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(56) Documents Cited

**NO 000179132 A SU 001380810 A**  
**US 5238331 A**  
**WPI abstract no. 1988-276762 of SU 1380810A**

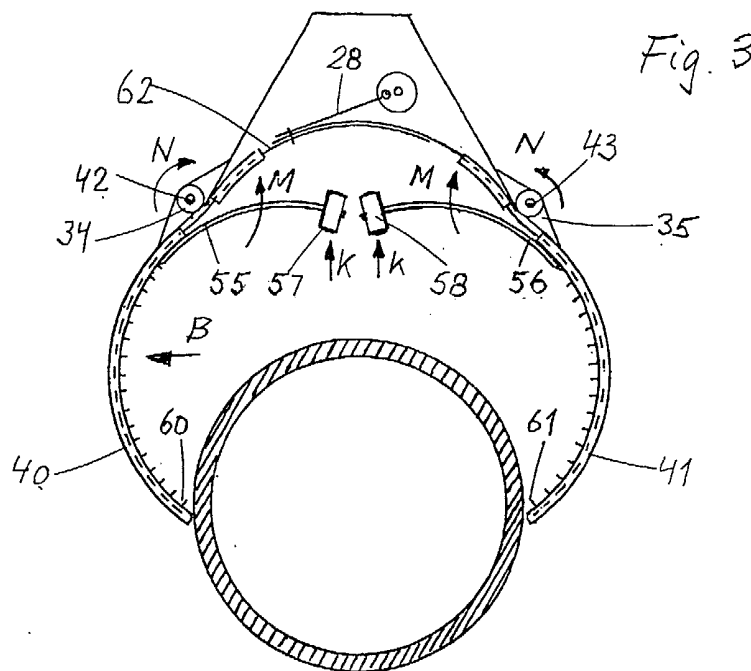
(58) Field of Search

UK CL (Edition T) **A4F FNB FNS FNX , F2N**  
INT CL<sup>7</sup> **B08B 9/023**  
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(54) Abstract Title

**A device for cleaning pipes**

(57) A device for cleaning pipes of cages in the water, comprising a stand (3, Fig 1) with a support device 40,41, which supports a curved, flexible cleaning band (46, Fig 2), whose ends 60,61 can be moved between a first and a second position. When the ends 60,61 are located in the first position, the pipe can be passed between them. When the ends 60,61 are located in the second position, the cleaning band (46, Fig 2) can enclose the pipe. The device comprises a pre-tensioning device, which constantly attempts to move the ends 60,61 to the first position. By operating an influencing device 55,56 the ends 60,61 can be moved to the second position. A drive device 28 can move the cleaning band (46, Fig 2) in its longitudinal direction.



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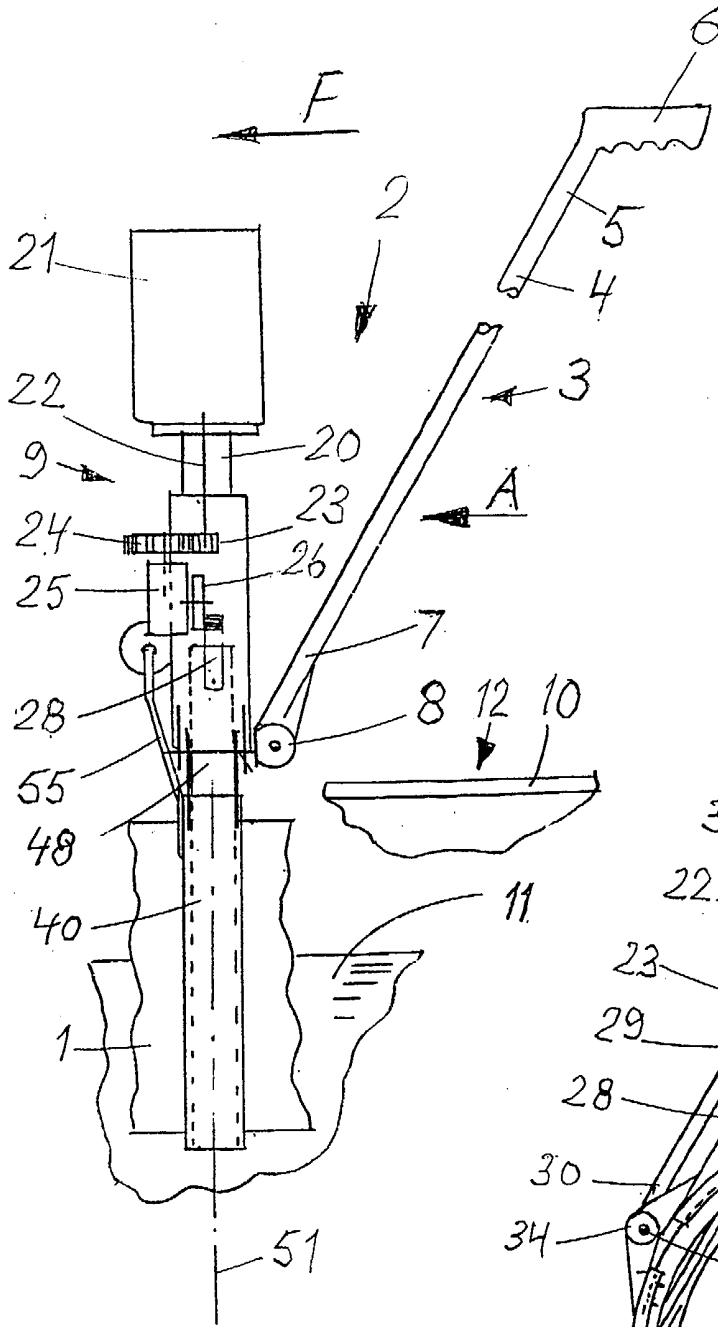


Fig. 1

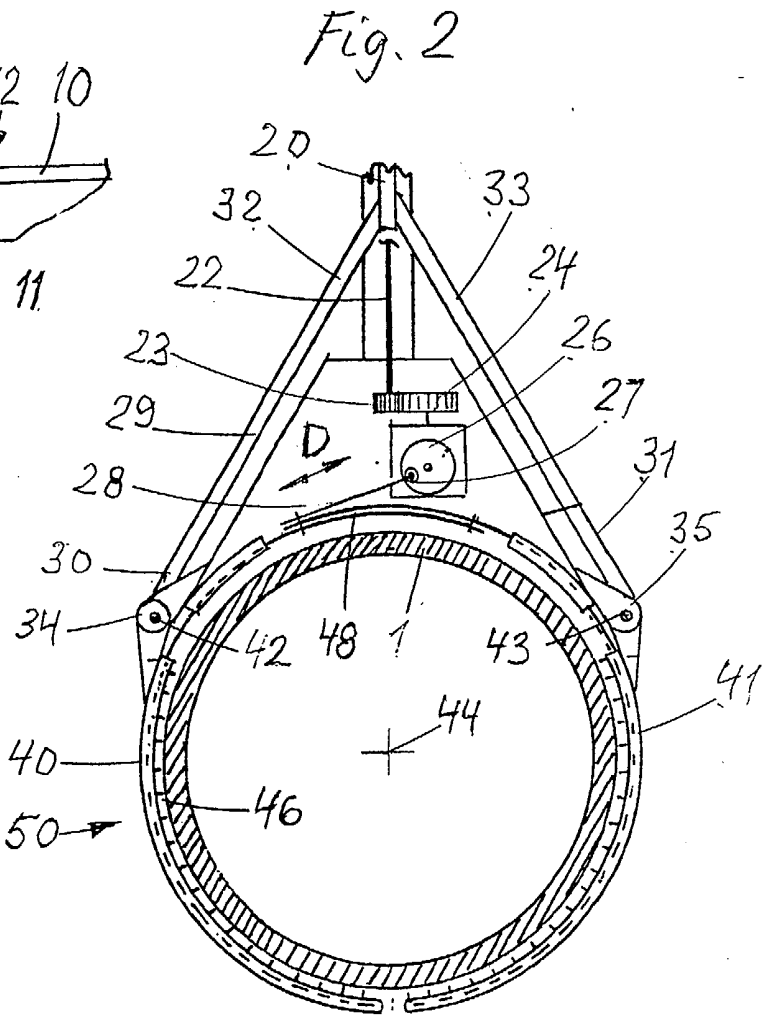


Fig. 2

Fig. 3

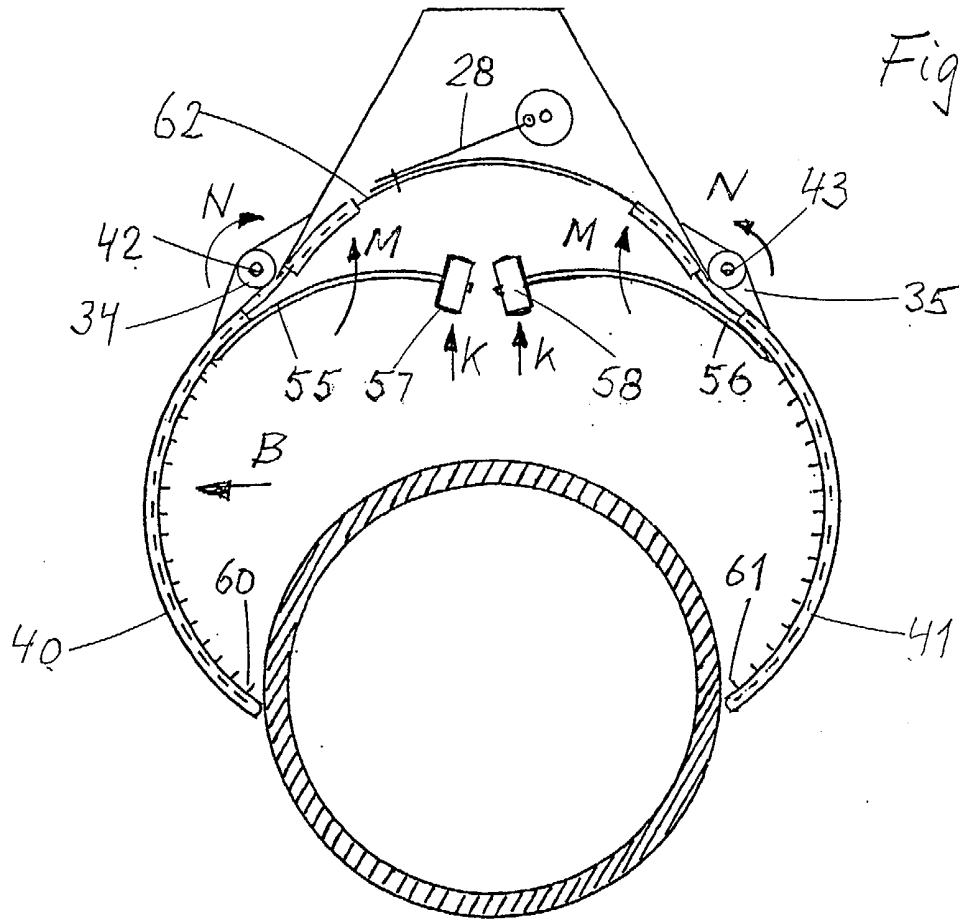


Fig. 4

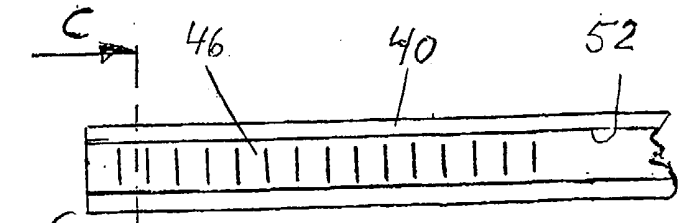


Fig. 5

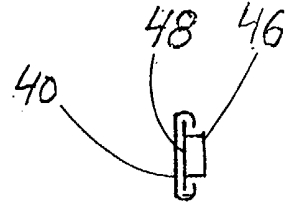


Fig. 6

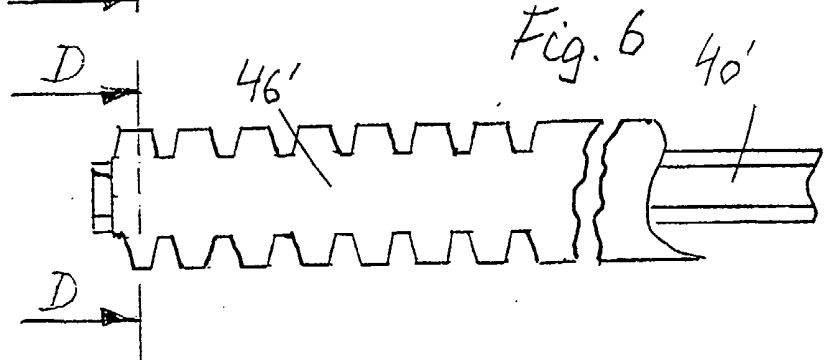
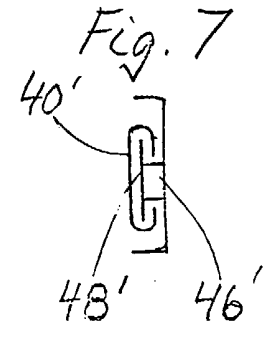


Fig. 7



### A device for cleaning pipes

The invention relates to a device for cleaning pipes as indicated in the introduction to claim 1.

5 A main object of the device according to the invention is cleaning pipes, which act as floats in cages for rearing fish. Such pipes are watertight and filled with air, usually floating horizontally and in the form of a loop, partly submerged along the surface of the water. To the pipe is attached an upper peripheral portion of a cup-shaped net or a cage, which is submerged in the water, and wherein the fish can be confined. In order to keep the sides of the cage  
10 vertical, sinkers are attached to the lower portions of the cage. The pipes therefore also have to support the sinkers. When plants and animals, such as kelp and seaweed, shellfish, etc., become attached to the pipes, the ability of the pipes to support another load is reduced and the pipes therefore have to be cleaned at regular intervals.

15 From NO 179132 an apparatus of the type mentioned in the introduction is known for cleaning the external surface of pipes, particularly for removing rust or paint from the pipe. Two first end portions of two separate, semicircular first and second rotor parts can be coupled or hooked together and these rotor parts can be mounted in such a manner that they extend round the pipe,  
20 whereupon the two second end portions of the parts are hooked together, with the result that the rotor parts form a ring, with the hooking operation being performed manually. The annular rotor is supported in a stator via support wheels of the stator. Radially on the exterior the rotor has a number of blades on to which compressed air can be played via a nozzle on the stator. The rotor  
25 carries a mechanism comprising a number of rollers, which can come into contact with the pipe, and whereby the rotor can be centred relative to the pipe. Furthermore, the mechanism has a number of cleaning elements, which can similarly be brought into contact with the pipe. The rollers and the cleaning elements are arranged to be pressed against the pipe by means of a  
30 mechanism, which exploits the centrifugal force exerted when the rotor rotates.

The above-mentioned connection of the rotor parts of the apparatus can be implemented relatively easily if the pipe is located above water. However, if the apparatus is to be used for cleaning a pipe floating on the water, an operator can start by connecting the first rotor end portions above the water.  
35 The operator, however, then has to grip one of the rotor halves and by means

thereof lower the second rotor half into the water at one side of the pipe. The second rotor half can hereby pivot freely about its hinge axis. The operator then has to grip the second half and bring it partly up out of the water and connect the second end portions of the rotor halves so that together they  
5 annularly enclose the pipe.

The installation of such a connecting device involves obvious risks for an operator, particularly in bad weather. When mounting the numerous parts of the apparatus there may be a need for more than one operator and there may be a risk that components of the apparatus could be lost in the water. If the  
10 cleaning elements are located under water, the resistance to a rotation will probably be great and correspondingly a substantial torque has to be exerted by the rotor's drive device, particularly since in order to function, the apparatus is dependent on the exertion of a centrifugal force against  
15 components of its mechanism. In addition, a torque has to be exerted in order to achieve the object of the apparatus, viz. the execution of the cleaning of the pipe. In total, therefore, a substantial torque has to be exerted against the rotor. In order to maintain the apparatus in a desired position during operation, the operator consequently has to exert a substantial counter-torque, which can be strenuous and tiring for the operator.

20 If an apparatus of the known type is to be used for cleaning pipes in cages where the pipes are located partly under water and are heavily fouled, it looks as though portions of the apparatus could easily become clogged and the many small components such as rollers, movable arms, etc. could easily become jammed. To enable the apparatus to work, the rotor's rotational frequency must  
25 be high and it is not indicated that the rotor's direction of rotation can be reversed. If a reversal had been possible, it would probably have taken a relatively long time to achieve braking and renewed acceleration of the rotor to the required rotational frequency.

The apparatus comprises many components and the installation of the  
30 apparatus on the pipe is complicated. It is therefore expensive to purchase and to use. The apparatus can probably be used for cleaning a relatively smooth pipe surface in air, but it looks as though it is highly impractical for use in cleaning pipes for cages of the above-mentioned type.

35 From US 4 912 799 and US 4 750 249 scraping chains are known, which are arranged to be placed round a pipe and pulled by hand alternately one way and

the other for cleaning, particularly of an exposed portion of a water pipe, whose remaining portion is buried in the ground. These scraping chains also have to be placed round the pipe in the same way as the rotor of the apparatus according to NO 179132. Even though such chains are simple and inexpensive,  
5 they are time-wasting and awkward to use, and are not suitable for a fast and effective industrial cleaning operation.

With the pipe cleaner according to the invention it is not necessary for one or more operators to bend or kneel down on gangways beside the pipe in order to lower components of the device, e.g. by hand, into the water beside a pipe  
10 located entirely or partly under water, to put their hands down into the water in order to grip the components, and place the components round the pipe and connect them in such a manner that they enclose the pipe.

The device according to the invention comprises only components that are interconnected all the time. Thus there is no risk of components of the device  
15 being lost, either during the installation phase, the operational phase or the dismantling phase.

The device comprises a motor-driven cleaning element, which is arranged to extend round the pipe and during operation to be moved backwards and forwards in the pipe's circumferential direction. During this process oppositely  
20 directed torques may be exerted in quick succession against the stand and components fixed thereto. Thus a torque, which attempts to move the stand in one direction about the pipe axis, is immediately succeeded by a torque, which attempts to move the stand in the opposite direction, with the result that the stand can remain substantially at rest or be moved only slightly in a lateral  
25 direction. The device according to the invention can therefore clean the pipe substantially without the device's operator having to compensate for such torques, but only having to pass the device continuously along the pipe.

With the device according to the invention the cleaning element's direction of rotation is automatically constantly reversed, whereby plants such as seaweed,  
30 etc., which during rotation in one direction are laid in one direction along the pipe's circumference, can more easily be removed from the pipe by a reversal of the direction of rotation. More rigid objects and objects which are very firmly stuck to the pipe, such as crustaceans, can thereby be more easily removed from the pipe, since they are influenced on opposite sides.

The characteristic of the device according to the invention is set forth in the characterising features indicated in the claims.

5 The invention will now be described in greater detail with reference to the drawing, which schematically illustrates an embodiment of the device according to the invention.

Fig. 1 is a side view of a device according to the invention, where components have been cut away.

10 Fig. 2 is a view of the device illustrated in fig. 1, viewed in the direction of the arrow A in fig. 1, side portions of a curved cleaning element being located in a closed position, wherein the side portions extend along the circumference of a pipe and can clean the pipe.

15 Fig. 3 is a view resembling that illustrated in fig. 2, but where other components of the device are illustrated, the cleaning element's side portions being located in an open position, wherein free ends of the cleaning element have been moved away from each other.

Fig. 4 is a view of a possible, first embodiment of a cleaning element, which is carried by a support device, viewed in the direction of the arrow B in fig. 3, where portions have been cut away.

Fig. 5 illustrates a section along line C-C in fig. 4.

20 Fig. 6 is a view resembling that illustrated in fig. 4, but illustrating a second embodiment of a cleaning element.

Fig. 7 illustrates a section along line D-D in fig. 6.

25 In the following text, the term "up" should be understood in figs. 1 and 2 to refer to the direction towards the edge of the page facing away from the reader, and the term "forward" should be understood to refer to the direction of the arrow F in fig. 1, which also indicates a horizontal direction.

30 As illustrated in figs. 1-3, a pipe 1 of a cage 12 is floating in the water 11. The pipe 1 normally extends along a loop or circle. Along the pipe 1 and above the water 11 extends a gangway 10, on which operators (not shown) tending the cage 12 can walk. At regular intervals fouling, i.e. marine plants and animals which have become attached to the pipe, has to be removed from the pipe 1, where not only a lower portion of the pipe 1 can be fouled, but also an upper

portion thereof, since waves normally wash over the entire pipe. For this purpose, therefore, a device 2 may be employed, which can be slidably connected to the pipe 1.

The device 2 comprises a stand 3 with a pole portion 4 with an upper end portion 5 and a lower end portion 7. The upper end portion 5 is provided with a handle 6. In order to lift the device 2 when the device 2 is being mounted on the pipe 1 or removed from the pipe 1, an operator standing on the gangway 10 can grip the stand 3. To operate the device 2 after it has been mounted on the pipe 1, an operator located behind the device 2 can grip the handle 6 and push or pull the device 2 along the pipe 1.

The lower end portion 7 is linked via a hinge 8 to a main part 9 of the device.

The main part 9 of the device 1 comprises a frame 20, which supports a motor 21, such as a combustion engine, a hydraulic motor or an electromotor. The motor 21 is mounted on the frame's upper portion and has a drive shaft 22 extending downwards and has a lower end portion, which supports a small gear wheel 23. This small gear wheel 23 is engaged with a large gear wheel 24, which is rotatably mounted in the frame 20. Via a gear 25 the large gear wheel 24 drives a crank wheel or a crank 26, which is also mounted in the frame 20, and which can rotate about a horizontal axis. The crank 26 has a crank journal 27, which similarly extends horizontally and is connected to a driving rod 28, which, when the motor is running, is moved backwards and forwards substantially in its longitudinal direction in the direction of the double arrow D in fig. 2.

The main part 9 further comprises an upwardly pointed, approximately V-shaped portion 29, which is connected to the frame 20 and has legs 32, 33.

Lower end portions 30 and 31 respectively of the legs 32, 33 have hinges 34, 35, via which the legs 32, 33 are connected to respective support parts 40, 41, which together form a support device 50.

Each support part 40, 41 extends in a curved form and can pivot in a common curve plane 51 about respective rotational or hinge axes 42, 43. The driving rod 28 is arranged to be moved in a plane, which is parallel to this curve plane 51.

As is also illustrated in fig. 4, in an embodiment the support parts 40, 41 may be rigid hollow sections with a C-shaped cross section and with an opening 52



facing radially inwards relative to the curves along which the support parts extend.

5 The support parts 40, 41 support an elongated cleaning element 46 with a central portion 62 located between the support parts 40, 41. On each side of the central portion 62 the cleaning element 46 has side portions 63, 64, which extend along the respective support parts 40, 41 and which can easily be moved along them.

10 The cleaning element 46 comprises a substantially flat, rod-shaped section or band 48, which supports an elongated brushing or scraping device or a number of brushes or scrapers, which extend in the cleaning element's longitudinal direction and are attached to the rod-shaped section 48. The cleaning element 46 is flexible in its transverse direction, thus permitting it to be bent in the curve plane 51.

15 The rod-shaped section 48 of the cleaning element 46 can be made of a material such as Teflon, Lexan or the like, and has to be strong and capable of being easily moved, e.g. sliding easily relative to the support parts 40, 41.

20 When the cleaning element 46 is connected to the support parts 40, 41, the brushing or scraping device or the brushes or scrapers protrude through the opening 52, i.e. radially inwards past adjacent portions of the support parts 40, 41. The cleaning element's side portions 63, 64 have free ends 60, 61 (fig. 3), which are hereby located below or far from the central portion 62. The central portion 62 is connected to the driving rod 28. When the driving rod 28 is moved backwards and forwards, the cleaning element's side portions 63, 64 are moved in their longitudinal direction along the respective support parts 40, 25 41.

The cleaning element 46 can thereby remove fouling over the entire circumference of the pipe's exterior.

30 Each of the hinges 34, 35 via which the support parts 40, 41 are connected to the legs 32, 33 is provided with a spring device, such as a torsion spring (not shown), which is arranged to exert a torque  $N$  against the support parts 40, 41, and which constantly attempts to move the support parts 40, 41 to the position illustrated in fig. 3 relative to the legs 32, 33.

As illustrated in fig. 3, to each of the support parts 40, 41 there is attached an influencing device comprising a lever 55, 56, which extends approximately

parallel to the curve plane 51. Each lever 55, 56 has an end portion located at a distance from the rotational or hinge axes 42, 43, and each of the end portions supports a wheel 57, 58, which is arranged to rotate about a longitudinal axis of the end portion. If the support parts 40, 41 are located in the position  
5 illustrated in fig. 3 and if, e.g. during lowering of the cleaning device, forces K are exerted upwards against the wheels 57, 58 and thereby torques M about the axes 42, 43 against the support parts, as illustrated by arrows in fig. 3, where the torques M are greater than the torques N exerted by the spring device, the lower end portions 60, 61 of the cleaning element 46 can be tilted towards  
10 each other. The shape of the cleaning element can hereby be changed, thus enabling all brushes or scrapers to gradually come into contact with the pipe 1 and the cleaning element 46 to clean the pipe 1 when the cleaning element 46 is moved by means of the driving rod 28.

Figs. 4 and 5 illustrate a possible first embodiment of a cleaning element 46,  
15 and figs. 6 and 7 illustrate a second embodiment 46' of the cleaning element, where portions of the second embodiment of the cleaning element corresponding to portions of the first embodiment are indicated by the same reference numerals, but with the addition of an apostrophe. For both  
20 embodiments of the cleaning element the same support parts 40, 41, 41' may be employed. A person skilled in the art will know which cleaning element is best suited to the removal of the fouling concerned from the pipe.

The function of the device will now be explained, with the device initially not being mounted on the pipe and the support device's support parts being located in the open position as illustrated in fig. 3.

25 An operator therefore first grips the device's stand and possibly its handle and places it over a pipe 1, as illustrated in fig. 3. The device is then lowered until the wheels 57, 58 come into contact with the top of the pipe, whereupon the operator gradually reduces his lifting force, thus gradually lowering the device, whereby the wheels are pressed with increasing force K against the pipe and  
30 the support parts, the cleaning element's side portions thereby being simultaneously pivoted towards the opposite pipe sides until the side portions come into contact with these pipe sides.

The operator then starts the motor, whereby the driving rod 28 pulls the cleaning element backwards and forwards along the pipe's circumference, thus  
35 causing the pipe to be cleaned.

After a portion of the pipe has been cleaned at the point on the pipe where the device was lowered, the operator can either push or pull the device a desired distance, thus enabling another portion of the pipe to be cleaned.

5 When the whole pipe has been cleaned, the operator can grip the stand and lift the device, whereby the force exerted upwardly on the wheels 57, 58 is gradually reduced and the spring device can effect a pivoting of the support parts away from the pipe. The device can then be removed completely from the pipe.

10 Even though it has been stated above that the support parts 40, 41 are in the form of hollow sections, a person skilled in the art will appreciate that they may be designed differently, e.g. as sections of a different shape or they may comprise guide rollers or the like for guiding the cleaning element 46 when it is moved in its longitudinal direction by means of the drive device as indicated in NO 179132, the object of the support parts also being to effect a movement  
15 of the cleaning element 46 from one position, wherein the pipe can be brought in between its ends 60, 61 to a second position, wherein the cleaning element encloses the pipe 1, and vice versa. It will also be appreciated that the object of the invention is achieved with the above-mentioned levers but that these need not be operated automatically by means of rollers, which abut against the  
20 pipe. It will be obvious to a person skilled in the art that the object of the invention is also achieved if the levers are operated manually, e.g. via cords which influence the levers in the same way as the rollers after the pipe has been passed between the support parts, even though this may complicate the device slightly, resulting in the operator having to perform an extra operation  
25 while installing or removing the device. Moreover, it will also be understood that the support parts need not extend along the entire cleaning element, if this is not necessary for achieving adequate guidance of the cleaning element and satisfactory pressure thereof against the pipe during the use of the device.

## PATENT CLAIMS

1. A device for cleaning pipes, particularly pipes (1) of cages (12) in the water, comprising
- a stand (3)
  - 5 - a support device (50), which is mounted in the stand (3),
  - an elongated cleaning element (46,46'), which extends curvedly in a curve plane (51) and is supported by a support device (50), and which can be moved in its longitudinal direction in the curve plane (51) relative to the support device (50), and
  - 10 - a drive device (21,28) for moving the cleaning element (46,46'), the cleaning element (46,46') having two free ends (60,61), which can be moved in relation to each other in the curve plane between a first and a second position, wherein the distance between the ends (60,61) is greater or smaller respectively than the diameter of the pipe (1),
  - 15 characterised in that the cleaning element (46,46') comprises a band (48), which is flexible in the curve plane, the support device (50) comprises two support parts (40,41) and the stand (3) comprises two stand portions (30,31), wherein the respective support parts (40,41) are mounted, thus enabling them to rotate in the curve plane (51) about rotational axes (42,43) and thereby
  - 20 move the cleaning element's (46,46') ends (60,61) between the first and the second position, and the device further comprises a pre-tensioning device, which constantly attempts to move the support parts (40,41) one way in order to bring the cleaning element's free ends (60,61) to their first position, and an influencing device (55,56,57,58) for moving the support parts (40,41) the
  - 25 opposite way, thereby moving the cleaning element's ends (60,61) to their second position.
2. A device according to claim 1, characterised in that the band (48) is made of a plastic with good sliding properties, e.g. Teflon or Lexan.
- 30 3. A device according to claim 1 or 2, characterised in that the curved band (48) carries scrapers, brushes or the like on its radially inwardly facing side.
4. A device according to claim 3, characterised in that the support parts (40,41) are arranged to guide the band

(48), while at the same time the brushes, scrapers or the like protrude radially inwards past the support parts (40,41).

5 5. A device according to claim 4, characterised in that the support parts (40,41) are C-shaped in cross section and have a longitudinal opening (52), and the brushes and the scrapers protrude radially through the opening (52).

10 6. A device according to one of the preceding claims, characterised in that the pre-tensioning device comprises two torsion springs, each of which has a first and a second end portion, which is connected to the associated stand portion (30,31) and the associated supporting part (40,41) respectively.

15 7. A device according to one of the preceding claims, characterised in that the influencing device comprises two levers (55,56), which are securely connected to the respective support parts (40,41), and which have free end portions, which are located at a distance from the rotational axes (42,43).

8. A device according to claim 7, characterised in that the influencing device comprises two rollers (57,58), which are connected to the respective free end portions of the levers (55,56).

20 9. A device according to one of the preceding claims, characterised in that between its ends (60,61) the cleaning element (46,46') has a central portion (62), which is connected to the drive device (21,28) for operating the cleaning element (46,46') backwards and forwards in its longitudinal direction.

25 10. A device for cleaning pipes, substantially in accordance with any example hereinbefore described with reference to the accompanying drawings.



INVESTOR IN PEOPLE

Application No: GB 0128928.9  
Claims searched: 1-10

Examiner: Nicholas Mole  
Date of search: 8 February 2002

### Patents Act 1977 Search Report under Section 17

#### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK CI (Ed.T): F2N; A4F (FNS, FNB, FNX)  
Int CI (Ed.7): B08B 9/023  
Other: Online: WPI EPODOC JAPIO

#### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	US 5238331 (CHAPMAN)	
A	NO 179132 (DALSEIDE)	
A	WPI abstract no. 1988-276762 and SU 1380810 A (MENTYUKOV)	

N	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.