce que** ladite section de tuyau aval (2B) est formée en tant que partie intégrante de l'appareil.

9. Appareil selon la revendication 6, **caractérisé en ce que** ladite section de tuyau de connexion (2B) est formée en tant que partie séparée.

10. Appareil selon la revendication 6, **caractérisé en ce que** ladite section de tuyau de connexion (2B) forme une section partielle du tuyau aval ayant la même dimension.

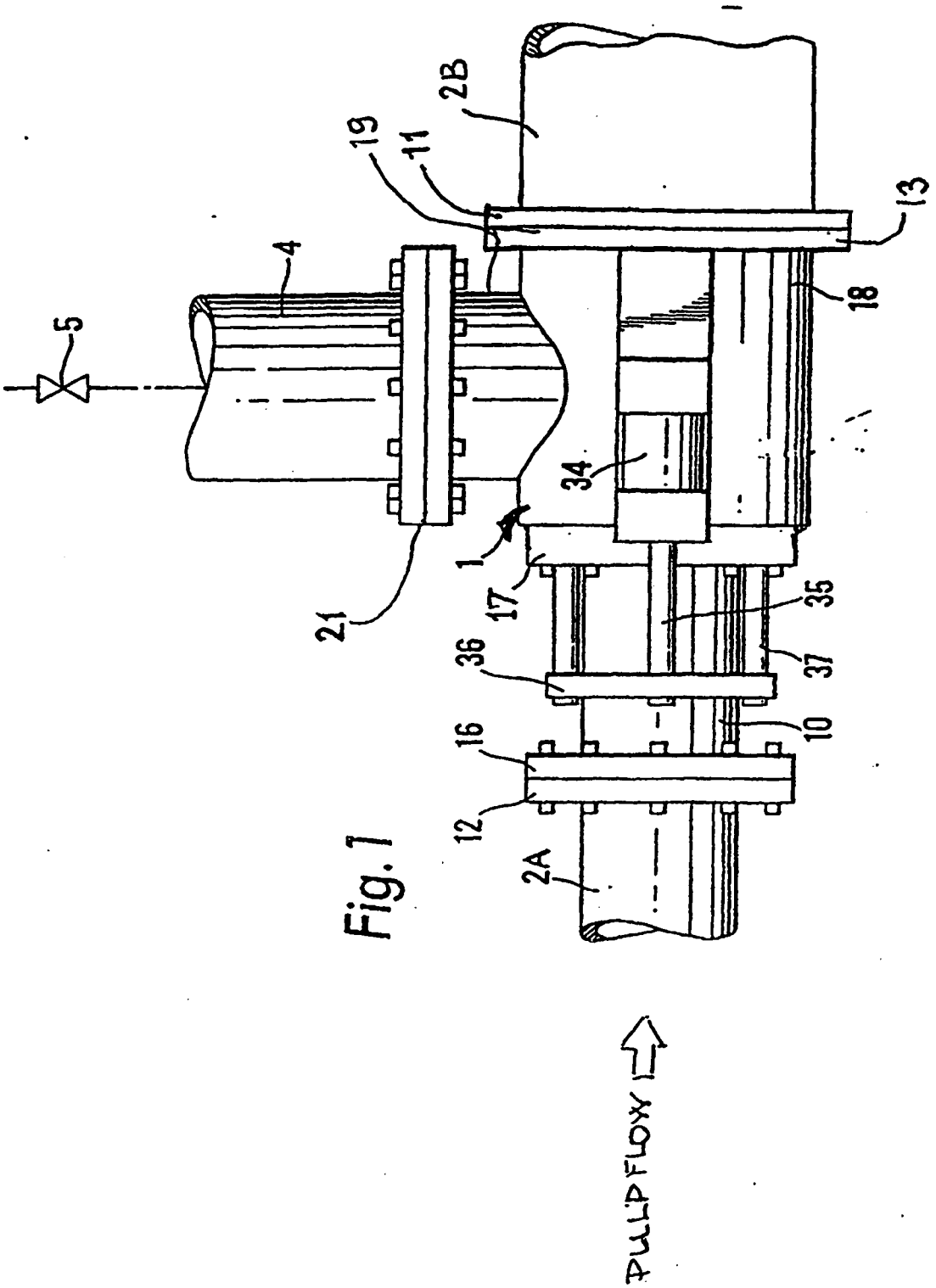

Fig. 1

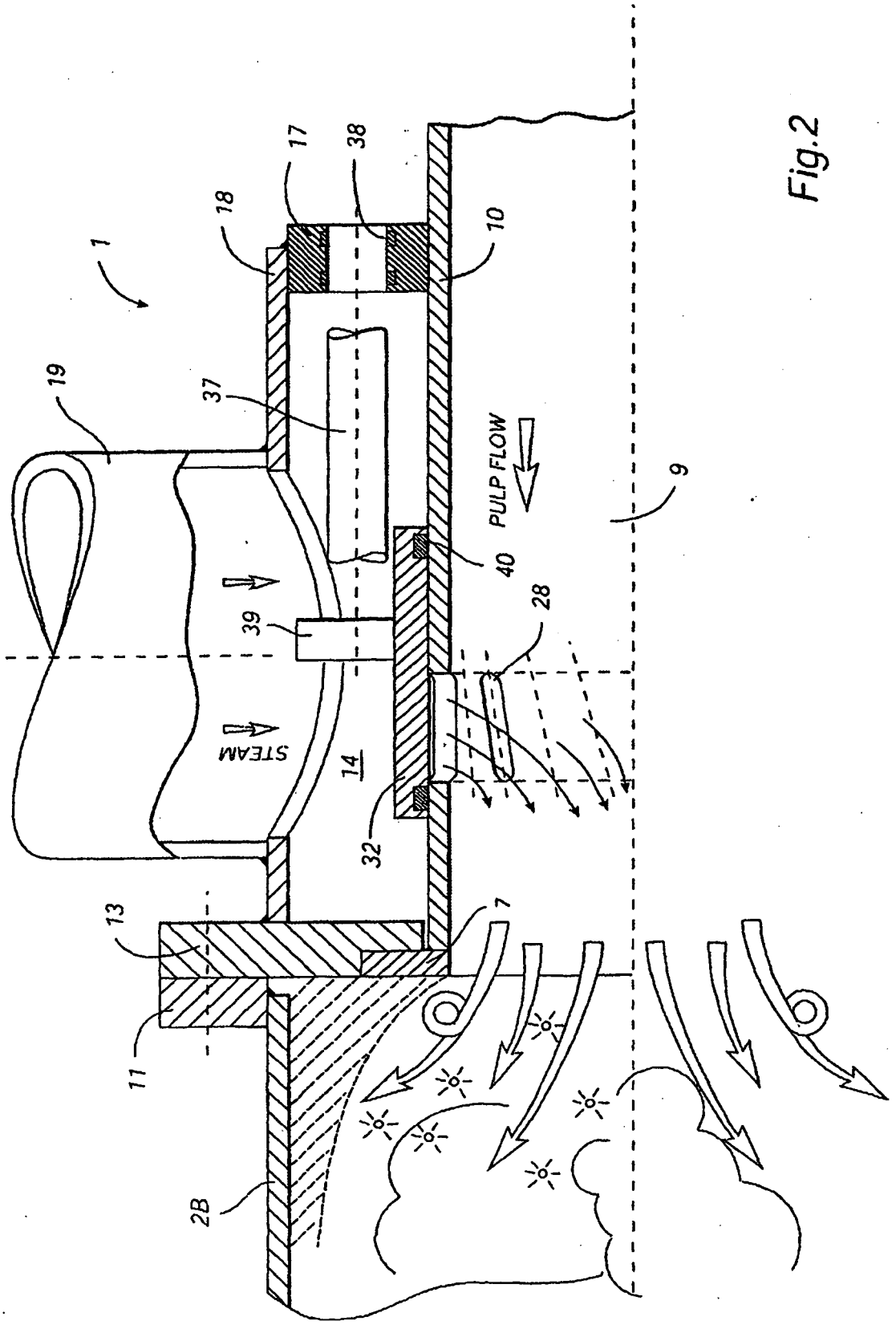

Fig.2

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

- SE 468341 **[0003] [0004]**
- SE 502393 **[0003] [0003]**