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

(11) Publication number: **0 384 519 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **90200324.3**

(22) Date of filing: **13.02.90**

(51) Int. Cl.5: **B08B 9/02, B08B 9/04, F28G 3/16**

(30) Priority: **23.02.89 NL 8900449**

(43) Date of publication of application: **29.08.90 Bulletin 90/35**

(84) Designated Contracting States: **BE DE ES FR GB IT LU**

(71) Applicant: **HOOGOVENS GROEP B.V.**
P.O. Box 10.000
NL-1970 CA IJmuiden(NL)

(72) Inventor: **Bakker, Bernardus Antonius Gemma Rijckholt**
Kleine Houtstraat 1
NL-2011 DD Haarlem(NL)
Inventor: **Bijleveld, Cornelis**
Albertine Agnesstraat 83
NL-1814 MG Alkmaar(NL)

(74) Representative: **Van Breda, Jacobus, Mr. Ir. et al**
HOOGOVENS GROEP BV P.O. Box 10.000
NL-1970 CA IJmuiden(NL)

(54) Apparatus and method for the internal cleaning of a pipe.

(57) Apparatus for the internal cleaning of a pipe (1) has a hose (4) which is rotatable around its longitudinal axis, a driving mechanism (7) for rotating the hose around said axis, and at the head-end of hose a spray head (5) for spraying cleaning fluid onto a pipe wall. The spray head is attached to the hose for rotation therewith. To achieve good self-location of the spray head in a simple manner, the hose has a non-bending portion adjoining the head-end (5).

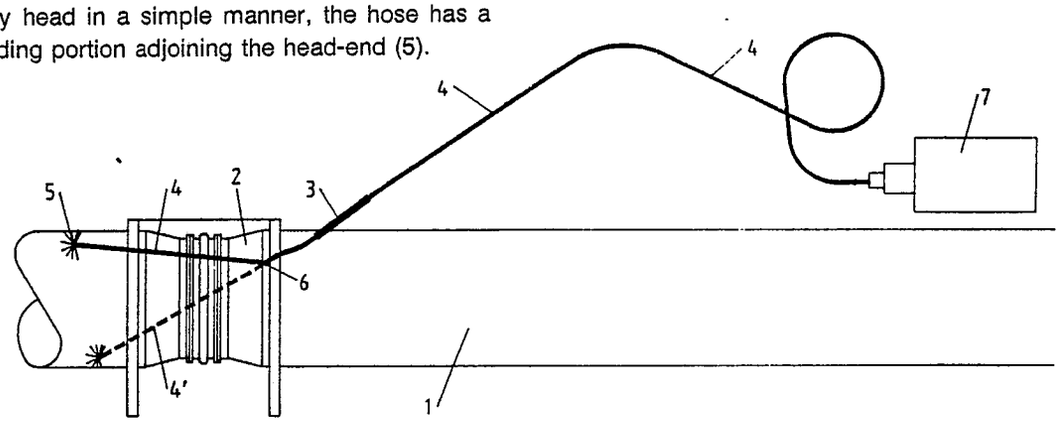

FIG. 1

EP 0 384 519 A2

APPARATUS AND METHOD FOR THE INTERNAL CLEANING OF A PIPE

The invention relates to an apparatus for the internal cleaning of a pipe, comprising a hose which is rotatable around its longitudinal axis, a driving mechanism for rotating the hose around said axis and at the head-end of the hose a spray head for spraying cleaning fluid onto a pipe wall, the spray head being attached to the hose for rotation therewith. The invention also relates to a method of cleaning a pipe using such apparatus.

Such an apparatus is known from DE-A-3148225. The hose is coupled to a high pressure source for supplying the cleaning fluid. The cleaning fluid leaves the spray-head laterally via several cleaning nozzles and has a cleaning effect on the inside of the pipe. The reaction forces of the cleaning fluid being sprayed keep the end of the hose positioned centrally in the pipe. This means that bends and constrictions may be passed easily as the hose is sent through the pipe. This known apparatus is used in pipes with a maximum internal diameter of about 20 mm.

US-A-4687011 also shows an apparatus as described initially above, but in this case the spray head is not free to move transversely of the pipe, being held against the pipe wall by a snake-like sprung guide projecting obliquely ahead of the nozzle.

GB-A-784585 discloses a pipe cleaning apparatus in which the supply pipe is not rotated and in which the spray head is attached to the supply pipe by a rigid arm. The supply pipe may be flexible or rigid. In the latter case, the rigid arm is rotatable relative to the supply pipe. During spraying, the reaction forces of the sprays centre the spray head in the pipe being cleaned.

EP-A-156955 shows a pipe cleaning apparatus in which a flexible hose is rotated and carries a spray head. No measures for positioning the spray head relative to the wall of the pipe being cleaned are described.

It has been found that it is not possible to use the apparatus of DE-A-3148225 for pipes with a larger internal diameter, for example in excess of about 20 cm because with such large internal diameters the centering function of the spray-head is lost, and the hose is no longer easy to send through the pipe. The other devices described above are also not suitable for large pipes, or are complex.

The object of the invention is to solve this problem and in particular to provide a simple arrangement for cleaning of large pipes.

The apparatus in accordance with the invention is characterized in that the hose has a non-bending portion adjoining its head-end. This prevents the spray-head from wandering in the pipe and avoids the problem of the spray-head turning round in the tube and moving in the direction opposite to the intended direction of travel of the hose.

This is achieved in particular if the non-bending part of the hose has a length which at least corresponds to the diameter of the pipe to be cleaned. It has been found that the apparatus in accordance with the invention is suitable for use in pipes with very large internal diameters, such as pipes for transporting blast furnace gas with an internal diameter of approx. 3200 mm.

The invention is especially applicable when the nozzle is free to move transversely of the pipe being cleaned. In that case, preferably the spray head effects non-symmetrical spraying with respect to the rotational axis of the non-bending portion of the hose in such a way that when spraying the spray head tends to stabilize in a position close to but spaced from the pipe wall, due to the reaction forces of the spray. This may be achieved if, as is preferred, the spray head is provided with one or more cleaning nozzles which cause a first reaction force acting transversely to the rotational axis of said non-bending portion and at least one elevation nozzle which causes a second reaction force acting transversely to the rotational axis of said non-bending portion in opposition to said first reaction force. Such nozzles, in addition to spraying with a transverse component, may also spray with an axial component.

Thus the cleaning nozzles may be located on one half side of the spray-head. The opposite half may be provided with at least one elevation nozzle. Both the cleaning nozzles and the elevation nozzle can project cleaning fluid laterally. By the rotation of the hose and the effect of the nozzles, the spray-head moves closely along the inner wall of the pipe and the cleaning nozzles are continuously aimed at the wall. The elevation nozzle is aimed away from the wall and serves to compensate for the reaction forces of the cleaning nozzles and to counter the force of gravity of the non-bending hose and the cleaning fluid supplied through it.

It is preferable to design the apparatus in such a way that the spray-head is provided with at least one propulsion nozzle directed away from the head-end and generally aimed in the longitudinal direction of the hose. This promotes the movement of the apparatus through the pipe.

In the following an embodiment of the invention will be illustrated by way of non-limitative example with reference to the drawings, in which:-

Fig. 1 shows an apparatus embodying the invention.

Fig. 2 shows the spray-head of the apparatus of Fig. 1 in front view and side view.

Fig. 1 shows a pipe 1 which is to be cleaned internally. Over the length to be cleaned the pipe 1 has constrictions such as constriction 2 and bends (not shown). A hose 4 for cleaning fluid is introduced slidably into the pipe 1 through a suitable entry port 3. The end of the hose 4 inside the pipe 1 is provided with a spray-head 5 and a portion of the hose 4 adjacent the spray-head 5 is non-bending i.e. is substantially rigid, in comparison with the flexible remainder of the hose. At point 6 the non-bending part of the hose 4 joins the flexible part. Outside the pipe 1 a motor 7 is arranged to which the hose 4 is coupled and which rotates the hose continuously. A high pressure pump is also provided outside the pipe 1 for supplying the cleaning fluid which is sprayed from the hose 4 at spray-head 5 as a series of high-pressure jets. The spray-head 5 rotates with the hose 4.

Fig. 2 shows an overhead view A and a side view B of the spray-head 5 as well as a part of the hose 4. The spray-head 5 has a hemi-spherical front face in which are located two cleaning nozzles 8 and an elevation nozzle 9. Also the spray-head 5 has a flat rear face in which several rearwardly directed propulsion nozzles 10 are located for promoting advance of the hose 4 in the pipe 1. The spray head is free to move transversely of the pipe. The nozzles 8,9 are so shaped and arranged that they spray non-symmetrically relative to the rotational axis of the hose, in such a way that the cleaning nozzles 8 are directed continuously at the inner wall of pipe 1, while the elevation nozzle 9 is directed away from the inner wall of pipe 1 and ensures that the spray-head 5 is kept continuously close to and spaced from the wall of pipe 1, both while the hose 4 is at an upper part of the pipe 1 and while it is at a lower part (indicated by broken line 4′ in Fig. 1). This is achieved because the cleaning nozzles together create a reaction force which is opposed by the reaction force of the elevation nozzle, in the plane perpendicular to the hose axis. At a certain distance from the pipe wall, these forces balance.

The apparatus has been found to be most satisfactory for cleaning a blast furnace gas main with a diameter of 3200 mm. The non-bending portion of the hose 4 has a length greater than the largest diameter of the pipe 1. During cleaning the hose rotation speed is in this case 10 to 20 revolutions per minute. The optimum number of revolutions depends on the thickness of the layer of dirt to be removed. The speed of advance of the spray-head 5 of the hose 4 through the pipe 1 depends on the speed of revolution and may be about 1cm/revolution. The cleaning fluid pressure applied is set at about 700 bar.

The invention is not limited to this application.

Claims

1. Apparatus for the internal cleaning of a pipe, comprising a hose (4) which is rotatable around its longitudinal axis, a driving mechanism (7) for rotating the hose around said axis, and at the head-end of hose a spray head (5) for spraying cleaning fluid onto a pipe wall, said spray head being attached to the hose for rotation therewith, characterized in that the hose (4) has a non-bending portion adjoining the head-end.

2. Apparatus in accordance with claim 1, wherein said spray head is free to move tranversely of the pipe and has spray nozzles which effect non-symmetrical spraying with respect to the rotational axis of said non-bending portion, so that when spraying in a pipe the spray head tends to occupy a position close to but spaced from the pipe wall.

3. Apparatus in accordance with claim 2, wherein the spray head is provided with one or more cleaning nozzles (8) which cause a first reaction force acting transversely to the rotational axis of said non-bending portion and at least one elevation nozzle (9) which causes a second reaction force acting transversely to the rotational axis of said non-bending portion in opposition to said first reaction force.

4. Apparatus in accordance with any one of claims 1 to 3 wherein the spray head is provided with at least one propulsion nozzle acting in the direction of the rotational axis of said non-bending portion.

5. Method of internal cleaning of a pipe wherein apparatus according to any one of the preceding claims is employed, the length of said non-bending portion of the hose being not less than the minimum diameter of the cleaned pipe.

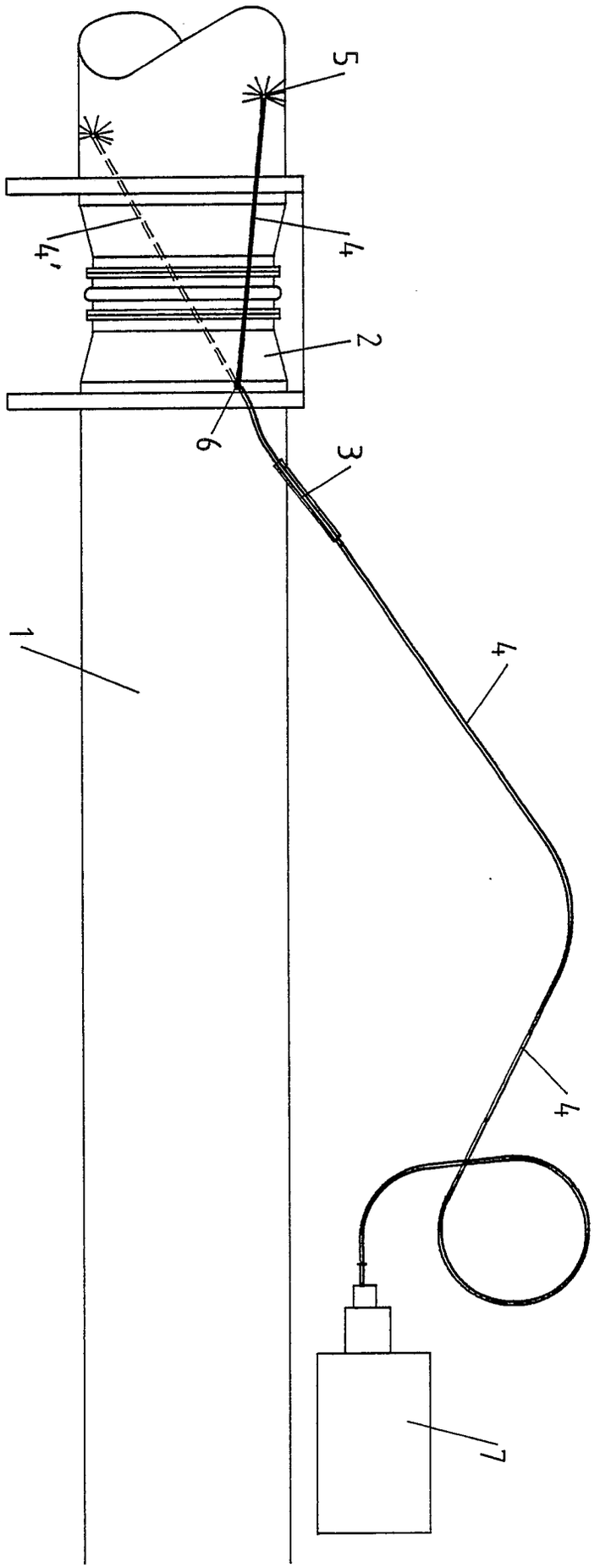

FIG. 1

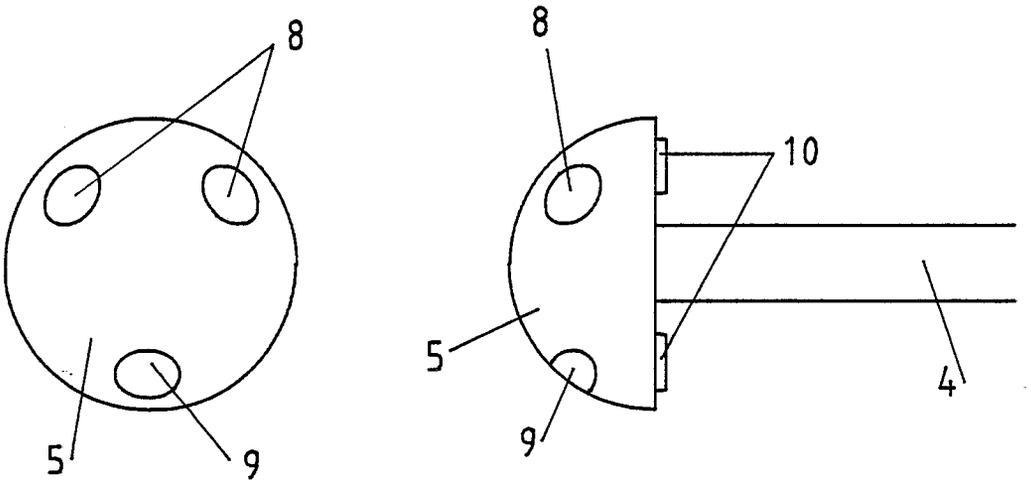

FIG. 2