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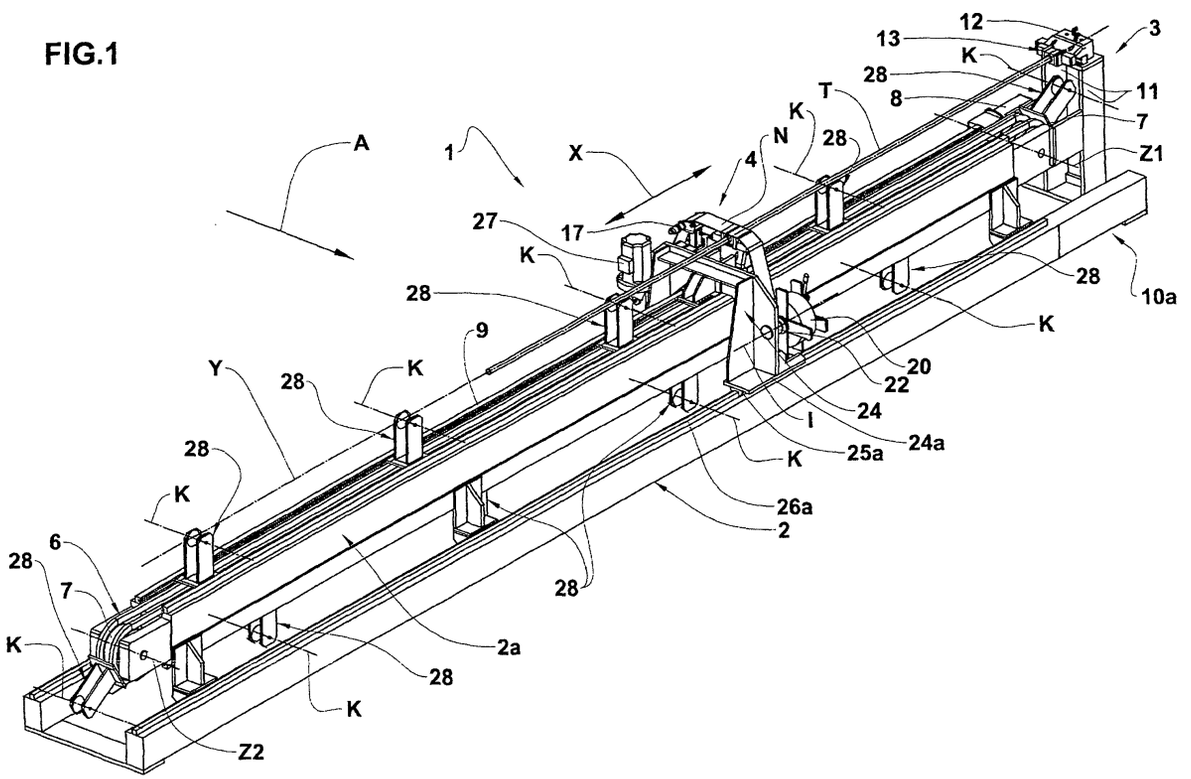
Amended claims in accordance with Rule 86 (2) EPC.

(54) Pipe cleaning device

(57) A pipe-cleaning machine comprises a base frame (2), a support member (3) for a pipe (T) to be cleaned mounted on the base frame (2) and at least one cleaning head (4) mounted on the base frame (2) and having a surface (5) for engagement with the pipe (T). The engagement surface (5) has a substantially tubular shape axially aligned with the support member (3) along a first direction (X). The support member (3) and cleaning head (4) are movable with respect to each other and carry out a movement close to and away from each other along the first direction (X).

FIG.1



EP 1 384 530 A1

Description

[0001] The present invention relates to a pipe-cleaning device. In particular, the present invention relates to a device for external cleaning of pipes that are subsequently to be submitted to bending operations.

[0002] It is known that bent metal pipes are used in many application fields. For example, in the motor-vehicle industry bent pipes are employed for making hydraulic and pneumatic circuits, in the braking system, air-conditioning system or cooling system for engines. Bent pipes are also utilized for accomplishing the exhaust system in motor-vehicles.

[0003] Pipes are for example obtained by drawing and, in order to avoid dangerous inconveniences in the subsequent bending process, cleaning of same at their outer surface is required. In fact, as known, pipes are held during bending by a head provided with a bending die and a presser element active on the pipe against the die action. The die is pivotally movable relative to the presser element and rotation of same gives rise to pipe bending. The requirement of externally cleaning the pipes mainly arises from the fact that possible metal scraps such as burrs or dust remaining on the pipe after drawing can penetrate into the soft material of which both the die and presser element are made and consequently cause scratching of all pipes that are subsequently bent by the die itself.

[0004] Devices for internal and external cleaning of pipes are known that consist of tanks usually holding suitably treated waters into which the pipes are introduced to be submitted to treatments using sodium carbonate, lye or ultrasounds.

[0005] The devices of the known art, while ensuring an excellent pipe cleaning, are very bulky and therefore not very suitable to be inserted in a pipe manufacturing and bending line.

[0006] In addition, usually pipes are dipped into the above mentioned tanks in groups and the required time for the cleaning process is very long where compared with the operating speed of the bending machines disposed downstream of the tank along the production line. As a result, accumulation of pipes in the tanks occurs and the waiting time of the bending machines is very long.

[0007] Finally, full cleaning of the pipe, both internally and externally is not strictly necessary for carrying out the mentioned bending operations.

[0008] Under this situation, the technical task underlying the present invention is to conceive a pipe-cleaning device capable of obviating the mentioned drawbacks.

[0009] In particular, it is an aim of the present invention to conceive a pipe-cleaning device enabling dust and other scraps present on the outer surface of each pipe to be efficiently eliminated.

[0010] It is a further aim of the invention to provide a pipe-cleaning device adapted to execute such an operation in a short period of time.

[0011] The present invention also aims at providing a compact pipe-cleaning device.

[0012] In addition, the invention aims at proposing a pipe-cleaning device which is adapted to be inserted in a pipe production line along which subsequent working operations such as bending of the pipes themselves are contemplated.

[0013] The technical task mentioned and the aims specified are achieved by a pipe-cleaning device having the features set out in one or more of the appended claims.

[0014] A preferred but not exclusive embodiment of a pipe-cleaning device in accordance with the invention is described hereinafter with the aid of the accompanying drawings, in which:

- Fig. 1 is a perspective view of a pipe-cleaning device in accordance with the invention, associated with a pipe to be cleaned;
- Fig. 2 is an elevation view of the pipe-cleaning device in accordance with arrow A in Fig. 1;
- Fig. 3 is a perspective view of a first enlarged portion of the device in Fig. 1; in a first operating configuration;
- Fig. 4 shows a second portion to an enlarged scale of the device in Fig. 1 in a first operating configuration;
- Fig. 5 shows the first enlarged portion seen in Fig. 3, in a second operating configuration;
- Fig. 6 shows the second enlarged portion seen in Fig. 4 in a second operating configuration;
- Fig. 7 is a front view of a detail of the device in Fig. 1.

[0015] With reference to the drawings, a pipe-cleaning device in accordance with the present invention has been generally identified by reference numeral 1.

[0016] Device 1 essentially consists of a base frame 2 on which a support member 3 for a pipe T to be cleaned and at least one cleaning head 4 are mounted.

[0017] Advantageously, the support member 3 and cleaning head 4 are movable with respect to each other and they move close to and away from each other along a first direction X which is coincident with the longitudinal axis Y of pipe T held by the support member 3 itself.

[0018] Preferably, as shown in the accompanying figures, the support member 3 is integral with the base frame 2 and the cleaning head 4 is slidably in engagement with the base frame 2 along the first direction X.

[0019] In accordance with an alternative embodiment not shown, the cleaning head 4 can be integral with the base frame 2, the support member 3 being slidably in engagement with the base frame 2 along the first direction X.

[0020] As better shown in Figs. 3 and 5, the cleaning head 4 is provided with a surface 5 for engagement with pipe T, which surface when brought into contact with pipe T, defines a substantially tubular shape surrounding the pipe to fully adhere to a portion of the outer pipe

surface to be cleaned (Fig. 3).

[0021] The engagement surface 5 of tubular shape is axially aligned with the support member 3 along the first direction X. Movement of the cleaning head 4 relative to pipe T while the engagement surface 5 is brought into contact with the pipe T itself, enables removal of the metal dust, lubricating oil film or other dirt particles still present on the outer surface of pipe T after the drawing operation or subsequent working/handling operations.

[0022] In more detail, in the preferred embodiment herein shown, the base frame 2 mainly extends along the first direction X and, at an upper portion thereof 2a, carries a conveyor belt 6 looped around respective pulleys 7 rotatably linked to the base frame 2 itself around respective horizontal rotation axes Z_1, Z_2.

[0023] An actuating means 8 to move the conveyor belt 6 is operatively active on one of pulleys 7 to cause rotation of same in either way and move the belt 6 in one way or in the opposite way along the first direction X.

[0024] In the embodiment shown, the actuating means 8 is defined by a motor, preferably of the electric type, connected to one of pulleys 7.

[0025] The conveyor belt 6 has an upper stretch 9 extending along the first direction X and carrying the cleaning head 4 which is integral therewith.

[0026] Vertically extending from a first end 10a of the base frame 2 is a pair of posts 11 to which the support member 3 is connected, at the upper part thereof. In more detail (Figs. 4 and 6), the support member 3 comprises a support structure 12 mounted on the base frame 2 through posts 11 and a grip element 13 linked to the support structure 12.

[0027] The grip element 13 is in turn made up of a first shoe 14a having a first active surface 15a, and a second shoe 14b having a second active surface 15b.

[0028] The first 14a and second 14b shoes are movable with respect to each other along a second direction W orthogonal to the first direction X between a position at which they are close to each other (Fig. 4) and a position at which they are spaced apart from each other (Fig. 6).

[0029] In the approached position the first shoe 14a lies close to the second shoe 14b to clamp pipe T at an end thereof.

[0030] In the spaced position the first 14a and second 14b shoes are mutually spaced apart from each other to enable removal of an already cleaned pipe T or setting of a pipe T to be cleaned.

[0031] Preferably, the active surfaces 15a, 15b each have a hemi-cylindrical concave shape and, once they are close to each other, form an overall active surface 15 the shape of which matches that of the pipe T to be clamped.

[0032] In addition, to enable cleaning of pipes T of different diameters, shoes 14a, 14b can be dismantled from the support structure 12 and replaced with other shoes 14a, 14b having active surfaces 15a, 15b of different sizes, in this context "sizes" meaning the bending radii of same - or even different shapes, to clean pipes T of non circular section.

[0033] In the embodiment shown, the cleaning head 4 is therefore movable together with the conveyor belt 6, for displacement close to and away from the support member 3.

[0034] Advantageously, referring particularly to Figs. 3 and 5, the cleaning head 4 comprises a support structure 16 installed on the base frame 2 across belt 6, and a clamp 17 mounted on the support structure 16.

[0035] Clamp 17 has a first jaw 18a provided with a first active surface 19a and a second jaw 18b provided with a second active surface 19b.

[0036] The first and second jaws 18a and 18b are movable with respect to each other along a third direction V, orthogonal to the first direction X, between a position of mutual approaching (Fig. 3) and a position of mutual spacing (Fig. 5).

[0037] In the approached position (Fig. 3), the first jaw 18a lies close to the second jaw 18b, to put the respective active surfaces 19a, 19b in a contact relationship with pipe T interposed therebetween.

[0038] In the spaced position (Fig. 5), the first jaw 18a is moved away from the second jaw 18b to enable removal of a cleaned pipe T or setting of a pipe T to be cleaned.

[0039] Preferably, each of the active surfaces 19a, 19b of clamp 17 has a hemi-cylindrical form so that, when jaws 18a, 18b are close to each other, the engagement surface 5 can take a substantially tubular shape matching the shape of pipe T to be cleaned.

[0040] With jaws 18a, 18b in the approached position, the cleaning head 4 is slidably moved along pipe T.

[0041] In addition, to enable cleaning of pipes T of different diameters, jaws 18a, 18b too can be dismantled from the support structure 17 and replaced with other jaws 18a, 18b having active surfaces 19a, 19b of different sizes, in this context "sizes" meaning the bending radii of same - or even different shapes, to clean pipes T of non circular section.

[0042] Advantageously, the cleaning head 4 further comprises a sheet F of cleaning, preferably absorbing, material, paper or fabric material for example, disposed on the engagement surface 5 and therefore intended for association in contact relationship with pipe T.

[0043] According to an embodiment not shown, sheet F directly coats the engagement surface 5 forming a unitary body therewith.

[0044] Preferably, as shown in the accompanying figures, sheet F is positioned between the first and second jaws 18a, 18b. When jaws 18a, 18b are in the moved-apart position (Fig. 5) sheet F only lays on the active surfaces 19a, 19b, going under the pipe and forming a loop that partly surrounds the pipe T itself. Closing of jaws 18a, 18b around pipe T causes entrapping of sheet F between the outer pipe surface and the engagement surface 5.

[0045] Still more preferably, sheet F is part of a ribbon

N of cleaning material running along a predetermined feeding path H extending between the first and second jaws 18a, 18b to form the above mentioned loop.

[0046] According to a preferred embodiment herein shown, the ribbon of cleaning material N is wound on a supply reel 20 and extends along the predetermined feeding path H until a receiving reel 21, shown in Fig. 2.

[0047] In particular, the supply reel 20 is mounted on a first rotating shaft 22 rotatable about a respective axis I parallel to the first direction X and the receiving reel 21 is mounted on a second rotating shaft 23 rotatable about a respective axis J also parallel to the first direction X.

[0048] The first and second rotating shafts 22, 23 are installed on a support frame 24 integral with the support structure 16 of the cleaning head 4.

[0049] As better viewed from Figs. 3 and 5, the support frame 24 has an inverted-U conformation the two ends of which 24a, 24b carry respective slides 25a, 25b slidably linked to two rails 26a, 26b, formed in the base frame 2 and extending parallel to the first direction X.

[0050] The support frame 24 is placed across the base frame 2 and the first and second rotating shafts 22, 23 lie at the ends 24a, 24b of same. The predetermined feeding path H takes a substantially U-shaped conformation around the base frame 2.

[0051] Device 1 further comprises actuating means 27 for the second rotating shaft 23, to cause running of ribbon N from the supply reel 20 to the receiving reel 21.

[0052] In particular the actuating means 27 is defined by a motor, preferably of the electric type, connected to the second rotating shaft 23 that, once operated, causes unwinding of the ribbon N from the supply reel 20 and rewinding of the same ribbon N on the receiving reel 21.

[0053] Device 1 finally comprises a plurality of support elements 28 for pipe T integrally mounted on the conveyor belt 6 and spaced apart from each other.

[0054] The support elements 28 each extend transversely of the conveyor belt 6 and carry, at a free end 28a thereof, a seat 29 on which pipe T rests, said seat being disposed at the same height as the grip element 13 and clamp 17.

[0055] In more detail, as better shown in Fig. 7, each support element 28 has a base 30 integral with the conveyor belt 6 from which two wings 31 spaced apart from each other extend at right angles, the seat 29 being interposed therebetween.

[0056] The seat 29 is defined by two frustoconical pieces 29a, 29b abutting against each other at their minor bases and pivoting on wings 31 at a respective rotation axis K.

[0057] Preferably, the support elements 28 are placed along the whole extension of the conveyor belt 6 so that part of same always lies on the upper stretch 9 of belt 6 to support pipe T, irrespective of the position of the cleaning head 4.

[0058] After the above description mainly concerning the device structure, a method of cleaning pipes being part of the present invention is disclosed hereinafter.

[0059] After positioning pipe T on two or more support elements 28 so that it has one end between the shoes 14a, 14b of the grip element 13, said shoes 14a, 14b are moved close to each other until locking of pipe T is carried out.

[0060] Subsequently the two jaws 18a, 18b of clamp 17 are closed around pipe T, the cleaning head 4 being positioned either close to the grip element 13 or at the pipe end opposite to that clamped by the grip element 13. The two jaws 18a, 18b are associated with the outer surface of pipe T without tightening the pipe itself, to enable the relative movement between pipe T and the cleaning head 4. In this manner the sheet N of cleaning material placed between jaws 18a, 18b is associated with a circumferential portion of the outer surface of pipe T, by "circumferential portion" being intended a portion of the pipe surface, taken along the longitudinal extension, extending through 360° around axis Y of pipe T.

[0061] At this point, through the actuating means 8 acting on the conveyor belt 6, the cleaning head 4 and the support elements 28 therewith are moved on the base frame 2 to move sheet N relative to pipe T along the first direction X coincident with the longitudinal extension of the pipe itself.

[0062] If in its initial position the cleaning head 4 is close to the grip element 13, operation of the actuating means 8 is carried out to move head 4 away from the grip element 13 itself, until the whole length of pipe T is covered.

[0063] If, on the contrary, in its starting position the cleaning head 4 is at the opposite end of pipe T, the head 4 itself is moved close to the grip element 13.

[0064] Head 4 may also be moved first in one way and then in the other way to travel along pipe T several times and carry out several cleaning cycles.

[0065] The actuating means 27 connected to the second rotating shaft 23 causes unwinding of ribbon N from the supply reel 20, so that the ribbon N portion in contact with pipe T can be replaced.

[0066] Movement of ribbon N can be either continuous and simultaneous with displacement of the cleaning head 4 in order that the ribbon N portion in contact with pipe T can be replaced in a continuous manner, or it can be carried out after each passage, depending on the dirt amount to be eliminated, the length of pipe T and the type of ribbon N used.

[0067] The invention achieves important advantages.

[0068] It should be noted first of all that the pipe-cleaning device in accordance with the present invention enables the metal dust, oil film and other dirt particles present on the outer surface of each pipe to be eliminated in an efficient and quick manner. Therefore, by use of the inventive device the pipe can be submitted to further working operations without running into the dangerous inconveniences resulting from the presence of foreign particles. In particular, the device enables the subsequent bending process to be carried out in a completely safe manner.

[0069] It should be also recognized that the pipe-cleaning device in accordance with the present invention is compact and has a structure suitable to be inserted in a production and bending line for pipe manufacture.

Claims

1. A pipe-cleaning device **characterized in that** it comprises:

   - a base frame (2);
   - a support member (3) for a pipe (T) to be cleaned, mounted on the base frame (2);
   - at least one cleaning head (4) mounted to the base frame (2) and having a surface (5) for engagement with the pipe (T); said engagement surface (5) having a substantially tubular shape axially aligned with the support member (3) along a first direction (X); the support member (3) and cleaning head (4) being movable with respect to each other and carrying out a movement close to and away from each other along said first direction.

2. A pipe-cleaning device as claimed in claim 1, **characterized in that** the support member (3) is integral with the base frame (2), and the cleaning head (4) is slidably engaged on said base frame (2) along the first direction (X).

3. A pipe-cleaning device as claimed in claim 1, **characterized in that** the cleaning head (4) is integral with the base frame (2), and the support member (3) is slidably engaged on said base frame (2) along the first direction (X).

4. A pipe-cleaning device as claimed in claim 1, **characterized in that** the cleaning head (4) further comprises a sheet (F) of cleaning material disposed on the engagement surface (5) and associable in contact relationship with the pipe (T) to be cleaned.

5. A pipe-cleaning device as claimed in claim 1, **characterized in that** the support member (3) for the pipe (T) to be cleaned comprises:

   - a support structure (12) mounted to the base frame (2);
   - a first shoe (14a) mounted on the support structure (12) and having a first active surface (15a);
   - a second shoe (14b) mounted on the support structure (12) and having a second active surface (15b);

   said first (14a) and second (14b) shoes being movable with respect to each other along a second direction (V), orthogonal to the first direction (X), between a mutually approached position at which the first shoe (14a) lies close to the second shoe (14b) to clamp the pipe (T), and a mutually spaced position at which the first shoe (14a) is spaced apart from the second shoe (14b).

6. A pipe cleaning device as claimed in claim 1, **characterized in that** the cleaning head (4) comprises:

   - a support structure (16) mounted on the base frame (2);
   - a first jaw (18a) mounted on the support structure (16) and having a first active surface (19a);
   - a second jaw (18b) mounted on the support structure (16) and having a second active surface (19b);

   said first (18a) and second (18b) jaws being movable with respect to each other along a third direction (W), orthogonal to the first direction (X), between an approached position, at which the first jaw (18a) lies close to the second jaw (18b) and the first (19a) and second (19b) active surfaces altogether define said engagement surface (5) of substantially tubular shape, and a spaced position, at which the first jaw (18a) is moved away from the second jaw (18b).

7. A pipe-cleaning device as claimed in claim 6, **characterized in that** the cleaning head (4) further comprises a sheet (F) of cleaning material disposed between the first (18a) and second (18b) jaws and associable with the pipe (T) in contact relationship therewith.

8. A pipe-cleaning device as claimed in claim 7, **characterized in that** it further comprises:

   - a supply reel (20) to feed a ribbon of cleaning material (N) along a predetermined feeding path (H) extending between the first (18a) and second (18b) jaws to define said sheet of cleaning material (F); and
   - a receiving reel (21) to rewind the ribbon of cleaning material (N) from the predetermined feeding path (H).

9. A pipe-cleaning device as claimed in claim 8, **characterized in that** it further comprises:

   - a support frame (24) integral with the support structure (16) of the cleaning head (4);
   - a first rotating shaft (22) mounted on the support frame (24), to support the supply reel (20);
   - a second rotating shaft (23) mounted on the support frame (24) to support the receiving reel (21); and
   - actuating means (27) for operation of the sec-

ond rotating shaft (23), to cause passage of the ribbon (N) from the supply reel (20) to the receiving reel (21) and between the first (18a) and second (18b) jaws.

10. A pipe-cleaning device as claimed in claim 1, **characterized in that** it further comprises:

- a conveyor belt (6) looped around respective pulleys (7) rotatably linked to the base frame (2) around respective rotation axes (Z_1, Z_2) and having an upper stretch (9) extending along said first direction (X), the cleaning head (4) being integrally linked to said upper stretch (9) of the conveyor belt (6); and
- actuating means (8) for operation of the conveyor belt (6).

11. A pipe-cleaning device as claimed in claim 10, **characterized in that** it further comprises a plurality of support elements (28) for the pipe (T) integrally mounted on the conveyor belt (6) and mutually spaced apart.

12. A method of cleaning pipes, **characterized in that** it comprises the following steps:

- locking the pipe (T) to be cleaned at an end thereof;
- associating a sheet (F) of cleaning material with a circumferential portion of the outer surface of the pipe (T) ;
- moving the sheet (F) relative to the pipe (T) along a direction (X) which is coincident with the longitudinal axis (Y) of said pipe.

Amended claims in accordance with Rule 86(2) EPC.

1. A pipe-cleaning device comprising:

- a base frame (2);
- a support member (3) for a pipe (T) to be cleaned, mounted on the base frame (2);
- at least one cleaning head (4) mounted to the base frame (2) and having a surface (5) for engagement with the pipe (T); the support member (3) and cleaning head (4) being movable with respect to each other and carrying out a movement close to and away from each other along said first direction;

characterized in that said engagement surface (5) has a substantially tubular shape axially aligned with the support member (3) along a first direction (X); the cleaning head (4) further comprising a sheet (F) of absorbing cleaning material disposed on the tubular engagement surface (5) and associable in contact relationship with the pipe (T) to be cleaned.

2. A pipe-cleaning device as claimed in claim 1, **characterized in that** the support member (3) is integral with the base frame (2), and the cleaning head (4) is slidably engaged on said base frame (2) along the first direction (X).

3. A pipe-cleaning device as claimed in claim 1, **characterized in that** the cleaning head (4) is integral with the base frame (2), and the support member (3) is slidably engaged on said base frame (2) along the first direction (X).

4. A pipe-cleaning device as claimed in claim 1, **characterized in that** the support member (3) for the pipe (T) to be cleaned comprises:

- a support structure (12) mounted to the base frame (2);
- a first shoe (14a) mounted on the support structure (12) and having a first active surface (15a);
- a second shoe (14b) mounted on the support structure (12) and having a second active surface (15b);

said first (14a) and second (14b) shoes being movable with respect to each other along a second direction (V), orthogonal to the first direction (X), between a mutually approached position at which the first shoe (14a) lies close to the second shoe (14b) to clamp the pipe (T), and a mutually spaced position at which the first shoe (14a) is spaced apart from the second shoe (14b).

5. A pipe cleaning device as claimed in claim 1, **characterized in that** the cleaning head (4) comprises:

- a support structure (16) mounted on the base frame (2);
- a first jaw (18a) mounted on the support structure (16) and having a first active surface (19a);
- a second jaw (18b) mounted on the support structure (16) and having a second active surface (19b);

said first (18a) and second (18b) jaws being movable with respect to each other along a third direction (W), orthogonal to the first direction (X), between an approached position, at which the first jaw (18a) lies close to the second jaw (18b) and the first (19a) and second (19b) active surfaces altogether define said engagement surface (5) of substantially tubular shape, and a spaced position, at which the first jaw (18a) is moved away from the second jaw (18b).

6. A pipe-cleaning device as claimed in claim 5, **characterized in that** the sheet (F) of absorbing clean-

ing material is disposed between the first (18a) and second (18b) jaws and associable with the pipe (T) in contact relationship therewith.

7. A pipe-cleaning device as claimed in claim 6, **characterized in that** it further comprises:

- a supply reel (20) to feed a ribbon of absorbing cleaning material (N) along a predetermined feeding path (H) extending between the first (18a) and second (18b) jaws to define said sheet of **absorbing** cleaning material (F); and
- a receiving reel (21) to rewind the ribbon of **absorbing** cleaning material (N) from the predetermined feeding path (H).

8. A pipe-cleaning device as claimed in claim 7, **characterized in that** it further comprises:

- a support frame (24) integral with the support structure (16) of the cleaning head (4) ;
- a first rotating shaft (22) mounted on the support frame (24), to support the supply reel (20);
- a second rotating shaft (23) mounted on the support frame (24) to support the receiving reel (21); and
- actuating means (27) for operation of the second rotating shaft (23), to cause passage of the ribbon (N) from the supply reel (20) to the receiving reel (21) and between the first (18a) and second (18b) jaws.

9. A pipe-cleaning device as claimed in claim 1, **characterized in that** it further comprises:

- a conveyor belt (6) looped around respective pulleys (7) rotatably linked to the base frame (2) around respective rotation axes (Z_1, Z_2) and having an upper stretch (9) extending along said first direction (X), the cleaning head (4) being integrally linked to said upper stretch (9) of the conveyor belt (6); and
- actuating means (8) for operation of the conveyor belt (6).

10. A pipe-cleaning device as claimed in claim 9, **characterized in that** it further comprises a plurality of support elements (28) for the pipe (T) integrally mounted on the conveyor belt (6) and mutually spaced apart.

11. A method of cleaning pipes, comprising the step of locking the pipe (T) to be cleaned at an end thereof; **characterised in that it comprises the steps of:**

- associating a sheet (F) of absorbing cleaning material with a circumferential portion of the outer surface of the pipe (T), **to define a tubular shape fully adhereing to said portion of the outer surface of the pipe (T);**
- moving the sheet (F) relative to the pipe (T) along a direction (X) which is coincident with the longitudinal axis (Y) of said pipe.

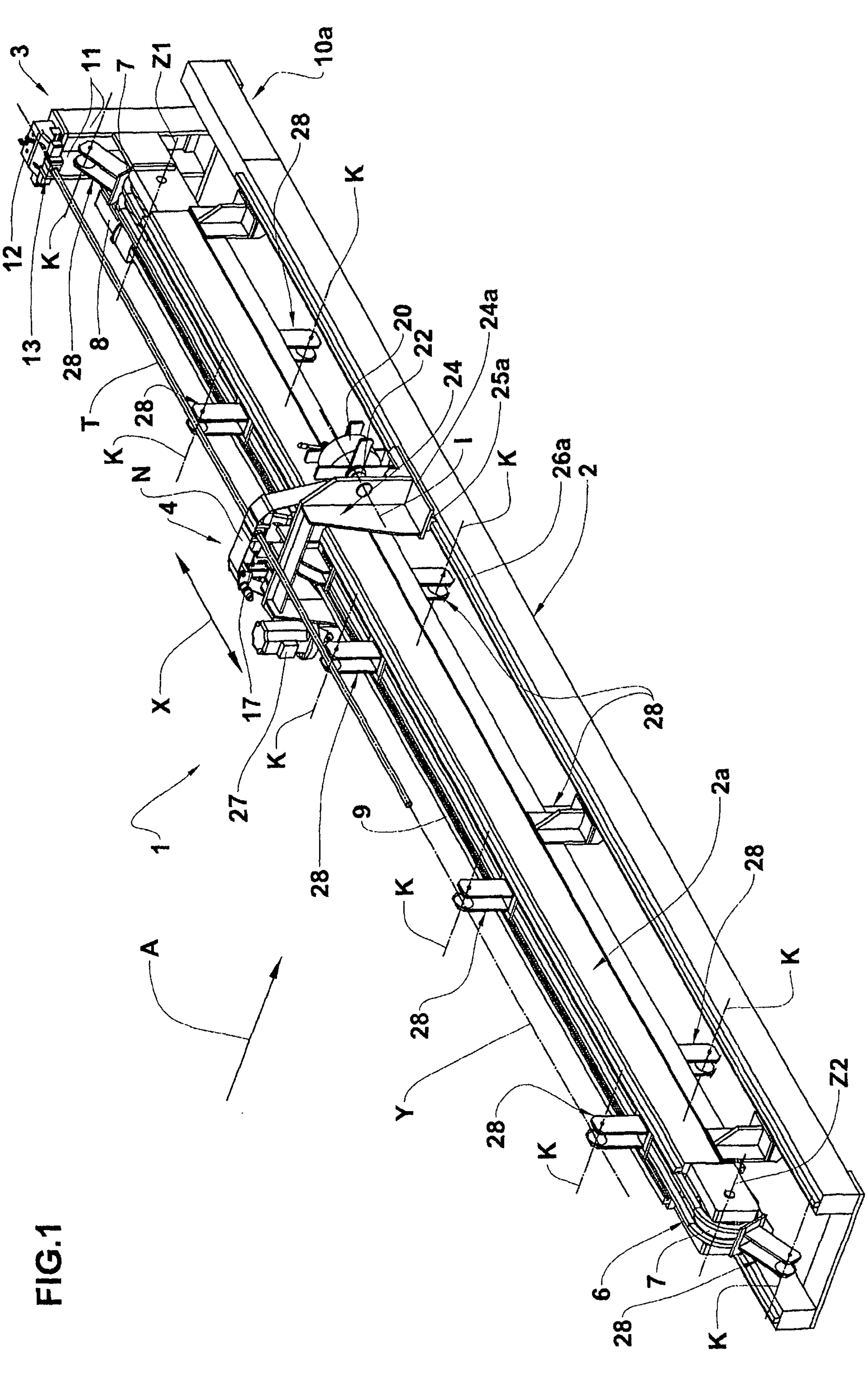

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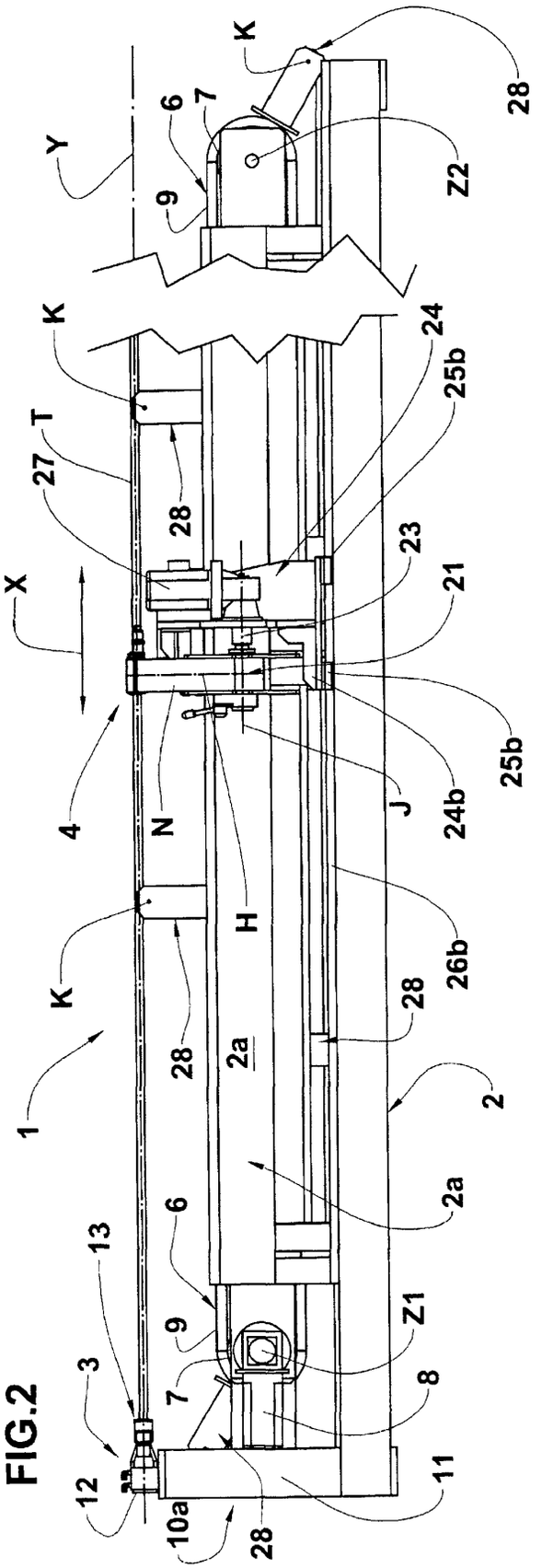
FIG.1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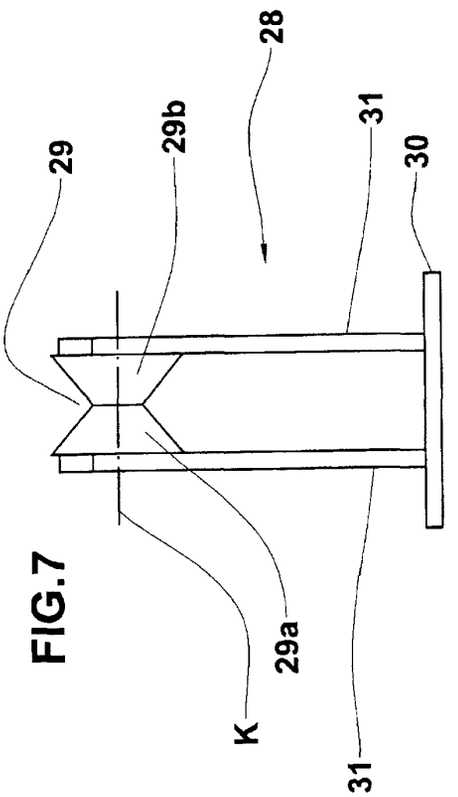
Z2

FIG.2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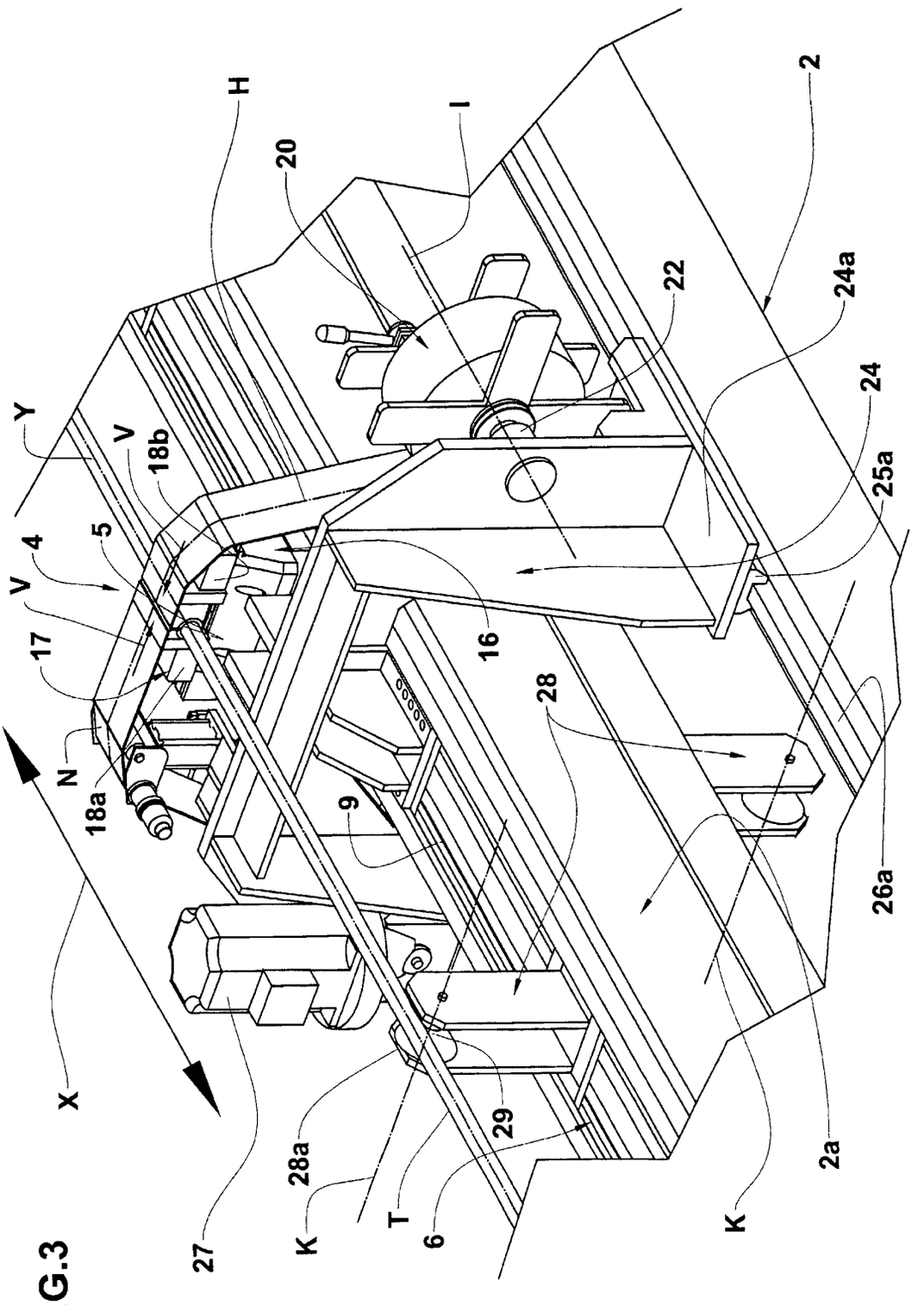
31

FIG.7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29
2a
27
K
T
6
K

FIG.3

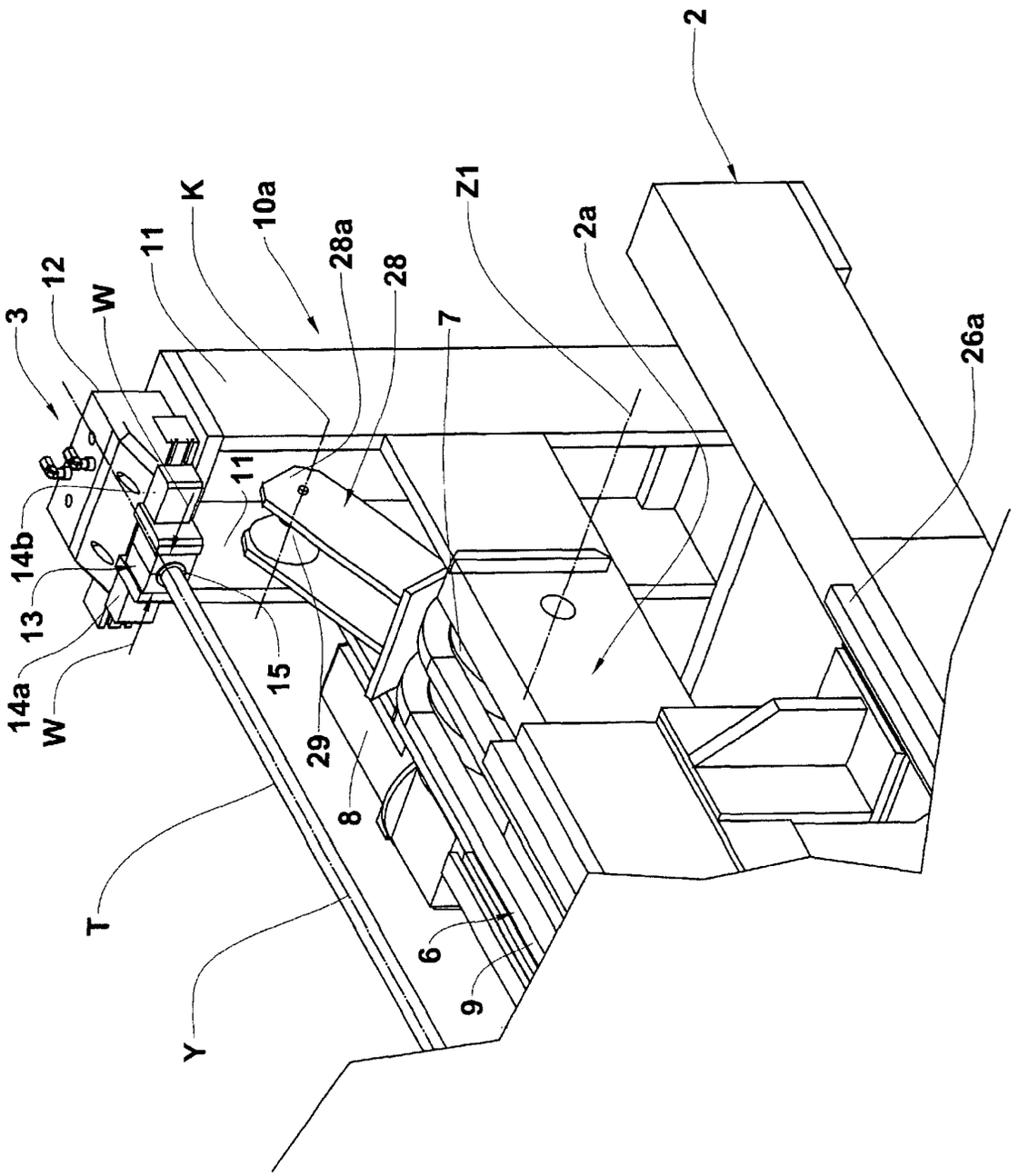
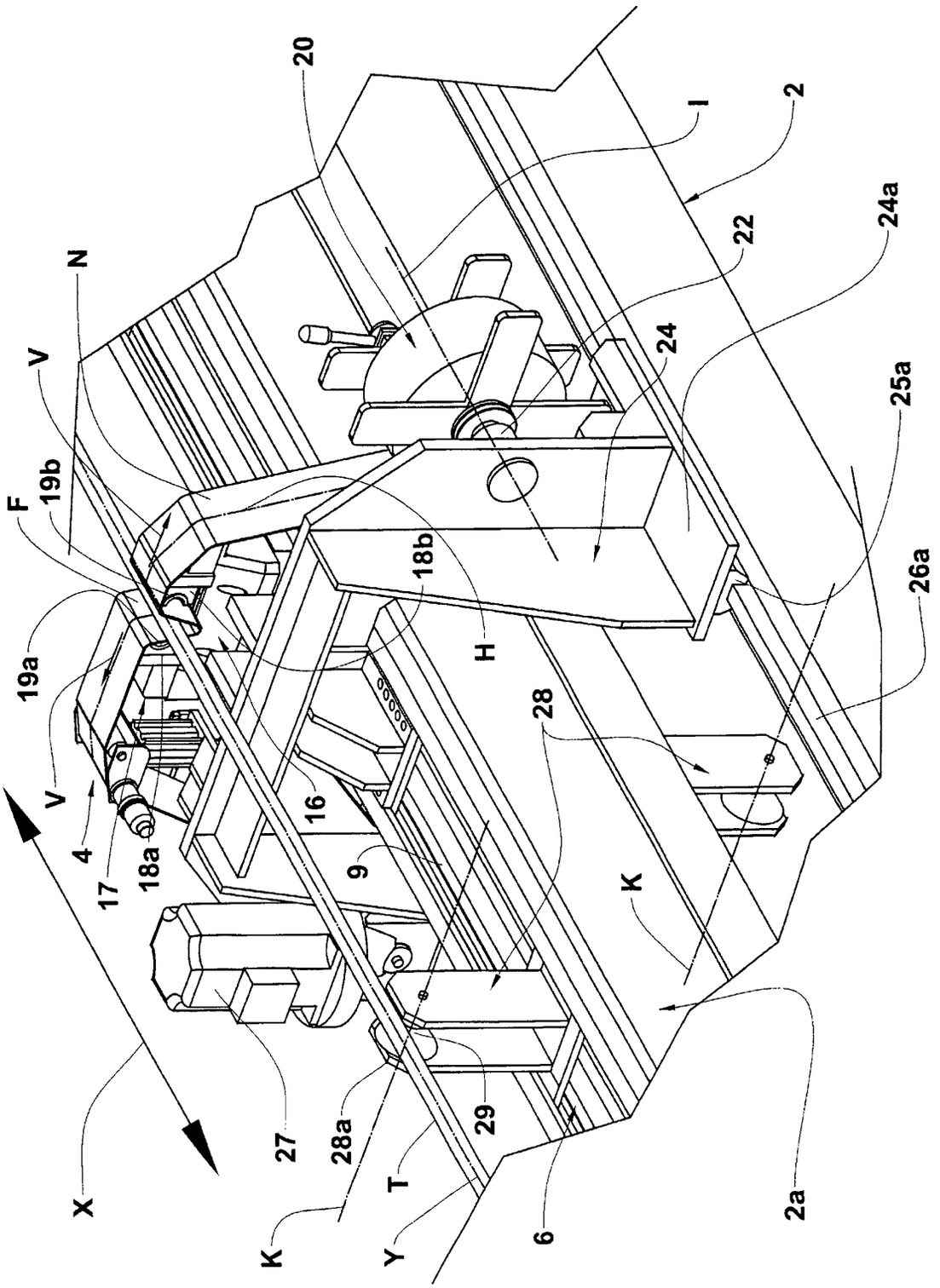


FIG.4


20
I
2
N
22
24a
V
24
25a
F
19b
18b
26a
19a
H
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V
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9
K
17
18a
27
28a
29
T
2a
X
K
Y
6

FIG.5

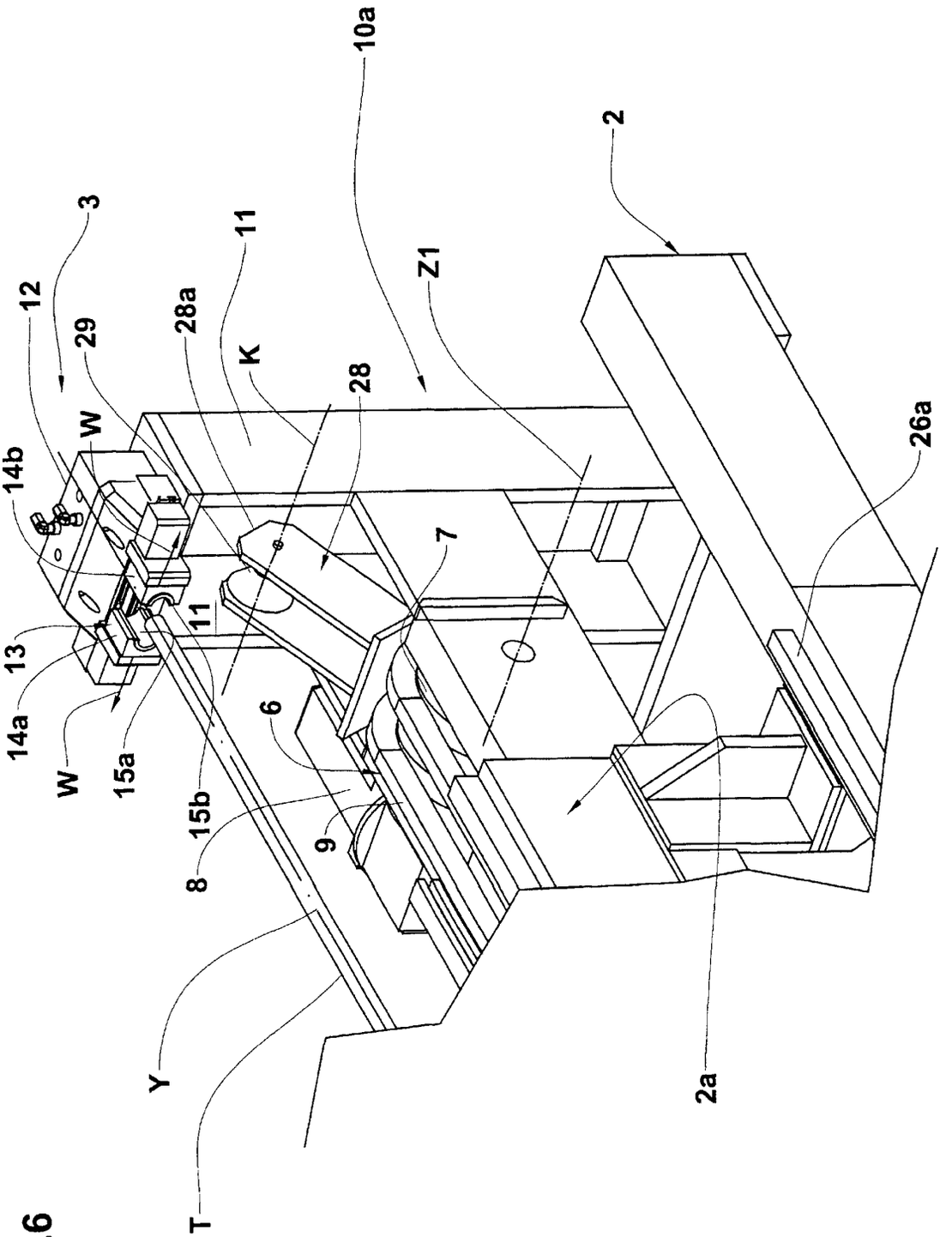

FIG.6

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EUROPEAN SEARCH REPORT

Application Number
EP 02 42 5484

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 January 2003	van der Zee, W

CATEGORY OF CITED DOCUMENTS

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