

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 633 969 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

21.01.1998 Bulletin 1998/04

(21) Application number: **93906714.6**

(22) Date of filing: **22.03.1993**

(51) Int Cl.⁶: **E03F 9/00, B08B 9/02**

(86) International application number:
PCT/GB93/00576

(87) International publication number:
WO 93/20295 (14.10.1993 Gazette 1993/25)

(54) **JETTING HEAD**

RÄUMDÜSE

TETE DE GICLAGE

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

(30) Priority: **30.03.1992 GB 9206910**

(43) Date of publication of application:
18.01.1995 Bulletin 1995/03

(73) Proprietor: **CRANE, Norman William**
Thames Ditton, Surrey KT7 0DY (GB)

(72) Inventor: **CRANE, Norman William**
Thames Ditton, Surrey KT7 0DY (GB)

(74) Representative: **Rackham, Stephen Neil et al**
GILL JENNINGS & EVERY,
Broadgate House,
7 Eldon Street
London EC2M 7LH (GB)

(56) References cited:
DE-A- 2 331 030 **GB-A- 1 046 829**
US-A- 3 678 948 **US-A- 4 699 163**

EP 0 633 969 B1

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

The present invention relates to a head for use in cleaning sewers, of the type known as a "jetting head".

The use of a jetting head, as disclosed by GB-A-1,046,829, is one of a number of techniques which have been adopted for cleaning sewers to remove sediment and detrital matter. A hose is fed down the sewer and water is jetted at high velocity from a nozzle on the end of the pipe. Initially, the jetting of the water serves to propel the head along the sewer a certain distance. Subsequently, the head is winched back, and as it progresses along the sewer the jets of water from the head strike and dislodge some of the detritus and other material in the sewer. The dislodged material is then carried away by water pressure from the jet flowing downstream and typically is extracted by a suction unit operating in conjunction with the cleaning head.

Although the use of jetting heads offers advantages over some other methods of sewer cleaning, it is still a relatively expensive procedure both in terms of the capital cost of the jetting equipment and also in terms of the manpower required to carry out the operation. Accordingly it is important that the jetting operation should be as efficient as possible.

According to the present invention, there is provided a jetting head for use in cleaning a sewer comprising a body including an inlet for connection to a pipe carrying water, and an outlet for a jet of water, characterised in that the body is arranged to lie generally horizontally in the invert of the sewer and includes a single main outlet only, the outlet being arranged to direct a single spread far-shaped jet of water downwards at a shallow angle to the longitudinal axis of the body, in use the jet striking detritus in the invert at a shallow angle of attack.

Preferably the outlet directs the jet at an angle of less than 25° to the longitudinal axis of the head, and more preferably less than 10° . Preferably the jet is directed at an angle of substantially 5° .

The present inventor has recognised that a very marked improvement in the performance of the jetting head can be realised by directing the jet at a far shallower angle so that it is almost parallel to the longitudinal axis of the sewer. The jet is then effective to sweep downstream the detritus from the point at which the jet impacts. Any detrital material overlying the point of impact then in turn falls downwards, is struck by the jet and is also swept downstream. Functioning in this manner, the head can clear a sewer at a far greater rate than has hitherto been possible. In trials carried out by the inventor, such a head, using a water pressure of between 1500 and 2000 psi was able to clear a 30 metre length of 15", half full sewer in 25 minutes. By contrast, a conventional head used on the same sewer was found to take twice as long, that is 50 minutes, to clear a 30 metre length, and still left depositions in the invert.

Preferably the head includes a hollow body, an inlet on one end wall of the body, an outlet formed in a bottom

wall of the body, and a channel extending downwardly from the outlet at a shallow angle, the far end of the channel being open to direct the jet of water at the invert.

According to a second aspect of the present invention, a method of cleaning a sewer includes the step of directing a single spread far-shaped jet only from a jetting head at a layer of detritus in the invert of the sewer at a shallow angle from a position such that the jet impacts upon the detritus in a region below the top of the layer.

A jetting head in accordance with the present invention will now be described in detail and contrasted with the prior art with reference to the accompanying drawings, in which:-

Figures 1A and 1B are side and front elevations of a prior art jetting head in use;

Figures 2A and 2B are a sectional view and a side elevation of one example of a jetting head in accordance with the present invention in use;

Figure 2C is a simplified sectional view showing the water flow within the head;

Figure 3 is a sectional view on line D-D of the jetting head;

Figure 4 is a plan view on line B-B of the jetting head; and

Figure 5 is a plan view on line C-C of Figure 4.

Figures 1A and 1B show the manner of use of a jetting head, with reference to a prior art head. The head 1' is attached to the end of a flexible hose 2' connected to a pump arranged to supply water under pressure. The hose and jetting head are inserted into the sewer through a manhole cover. Water is sprayed generally backwardly from the head in the directions indicated by the arrows in Figures 1A and 1B. This serves to drive the head down along the sewer, although the distance of travel in the case of this prior art head is relatively limited. The head is then drawn back by the hose winding in along the sewer, cleaning the sewer as it moves.

A jet from the head impacts upon the detritus collected in the invert 5' of the sewer, loosening the detritus so that it is carried along by the downstream flow of water in the sewer. Typically the loosened detrital matter is then collected by a suction unit.

As seen Figure 1A, in this prior art head, the jet which strikes the detritus does so at an angle α of 30° or more. As a result, a significant proportion of the velocity of the water is in the direction towards the wall of the invert and most of the velocity is dissipated when the jet strikes the wall. The initial impact of the jet is on the top of the layer of detritus. Moreover, although four or more jets are output from the head, it is possible for no more than one or two, or at most three, to strike the detritus, so that the head is over 50% inefficient in its use of the water.

Figure 2 shows one example of a head formed in accordance with the present invention in use. This head

is intended for use in sewers with a diameter of 9" (225 mm) to 4' (1.2 m) and has a 25 mm (1") direct connection. 1¼" (31 mm) or 1½" (37 mm) connections are used on heads for sewers up to 7'6" (2.25 m). As with the prior art head discussed above, the head is fitted to the end of a pipe connected to a high pressure water source. A single fan-shaped jet is output from the head from an outlet O in the base a hollow body 6 of rectangular cross-section. Water from the outlet O is guided through a channel 7 which directs the jet away from the head at a shallow angle α of 5° (for clarity the angle is exaggerated in Figure 2). A greater angle α , up to typically 9°, may be used according to the condition of the sewer, or depending on the water pressure and the angle needed to give the required propulsion of the head. Because of the shallow angle, the jet strikes the detritus 8 with a large component of velocity in the longitudinal direction. Most of that velocity is effectively absorbed by the detrital matter and serves to speed its movement downstream, by contrast with the prior art in which the velocity was largely spent on impact with the wall of the invert as a single jet generally away from the greatest depth and heaviest concretion. A further important property of the position and angle of the jet is that it strikes the base of the layer of detritus first, rather than impacting from the top. Removing the bottom of the layer of detritus has the effect of weakening and loosening the overlying layers which then in turn fall down and are quickly swept away. This further serves to increase the speed with which the detritus can be cleared. These factors in combination enable the head of the present invention to clear a far longer length of sewer in a single sweep, and in a very much shorter period of time.

Although primarily intended for removing detritus from the invert, it has been found that if the head is turned on its back it is also highly effective in cleaning the soffit of the sewer, thus removing grease and slime from sewers up to 2' (600 mm) in diameter.

A further feature of this example of the present invention, is use of a closed circuit television camera CCTV mounted on the upper surface of the body of the head. Hitherto, after a sewer has been cleaned, it has been inspected in a separate operation, necessitating the use of additional equipment. A further significant saving in time and capital cost is achieved by combining an inspection camera with the jetting head itself, so that the progress of the cleaning can be monitored at the same time it is carried out. (When CCTV is used, the head is winched back by the hose.)

The construction of this example of a jetting head will now be described in further detail.

As seen in Figure 2A, a coupling 8 is formed in the head which, in use, connects a 1" (25 mm) pipe from the jetting machine to the jetting head. The coupling is formed in the end face 9 of a hollow body of rectangular cross-section of welded construction with walls formed from mild steel 15 mm thick. The body is mounted on skis 10 having a spacing of 117.5 mm. In use the skis

ride along the bottom of the invert. As already noted, an outlet O is formed in the bottom wall 11 of the body. As seen in the plan C-C, this outlet is rectangular. A channel 12 extends downwardly from the outlet at an angle of 5° to the longitudinal axis of the head. The bottom portion 12B of the channel is open and in use it is from here that the jet of water exits the head. The channel 12 has diverging walls so that the jet exits as a fan-shaped generally flat sheet of water, shown by cross-hatching in Figure 5.

Although in the figures individual skis are shown, these may be replaced by a sheet extending from one side of the head to the other having the same general longitudinal profile as the skis.

Figure 2C shows the dynamics of the water flow within the body from the coupling to the hose, as presently understood. Water flows into the head at high velocity from the coupling C and flows across the head until it encounters a turbulent boundary region associated with the opposing end wall 14 of the head. The flow of water is turned back at this point and exits through the outlet O. An upstanding block 13 of rectangular plan is fixed to the bottom wall of the head immediately adjacent the outlet O, as seen in Figure 4. This serves to increase the velocity of the flow into the outlet O while at the same time protecting the outlet from the direct impact of the incoming water from the inlet C. The height of the block 13 is less than the height of the inlet so that the initial inwards flow passes over the block.

The front of the head is in the form of a tapered "prow". This facilitates forwards movement of the head through the sewer. The inner wall of the body is radiussed in the horizontal plane but square to the top and bottom walls of the body.

The presently described example is intended to operate at water flow rates typically around 45 gallons/minute and has a weight of around 28 lbs (13 kg). This weight gives the necessary stability for the head as it moves through the detritus in the sewer. For operation at higher pressures it is desirable to increase the weight of the head, for example for a flow rate of 55 gallons/minute the weight of the head is desirably around 32 lbs (14.5 kg). For use with even higher sources of pressure it is preferable to include in the head means to step down the pressure, rather than further increasing the weight of the head.

It is found that the outlet velocity is maximised by moving the outlet and block away from the opposing end wall and towards the inlet. The minimum distance between the outlet and the inlet however is constrained by the need for the outlet channel 12 to be of sufficient length to give the required shape of jet, and by the need for a sufficient spacing (W4) between the end of the channel and the end of the head. With the construction adopted in the present example, a separation W2 of substantially 80 mm is found to be optimum. A similar spacing would be adopted for larger, longer heads, with a corresponding increase in the distance W3 from the

opposing end wall to the outlet.

As noted above, the head is mounted on skis 10. As well as facilitating the movement of the head through the detritus in the invert of the sewer, these also serve to lift the head and the outlet so as to ensure that the region where the jet impacts upon the detritus is not immediately under the head but is spaced some distance in front. With skis of height 12.5 mm, the point of impact of the jet upon the detritus is typically 10-15 cm away from the head, depending on the sewer diameter.

The example of the head described, with a 1" (25 mm) inlet, is suitable for 9" (225 mm) to 4' (1.2 m) sewers and in use would operate with a water delivery rate of 40-50 gallons/minute. For larger sewers from 12" (300 mm) to 7' (2.1 m), a larger head with a 1¼" (31 mm) inlet or larger would be used and a delivery rate of 60-110+ gallons/minute. For smaller sewers, a ¾" (19 mm) inlet and a delivery rate of 20-25 gallons/minute may be used. This is suitable particularly for 6" (150 mm) to 2' (600 mm) sewers.

Table 1 below lists the dimensions shown in Figure 2A, and Table 2 lists the dimensions shown in Figure 4.

TABLE 1

H1 =	26 mm
H2 =	5 mm
H3 =	12 mm
H4 =	38 mm
H5 =	12.5 mm
H6 =	12.5 mm
R1 =	8 mm
W1 =	155 mm
W2 =	80 mm
W3 =	75 mm
W4 =	22 mm
W5 =	63 mm
W6 =	46 mm
W7 =	4 mm
W8 =	34 mm
W9 =	40 mm
W10 =	165 mm
W11 =	60 mm

TABLE 2

A1 =	62 mm
A2 =	25 mm
A3 =	15 mm
R2 =	12.5 mm

Claims

1. A jetting head for use in cleaning a sewer comprising a body (1) including an inlet (C) for connection to a pipe carrying water, and an outlet for a jet of water, characterised in that the body is arranged to lie generally horizontally in the invert of the sewer and includes a single main outlet (O) only, the outlet being arranged to direct a single spread fan-shaped jet of water downwards at a shallow angle (α) to the longitudinal axis of the body, in use the jet striking detritus (8) in the invert at a shallow angle of attack.
2. A head according to claim 1, in which the main outlet (O) includes a nozzle (12) arranged to direct and spread the jet of water.
3. A head according to claim 2, in which the nozzle (12) is generally frusto-conical in plan section.
4. A head according to any one of the preceding claims, in which the outlet (O) directs the jet at an angle of less than 25° and preferably less than 10° to the longitudinal axis of the head.
5. A head according to claim 4, in which the jet is directed at an angle of substantially 5°.
6. A head according to any one of the preceding claims, in which the body comprises a hollow chamber, the inlet (C) being formed in one end wall of the chamber and the outlet (O) being formed in a bottom wall of the chamber.
7. A head according to claim 6, in which the hollow chamber is arranged so that water flowing into the chamber from the inlet (C) is turned back at a turbulent boundary associated with an opposing end wall of the chamber before exiting the chamber through the outlet.
8. A head according to claim 7, including an upstanding block formed on the bottom wall of the chamber adjacent the outlet and extending upwards for part only of the height of the chamber, the upstanding member being formed on the side of the outlet nearer the inlet and serving to increase the velocity of water flowing into the outlet.
9. A head according to any one of claims 6 to 8 when directly or indirectly dependent on claim 2, in which the nozzle is formed as a channel underlying the chamber and extending downwardly from the outlet at a shallow angle, the far end of the channel being open to direct the jet of water at the invert.
10. A head according to any one of the preceding claims, further comprising one or more longitudinal

support members underlying the head and serving in use to raise the outlet above the bottom of the invert so that the jet strikes the detritus in a region distanced from the head.

11. A head according to any one of the preceding claims, further comprising a prow formed on the end of the head away from the inlet and arranged to facilitate the movement of the head through the detritus in the sewer.
12. A method of cleaning a sewer characterised by directing a single spread fan-shaped jet only from a jetting head at a layer of detritus in the invert of the sewer at a shallow angle from a position such that the jet impacts upon the detritus in a region below the top of the layer.

Patentansprüche

1. Düsenkopf zur Verwendung bei der Säuberung einer Abwasserleitung, umfassend:
ein Gehäuse (1), einschließlich eines Einlasses (C) zum Verbinden mit einem Wasser führenden Rohr und einem Auslaß für einen Wasserstrahl, dadurch gekennzeichnet, daß das Gehäuse derart angeordnet ist, daß es generell horizontal umgekehrt in der Abwasserleitung liegt und nur einen einzigen Hauptauslaß (O) umfaßt, wobei der Auslaß so angeordnet ist, daß er einen einzigen fächerförmigen Ausbreitungsstrahl von Wasser in einem flachen Winkel (α) zur Längsachse des Gehäuses nach unten richtet, wobei im Betrieb der Strahl den Detritus (8) umgekehrt in einem flachen Angriffswinkel trifft.
2. Kopf nach Anspruch 1, bei dem der Hauptauslaß (O) eine Düse (12) umfaßt, die angeordnet ist, um einen Wasserstrahl auszurichten und auszubreiten.
3. Kopf nach Anspruch 2, bei dem die Düse (12) generell im Grundriß kegelstumpfförmig ist.
4. Kopf nach irgendeinem der vorstehenden Ansprüche, bei dem der Auslaß (O) den Strahl mit einem Winkel geringer als 25° ausrichtet, vorteilhafterweise geringer als 10° zur Längsachse des Kopfes.
5. Kopf nach Anspruch 4, bei dem der Strahl in einem Winkel von etwa 5° ausgerichtet ist.
6. Kopf nach irgendeinem der vorstehenden Ansprüche, bei dem das Gehäuse eine hohle Kammer umfaßt, und wobei der Einlaß (C) in einer Endwand der Kammer und der Auslaß (O) in einer Bodenwand der Kammer ausgebildet ist.
7. Kopf nach Anspruch 6, bei dem die hohle Kammer

derart angeordnet ist, daß das vom Einlaß (C) in die Kammer hineinströmende Wasser an einer turbulenten Grenze umgekehrt wird, die mit einer gegenüberliegenden Endwand der Kammer zusammenhängt, bevor es durch den Auslaß aus der Kammer austritt.

8. Kopf nach Anspruch 7, einschließlich eines aufrechten Blocks, der an der Bodenwand der Kammer angrenzend an den Auslaß ausgebildet ist und sich lediglich einen Teil der Höhe der Kammer nach oben erstreckt, wobei das aufrechte Teil an der Seite des Auslasses näher zum Einlaß ausgebildet ist und dazu dient, die Geschwindigkeit des Wassers, das in den Auslaß hineinströmt, zu steigern.
9. Kopf nach irgendeinem der Ansprüche 6 bis 8, wenn sie direkt oder indirekt von Anspruch 2 abhängen, bei dem die Düse als Kanal ausgebildet ist, der unter der Kammer liegt und sich vom Auslaß in einem flachen Winkel nach unten erstreckt, und wobei das abgelegene Ende des Kanals offen ist, um den Wasserstrahl umzukehren.
10. Kopf nach irgendeinem der vorstehenden Ansprüche, ferner umfassend ein oder mehrere längliche Tragglieder, die unter dem Kopf liegen und im Betrieb dazu dienen, den Auslaß über den Boden der Umkehrung anzuheben, so daß der Strahl in einem Bereich entfernt vom Kopf auf den Detritus auftrifft.
11. Kopf nach irgendeinem der vorstehenden Ansprüche, ferner umfassend einen Bug, der am Ende des Kopfes weg vom Einlaß ausgebildet und angeordnet ist, die Bewegung des Kopfes durch den Detritus in der Abwasserleitung zu erleichtern.
12. Verfahren zum Reinigen einer Abwasserleitung, gekennzeichnet durch Richten eines einzigen, fächerförmigen Ausbreitungsstrahls, nur von einem Düsenkopf, an eine Detrituslage in der Umkehrung der Abwasserleitung bei einem flachen Winkel aus einer Position, so daß der Strahl auf den Detritus in einem Bereich unterhalb der Oberseite der Lage auftrifft.

Revendications

1. Tête de giclage destinée au nettoyage d'une conduite d'égout, comportant un corps (1) comprenant une entrée (C) pour raccordement à une conduite transportant de l'eau, et une sortie pour un jet d'eau, caractérisée en ce que le corps est agencé de manière à être situé généralement à l'horizontale dans le radier de la conduite d'égout, et comporte une seule sortie principale (O), la sortie étant agencée de manière à diriger un seul jet d'eau étalé en forme

d'ailette, vers le bas sous un petit angle α par rapport à l'axe longitudinal du corps, le jet venant frapper en utilisation les détrit (8) présents dans le radier de la conduite suivant un petit angle d'attaque.

2. Tête selon la revendication 1, dans laquelle la sortie principale (O) comporte un ajustage (12) agencé pour diriger et étaler le jet d'eau. 5
3. Tête selon la revendication 2, dans laquelle l'ajutage (12) présente en plan une section généralement tronconique. 10
4. Tête selon l'une quelconque des revendications précédentes, dans laquelle la sortie (O) dirige le jet sous un angle inférieur à 25° et de préférence inférieur à 10° par rapport à l'axe longitudinal de la tête. 15
5. Tête selon la revendication 4, dans laquelle le jet est dirigé suivant un angle de substantiellement 5°. 20
6. Tête selon l'une quelconque des revendications précédentes, dans laquelle le corps comporte une chambre creuse, l'entrée (C) étant formée dans une paroi d'extrémité de la chambre, et la sortie (O) étant formée dans une paroi de fond dans la chambre. 25
7. Tête selon la revendication 6, dans laquelle la chambre creuse est agencée de telle sorte que l'eau pénétrant dans la chambre par l'entrée (C) est renvoyée vers l'arrière, sur une zone limite tourbillonnaire associée à une paroi d'extrémité opposée de la chambre, avant de quitter la chambre par la sortie. 30 35
8. Tête selon la revendication 7, comprenant un bloc en saillie formé sur la paroi de fond de la chambre en position adjacente à la sortie, et s'étendant vers le haut sur une partie seulement de la hauteur de la chambre, l'organe en saillie étant formé sur le côté de la sortie qui est le plus proche de l'entrée et servant à augmenter la vitesse de l'eau qui s'écoule dans la sortie. 40 45
9. Tête selon l'une quelconque des revendications 6 à 8, dans la mesure où celles-ci dépendent directement ou indirectement de la revendication 2, dans laquelle l'ajutage est formé sous la forme d'un canal situé en dessous de la chambre et s'étendant vers le bas suivant un petit angle à partir de la sortie, l'extrémité éloignée du canal étant ouverte pour diriger le jet d'eau vers le radier de la conduite. 50 55
10. Tête selon l'une quelconque des revendications précédentes, comportant en outre un ou plusieurs organes longitudinaux de soutien situés en des-

sous de la tête et servant en utilisation à relever la sortie au-dessus du fond du radier de la conduite, de telle sorte que le jet vienne frapper les détrit (8) dans une région située à distance de la tête.

11. Tête selon l'une quelconque des revendications précédentes, comportant en outre une proue formée à l'extrémité de la tête éloignée de l'entrée, et agencée pour faciliter le déplacement de la tête à travers les détrit (8) présents dans la conduite d'égout.
12. Procédé de nettoyage d'une conduite d'égout, caractérisé en ce que l'on dirige suivant un petit angle un seul jet étalé en forme d'ailette provenant d'une tête de giclage vers une couche de détrit (8) dans le radier de la conduite d'égout, à partir d'une position telle que le jet vienne frapper les détrit (8) dans une région située en dessous du sommet de la couche.

Fig. 1A.

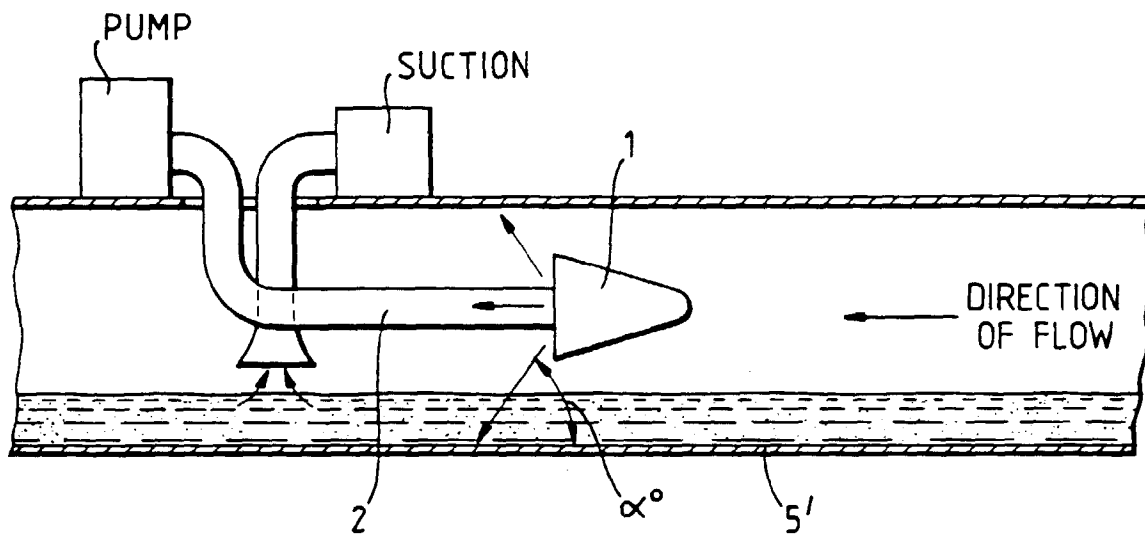


Fig. 1B.

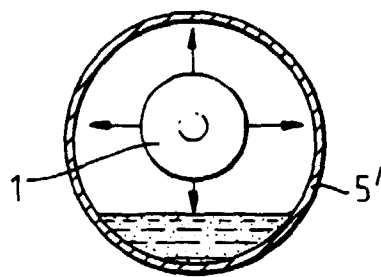


Fig.2A.

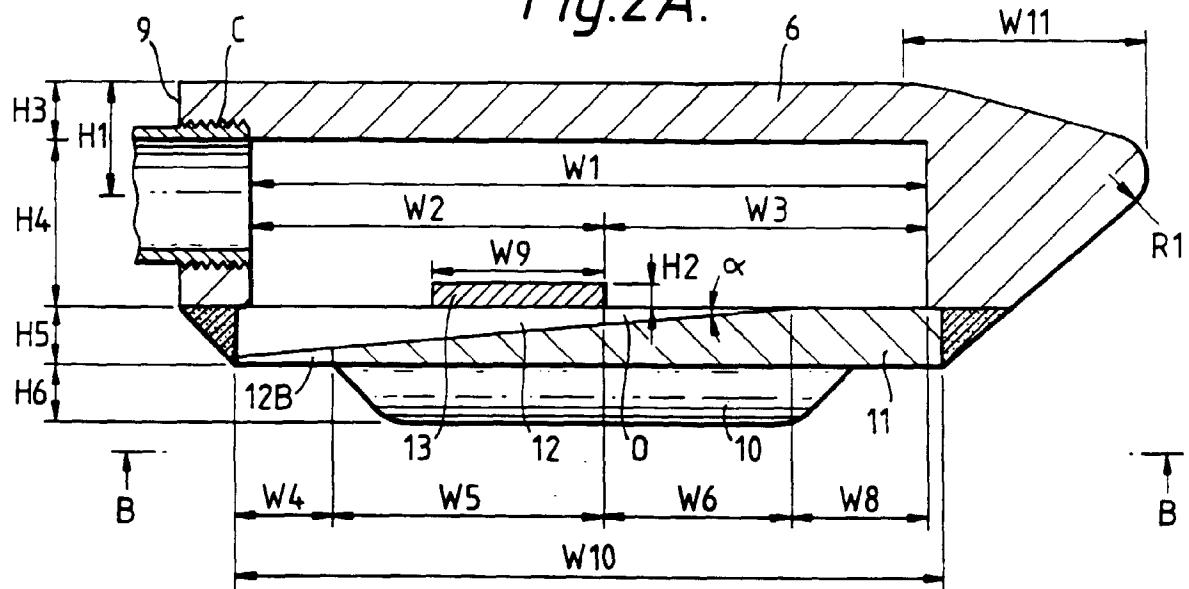


Fig.2B.

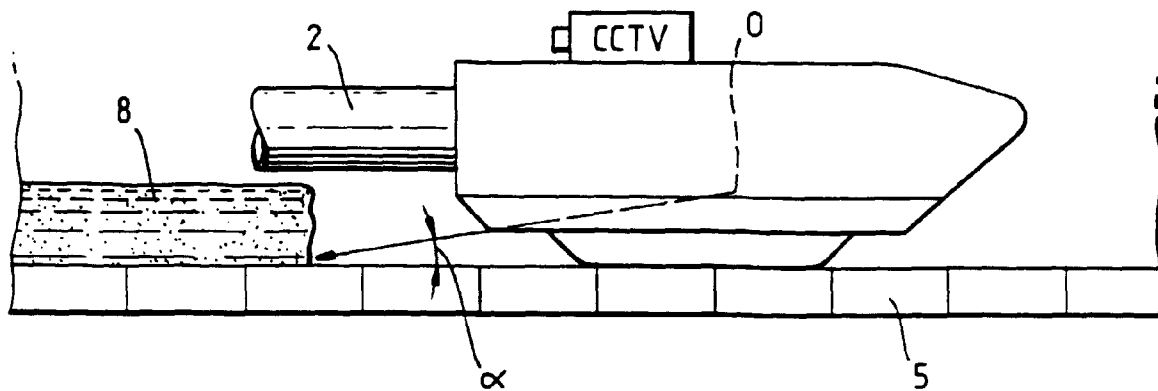


Fig. 2C.

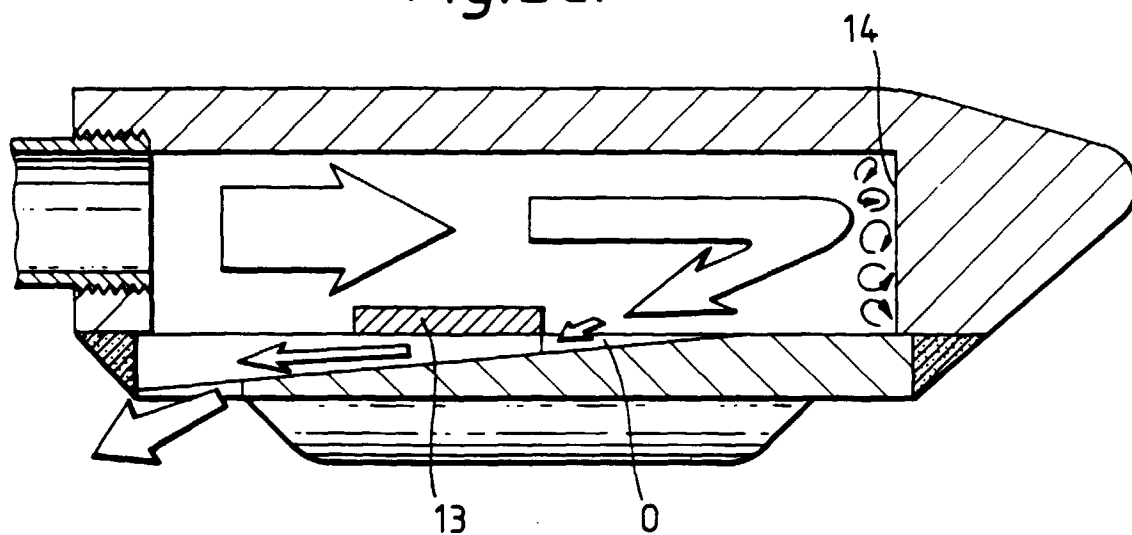


Fig. 3.

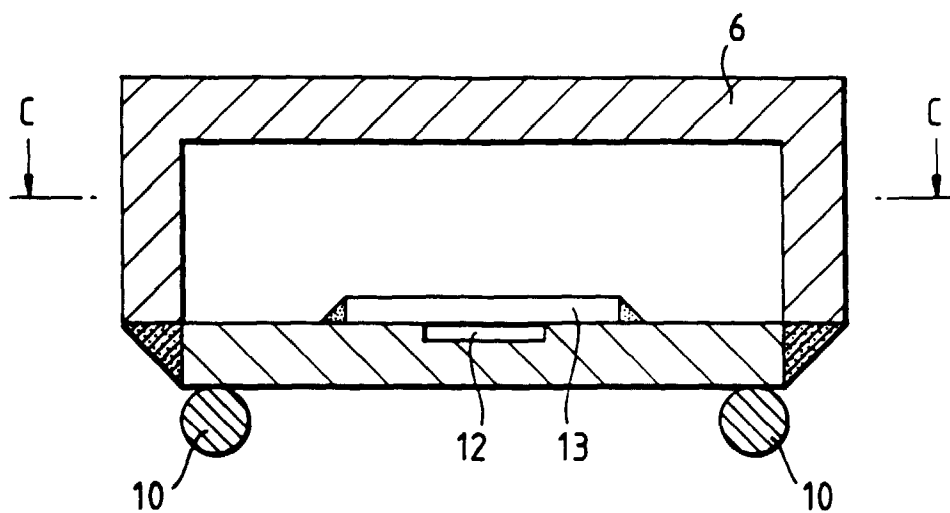


Fig.5.

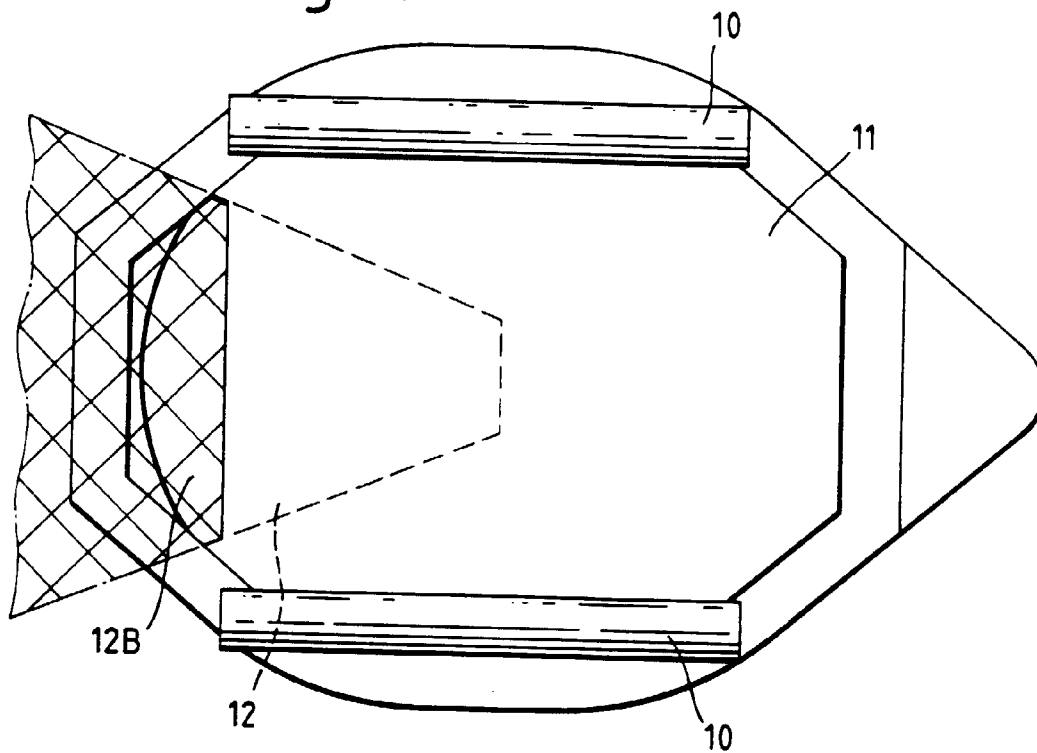


Fig.4.

