



(11)

EP 1 618 972 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.01.2006 Bulletin 2006/04

(51) Int Cl.:
B21D 41/04 (2006.01)

(21) Application number: **04425533.9**

(22) Date of filing: **19.07.2004**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
AL HR LT LV MK

(71) Applicant: **FABBRICA MACCHINE CURVATUBI
CRIPPA AGOSTINO S.p.A.
I-22060 Arosio (Como) (IT)**

(72) Inventor: **Crippa, Aurelio
22060 Arosio (Como) (IT)**

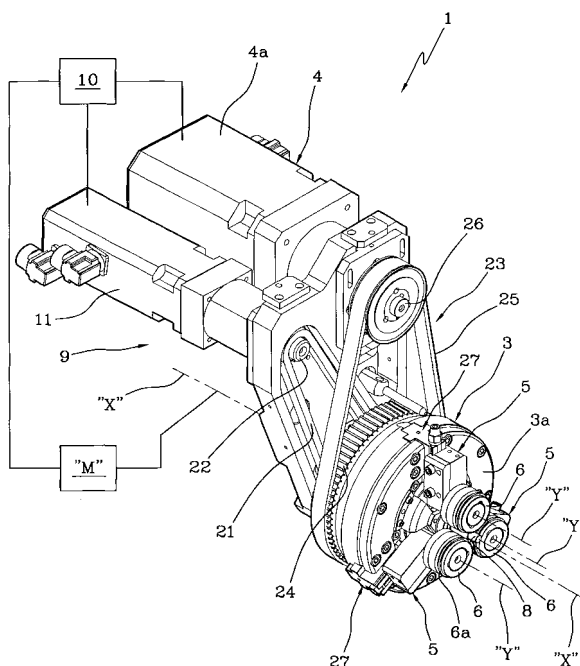
(74) Representative: **Ghioni, Carlo Raoul Maria
c/o BUGNION S.p.A.
Viale Lancetti 17
20158 Milano (IT)**

(54) **Pipe rolling head, machine for shaping pipes comprising said head and control method for said machine**

(57) A pipe-rolling head comprises a body (3) rotating around a respective rolling axis (X); and at least three roll-holders (5) mounted on the rotating body (3), each adapted to receive a respective roll (6); the rolls (6) freely rotate around respective rotation axes (Y) that are substantially parallel to the rolling axis (X); the roll-holders (5) are susceptible of translation relative to the rotating body (3) between an open position at which the rolls (6) lie spaced apart from each other and from the rolling axis (X) and a closed position at which the rolls (6) lie close

to each other in the vicinity of the rolling axis (X), to encompass a pipe (2) to be rolled which is coaxial with the rolling axis (X). The head further comprises a main motor (4a) connected with the rotating body (3) to set said rotating body (3) in rotation, and actuating means (9) to move the roll-holders (5) between the open and closed positions. The head is in addition provided with a control device (10) of the CNC type interlocked with the actuating means (9) for movement of the roll-holders (5) between the open and closed positions, to automatically control closing and opening of the roll-holders (5).

FIG 1



Description

[0001] The present invention relates to a pipe-rolling head, to a machine for shaping pipes comprising said head, and to a control method for said machine.

[0002] In the field of pipe manufacture it is known to submit the pipe ends to cold-deformation operations through the combined action of a punch and a die, to modify the traditional cylindrical and axially uniform cross-section of the pipe, in order to allow connection with other construction elements, such as pipe fittings, sleeves, hoses, etc.

[0003] Rolling is a particular working obtained by cold deformation carried out by means of a head provided with three rolls idly mounted on a rotating support and disposed around a predetermined axis which is coincident with the longitudinal axis of a pipe to be rolled. Each roll has a ridge on its circumferential surface the shape of which matches that of the impression to be formed in the pipe. The end of the pipe clamped by an appropriate vice, is enclosed in the three rolls and only subsequently the rolls are driven in rotation around the longitudinal axis of the pipe through rotation of the rotating support. The roll pressure combined with the rotational motion of the head gives rise to the desired impression in the pipe end.

[0004] In rolling heads of known type, rolls are moved to the closed or open position by a pneumatic system. In particular, as depicted in Fig. 4 showing the longitudinal section of a rolling head of known type, the pneumatic system comprises a thrust element (A) disposed around a rotation shaft (B) of the rolling head and movable in translation along the longitudinal axis (C). The thrust element is moved forward by admitting air under pressure through a duct (D) delimited by the thrust element itself. The thrust element, on the opposite side from the pressurised duct, has a sloping surface (E) on which three wheels (F) rest, each wheel being connected to a respective shaping roll (G). Translation of the thrust element gives rise to rolling of the wheels on the sloping surface and displacement of said wheels and of the rolls connected therewith along respective directions perpendicular to the longitudinal axis. As shown in Fig. 4, moving forward of the thrust element to the right causes approaching of the rolls to the longitudinal axis and closure of said rolls around the pipe, against the action of return springs (H) interposed between the rotation shaft and the wheel-supporting arms (I), while moving backward of the thrust element to the left allows the return springs to move the rolls away from the pipe. To limit the stroke of the rolls towards the pipe, each roll is further provided with a stop of the mechanical type (L) abutting against a spacer (M) mounted in the vicinity of the longitudinal axis. The rolls are mounted in a removable manner on carriages (N) rigidly connected to the arms carrying the wheels, so that the position of each roll in relation to the carriage carrying it can be varied.

[0005] The above described rolling head of known type, as shown in Fig. 4, allows working of the pipe to be

started only after the rolls are closed around the pipe. Therefore, the impression left in the pipe is exclusively determined by the geometry of the side surface of the rolls adopted therein and, possibly, by the greater or smaller approaching of the rolls to the longitudinal axis of the pipe, regulated by the mechanical stop element.

[0006] In addition, disadvantageously, it is necessary to replace the spacer and/or to vary the position of each roll on the respective carriage, depending on the diameter of the pipe to be worked, so as to adapt approaching of the rolls being closed to the pipe sizes and the geometry and dimension features of the impression.

[0007] Finally since the stroke of the rolls is fixed, the position of the rolls relative to the carriages being the same, and the same spacer being adopted - the heads of the known art do not enable rolling operations to be automatically carried out at different depths on a single pipe.

[0008] Under this situation the technical task underlying the present invention is to devise a pipe-rolling head, a machine for pipe shaping comprising said head and a control method for said machine that are able to obviate the mentioned drawbacks.

[0009] In particular it is an aim of the present invention to propose a machine for shaping pipes and a control method for said machine that enable more complicated working operations than those obtainable with the heads of the known art to be carried out.

[0010] It is a further aim of the present invention to devise a pipe-rolling head and a machine for shaping pipes comprising said head enabling rolling operations to be carried out on pipes of different diameters or at different depths on a single pipe, without dismantling and repositioning of head elements being required in order to adapt the roll stroke towards the rolling axis to the type of pipe or of working.

[0011] The technical task mentioned and the aims specified are achieved by a pipe-rolling head having the features set out in one or more of the appended claims 1 to 10, by a machine for pipe shaping comprising said head in accordance with claims 11 or 12 and by a control method for said machine in accordance with claims 13, 14 or 15.

[0012] Description of a preferred but not exclusive embodiment of a pipe-rolling head is now given by way of nonlimiting example and shown in the accompanying drawings, in which:

- Fig. 1 is a perspective view of a pipe-rolling head in accordance with the present invention;
- Fig. 2 is a longitudinal section of a portion of the head shown in Fig. 1;
- Fig. 3 is a diagrammatic cross-sectional view of the head portion of the invention taken along line II-II in Fig. 2; and
- Fig. 4 is a longitudinal section of a rolling head belonging to the known art.

[0013] With reference to Figs. 1, 2 and 3, a pipe-rolling head in accordance with the present invention is denoted by reference numeral 1.

[0014] Head 1 is mounted on a machine designed to shape the ends of pipes. The machine, of known type and therefore not shown or described in detail, comprises suitable means capable of clamping a pipe 2 to be worked, such as a vice. One end of pipe 2 clamped in the vice faces a tool assembly mounted on a base frame of the machine. The tools, among which the rolling head 1, are moved so as to face the vice in sequence, in order to carry out different types of machining operations on the end of pipe 2 through cold deformation and/or material removal.

[0015] Head 1, once it is positioned in front of the vice, is actuated by actuating means "M" of known type and only diagrammatically shown in Fig. 1, along a rolling axis "X". Head 1 carries out a translation between a position at which it is moved close to the vice and a position at which it is spaced apart therefrom, so as to be positioned at an axial portion of the end of pipe 2 designed to be machined.

[0016] Head 1 comprises a rotating body 3 being set in rotation around the rolling axis "X" which is coincident with the longitudinal axis of pipe 2, by dedicated means 4 comprising a main motor 4a connected to the rotating body 3.

[0017] The rotating body 3 externally is of a cylindrical shape the base 3a of which, when head 1 is brought in front of the pipe 2 (Fig. 2) retained by the vice, faces the vice itself.

[0018] Mounted on the rotating body 3 are at least three roll-holders 5 disposed around the rolling axis "X" and each of them being adapted to receive a respective roll 6. Rolls 6 freely rotate around respective rotation axes "Y" substantially parallel to the rolling axis "X".

[0019] In the preferred embodiment shown in Fig. 2, each roll 6 is rotatably coupled, through a ball bearing for example, with a respective stem 7 integral with a roll-holder 5.

[0020] Each roll 6 has one or more raised portions 6a on its circumferential side surface, said raised portions being designed to leave their impression on the pipe 2 to be submitted to rolling. Rolls 6 can be replaced by other rolls having different features depending on the type of impression it is necessary to leave on pipe 2.

[0021] The three roll-holders 5 carry out a translation relative to the rotating body 3 between an open position at which rolls 6 lie spaced apart from each other and from the rolling axis "X" and a closed position at which rolls 6 lie close to each other in the vicinity of the rolling axis "X" to encompass the pipe 2 to be rolled.

[0022] A pin 8 is installed in a removable manner on the rotating body 3 and extends along the rolling axis "X", which is coincident with the longitudinal axis of the rotating body 3, between rolls 6. The radial sizes of pin 8 are adapted to enable housing of same into the pipe 2 to be machined, so as to perform the function of counteracting

the pressure exerted by rollers 6. Pin 8 too can be replaced and it is selected based on the inner sizes of pipe 2.

[0023] Actuating means 9 moves the roll-holders 5 between the open and closed positions.

[0024] Advantageously and unlike the heads of the known art, head 1 being the object of the invention further comprises a control device 10 of the CNC (an acronym meaning Computerised Numerical Control) type, diagrammatically shown in Fig. 1 and interlocked with the actuating means 9 to move the roll-holders 5 between the open and closed positions so as to automatically control opening and closing of said roll-holders 5.

[0025] In particular, the roll-holder actuating means 9 comprises an auxiliary motor 11 and a mechanical member 12 connected to the auxiliary motor 11 and the roll-holders 5 to transmit the motion imparted by motor 11 to the roll-holders 5. The CNC control device 10 is connected to the auxiliary motor 11.

[0026] Preferably and advantageously, the CNC control device 10 is further connected to the main motor 4a to also control rotation of the rotating body 3 and of the means "M" for actuating head 1.

[0027] The control carried out by the CNC device 10 enables the head actuating means "M", the auxiliary motor 11 and main motor 4a to be suitably controlled and the movements of head 1 and rolls 6 to be combined, in order to obtain particular types of machining as described in the following.

[0028] In addition, advantageously and unlike the heads of the known art, the mechanical member 12 connected to the auxiliary motor 11 and the roll-holders 5 comprises at least one ball-bearing actuator 13 (Fig. 2).

[0029] In the embodiment shown in the accompanying drawings, the ball-bearing actuator 13 has a single lead screw 14 coaxial with the rolling axis "X" and a lead screw nut 15 rotatably engaged on the lead screw 14. The lead screw 14 is prevented from rotating, is movable in translation along the rolling axis "X" and is kinematically connected to the roll-holders 5.

[0030] The auxiliary motor 11 (Fig. 1) connected to the lead screw nut 15 drives the lead screw nut 15 in rotation and causes translation of screw 14.

[0031] The mechanical member 12 connected to the auxiliary motor 11 and the roll-holders 5 further comprises a motion-transmitting member 16 installed close to a first end 14a of the lead screw 14 and coupled with the roll-holders 5 to convert translation of the lead screw 14 along the rolling axis "X" into a movement of the roll-holders 5 between the open and closed positions (Fig. 2).

[0032] In more detail in terms of construction and referring particularly to Fig. 2, head 1 has a casing 17 inside which the lead screw nut 15 is rotatably housed, being supported by roller and/or ball bearings 18. The casing 17 does not rotate but carries out a translation relative to the base frame of the machine moved by the above mentioned actuating means "M" to take a position close to the axial portion of the end of pipe 2 designed to be

machined.

[0033] The rotating body 3 is rotatably coupled, through respective bearings 19 of the roller type for example, with the casing 17, and the lead screw 14 carries out a translation movement both in the casing 17 and in the rotating body 3.

[0034] The lead screw nut 15 on its outer circumferential surface has a toothing 20 in which a flexible transmission element 21, preferably a chain trained around a shaft 22 of the auxiliary motor 11, is engaged to transmit motion from the auxiliary motor 11 to the lead screw nut 15 (Figs. 1 and 3).

[0035] In a quite similar manner, a transmission 23 interposed between the main motor 4a and the rotating body 3 allows motion to be transmitted from said main motor 4a to said rotating body 3. For the purpose, the rotating body 3 is provided with a toothing 24 around which a flexible element 25 is partly wrapped, a toothed belt for example, also passing over a shaft 26 of the main motor 4a.

[0036] The motion-transmitting member 16 comprises a support element 27 for each of the roll-holders 5 which is mounted on the rotating body 3 and is movable along a respective direction "Z" orthogonal to the rolling axis "X". In particular, each support element 27 is slidably inserted in a groove 28 having a radial extension and formed in the rotating body 3 (Figs. 1 and 3). As shown in Fig. 3, grooves 28 are spaced apart the same distance from each other through an angle of 120° and open on base 3a of the rotating body 3 to enable each support element 27 to carry the respective roll-holder 5 in cantilevered fashion (Fig. 1).

[0037] The motion-transmitting member 16 further comprises a coupling element 29 mounted on the first end 14a of the lead screw 14 within the rotating body 3. The motion-transmitting member 16 is slidably associated with the support element 27 along a respective sloping surface 30 inclined relative to the rolling axis "X". In the embodiment shown, the sloping surfaces 30 converge towards the rolling axis "X" and towards each other moving away from the first end 14a of the lead screw 14.

[0038] In addition, the coupling element 29 is rotatably mounted on the lead screw 14 and rotates together with the rotating body 3.

[0039] In more detail, the coupling element 29 comprises a cylindrical body 31 coaxial with the lead screw 14 (Fig. 3) and coupled therewith by means of bearings 32 (Fig. 2). The cylindrical body 31 has at least three slits 33 formed at a side surface thereof, which slits 33 extend over the whole height of the cylindrical body 31 along a direction substantially parallel to the rolling axis "X". Each slit 33 further has a varying depth to define a respective sloping surface 30, and slidably receives a respective support element 27 extending along a radial direction relative to the rolling axis "X".

[0040] Each slit 33 is such shaped as to be able to exert both a thrust action away from the rolling axis "X" and a pulling action close to the same axis "X", on the

support element 27.

[0041] For the purpose, in accordance with the preferred but not exclusive embodiment shown in Fig. 3, each slit 33 has, seen in cross-section relative to the rolling axis "X", a T-shaped conformation, in which the upper horizontal segment of the "T" faces the rolling axis "X". The sloping surface 30 of each slit 33 is therefore formed of the bottom surface 30a of the slit 33 itself and of two auxiliary surfaces 30b of said slit 33 facing the bottom surface 30a.

[0042] In addition, each support element 27 has an end 27a the shape of which matches that of the slit 33 and which is housed in the slit 33 itself.

[0043] The cylindrical body 31 is installed in a hollow space 3b formed in the rotating body 3 the size of which, parallel to the rolling axis "X", is bigger than the axial size of the cylindrical body 31, to enable translation of the cylindrical body 31 itself together with the lead screw 14.

[0044] In use, with reference to the embodiment shown, head 1 is moved forward by the actuating means "M" of the machine towards pipe 2 to be rolled which is clamped by the vice and the rolling axis "X" of which is coincident with the longitudinal axis of pipe 2 and of the roll-holders 5 in the open position.

[0045] In the open position, the lead screw 14 lies in a backward position at which the first end 14a of said screw and the cylindrical body 31 are axially spaced apart from the roll-holders 5. With reference to the section view of the head in Fig. 2, the backward position corresponds to displacement to the left of screw 14.

[0046] Moving forward of head 1 leads rolls 6 to arrange themselves around the end of pipe 2, with the pin 8 inserted in pipe 2.

[0047] Due to the control carried out by the CNC control device 10 on the auxiliary motor 11, the main motor 4a and the actuating means "M", it is possible to combine or interpolate the movements of head 1 as a whole and of rolls 6 relative to head 1 to carry out particular working operations on pipe 2.

[0048] In fact, in accordance with a first alternative embodiment of the control method of the machine being the object of the invention, during moving forward of head 1 towards pipe 2 the auxiliary motor 11 driven by the CNC control device 10, causes rotation of the lead screw nut 15 in a predetermined direction, so as to make the lead screw 14 and the cylindrical body 31 move forward towards the roll-holders 5 (to the right in Fig. 2).

[0049] Moving forward of the cylindrical body 31 causes the ends 27a of the support elements 27 housed in slits 33 to slide relative to the cylindrical body 31 itself, and makes the support elements 27, that are slidable in the respective grooves 28, approach the rolling axis "X". The radial translation of the support elements 27 towards the rolling axis "X" results from the pulling action exerted by the auxiliary surfaces 30b on the ends 27a of the support elements 27 themselves (Fig. 3). Approaching of rolls 6 to the rolling axis "X", and therefore the closure degree, is a function of the number of revolutions of the

lead screw nut 15.

[0050] When closure of rolls 6 is completed, the main motor 4a drives the rotating body 3 in rotation to enable rolls 6 to roll on pipe 2 and leave their impression on the outer surface of the pipe 2 itself.

[0051] Since closure of rolls 6 on pipe 2 is carried out simultaneously with moving forward of head 1, the closed position is reached more quickly and starting of rotation of the rotating body 3 takes place in a shorter period of time, as compared with the known art in which a pneumatic head was used and where, due to lack of control on the position of the rolls, a combined movement could not be carried out without the risk of the rolls being closed on a wrong point of pipe 2.

[0052] Alternatively, the control through a CNC device advantageously allows rolls 6 to be closed on pipe 2 and the rotating body 3 to rotate while the head 1 is still moving forward, thereby combining the three movements during the working process to carry out a dynamic shaping of the end of pipe 2.

[0053] Therefore, the shape of pipe 2 is not only a function of the geometry of the side surface of the rolls 6 therein adopted, but is also a function of the combination/interpolation of the movements of head 1, of rolls 6 and of the rotating body 3 controlled by the programmable control device 10 of the CNC type.

[0054] The head 1 being the object of the invention is in any case able to perform the same steps in succession as the pneumatic head of known type, i.e. to first move forward head 1 to cause arrangement of rolls 6 around the end of pipe 2, to subsequently close rolls 6 on pipe 2 and to ultimately start rotation of the rotating body 3 to carry out a traditional rolling.

[0055] At all events, when working is over, the auxiliary motor 11 rotates the lead screw nut 15 in the opposite way and moves the lead screw 14 and the cylindrical body 31 backwards (to the left in Fig. 2). The backward movement of the cylindrical body 31 makes the support elements 27 move away from the rolling axis "X". The radial translation of the support elements 27 away from the rolling axis "X" is caused by the thrust action exerted by the bottom surface 30a of groove 33 on the ends 27a of the support elements 27 themselves (Fig. 3).

[0056] The invention achieves important advantages.

[0057] It is to be pointed out first of all that with the rolling head in accordance with the present invention, rolling operations on pipes of different diameters or rolling operations with different impression depths on the same pipes can be carried out, without dismantling and repositioning of head elements being required, to adapt the stroke of rolls 6 towards the rolling axis to the type of pipe or of working. In fact, the radial displacement of the rolls is fully controlled by the CNC device.

[0058] In addition, the machine for shaping pipes in accordance with the present invention enables more complicated working operations to be carried out as compared with those obtainable with the rolling heads of the known art, due to the possibility of combining and con-

trolling all movements of the head and the rolls.

[0059] Finally, by virtue of the CNC control, the head of the invention is able to carry out rolling with very narrow tolerances, which is presently more and more required by users of shaped pipes.

Claims

1. A pipe-rolling head, comprising:

- a body (3) rotating about a respective rolling axis (X) ;
- at least three roll-holders (5) mounted on the rotating body (3), and each adapted to receive a respective roll (6), the rolls (6) being freely rotatable about respective rotation axes (Y) that are substantially parallel to the rolling axis (X); said at least three roll-holders (5) being susceptible of translation relative to the rotating body (3) between an open position at which the rolls (6) lie spaced apart from each other and from the rolling axis (X), and a closed position at which the rolls (6) lie close to each other in the vicinity of the rolling axis (X), to encompass a pipe (2) to be rolled which is coaxial with said rolling axis (X);
- a main motor (4a) connected with the rotating body (3) to set said rotating body (3) in rotation; and
- means (9) for actuating the roll-holders (5) between the open position and closed position;

characterised in that it further comprises a control device of the CNC type (10) interlocked with the means (9) for actuating the roll-holders (5) between the open and closed positions, to automatically control closure and opening of said roll-holders (5).

2. A head as claimed in claim 1, **characterised in that** the means (9) for actuating the roll-holders (5) comprises an auxiliary motor (11), and a mechanical member (12) connected to the auxiliary motor (11) and the roll-holders (5) to transmit the motion imparted by the auxiliary motor (11) to the roll-holders (5); the CNC control device (10) being connected to said auxiliary motor (11).

3. A head as claimed in claim 1, **characterised in that** the CNC control device (10) is further connected with the main motor (4a) to also control rotation of the rotating body (3).

4. A head as claimed in claim 1, **characterised in that** the mechanical member (12) connected to the auxiliary motor (11) and the roll-holders (5) comprises at least one ball-bearing actuator (13).

5. A head as claimed in claim 4, **characterised in that** the ball-bearing actuator (13) has a lead screw (14) coaxial with the rolling axis (X) and connected to the roll-holders (5) and a lead screw nut (15) rotatably engaged on the lead screw (14) and connected to the auxiliary motor (11).
6. A head as claimed in claim 5, **characterised in that** the lead screw (14) is prevented from rotating; and **in that** the lead screw nut (15) is movable in rotation on the lead screw (14) to cause translation of said lead screw (14) along the rolling axis (X).
7. A head as claimed in claim 6, **characterised in that** the mechanical member (12) further comprises a motion-transmitting member (16) installed at a first end (14a) of said lead screw (14) and coupled with the roll-holders (5) to convert translation of the lead screw (14) along the rolling axis (X) into a movement of the roll-holders (5) between the open and closed positions.
8. A head as claimed in claim 7, **characterised in that** the motion-transmitting member (16) has a support element (27) for each of said roll-holders (5) that is mounted on the rotating body (3) and is susceptible of translation along a respective direction (Z) orthogonal to the rolling axis (X); and a coupling element (29) mounted on the first end (14a) of the lead screw (14) and slidably associated with the support element (27) along a respective sloping surface (30) that is inclined relative to the rolling axis (X).
9. A head as claimed in anyone of claims 5 to 8, **characterised in that** it further comprises a flexible transmission element (21) passing over a shaft (22) of the auxiliary motor (11) and the lead screw nut (15) to transmit motion from the auxiliary motor (11) to the lead screw nut (15).
10. A head as claimed in claim 1, **characterised in that** it further comprises a flexible element (25) passing over a shaft (26) of the main motor (4a) and the rotating body (3), to transmit motion from the main motor (4a) to the rotating body (3).
11. A machine for shaping pipes, comprising:
- means for clamping a pipe (2) to be shaped;
 - at least one head (1) for pipe (2) rolling;
 - means (M) for actuating said at least one head (1) between a position close to the pipe-clamping means and a position away from said means, so as to be positioned at an axial portion of the pipe (2) end designed to be worked;

characterised in that said at least one pipe-rolling head (1) is made in accordance with at least one of

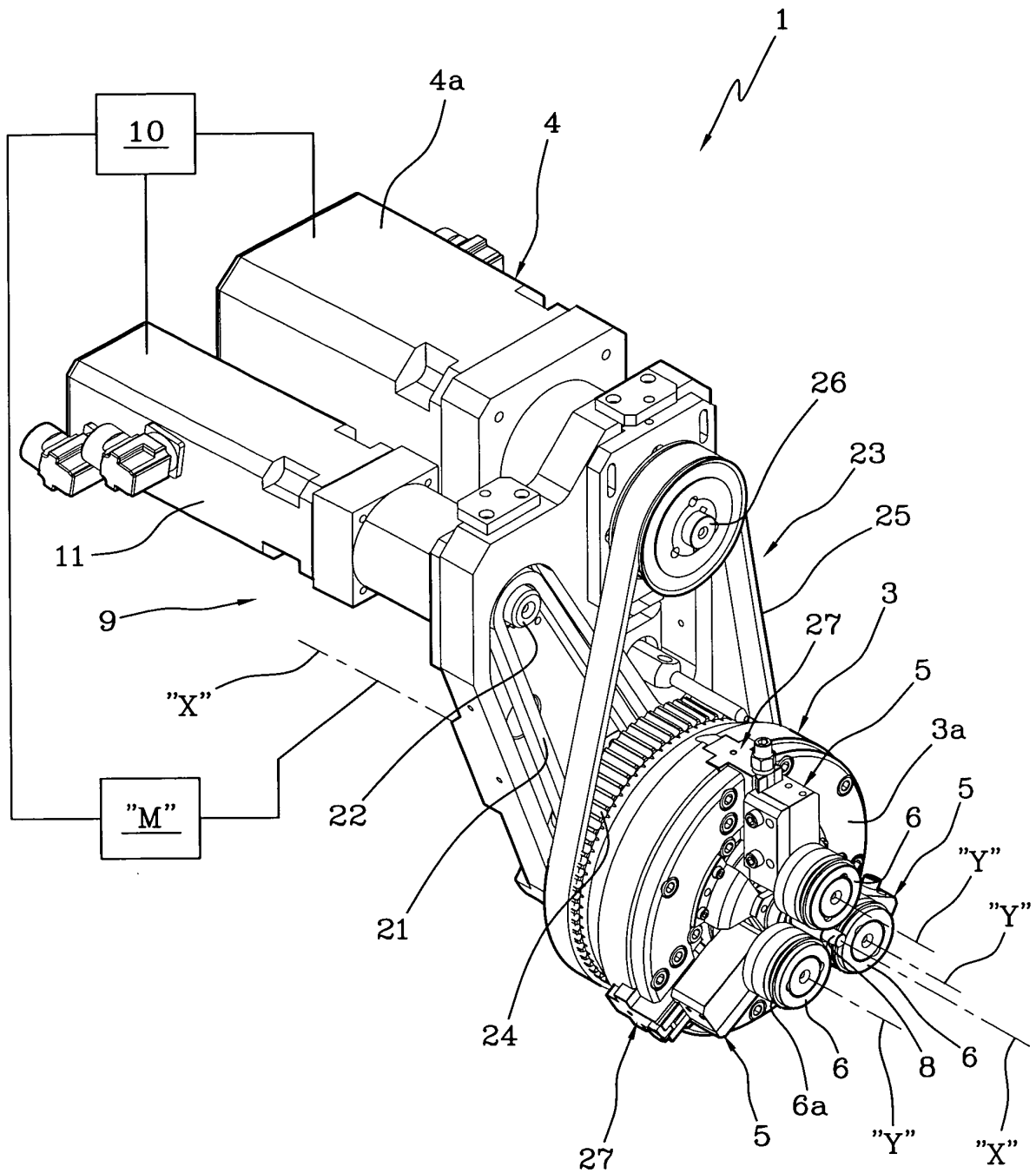
claims 1 to 10.

12. A machine as claimed in the preceding claim when depending on claim 2, **characterised in that** the CNC control device (10) is further connected with the means (M) for actuating said at least one head (1), so as to control, in synchronism with said means (M) for actuating said at least one head (1), the auxiliary motor (11) and the main motor (4a) and combine the movements of the head (1) and the rolls (6).
13. A control method for a pipe-shaping machine, comprising the steps of:
- clamping a pipe (2) on clamping means;
 - actuating a pipe-rolling head (1) made in accordance with at least one of claims 1 to 10, from a position away from the clamping means to a position close to said clamping means, so as to position the rolling rolls (6) of the head (1) around an axial portion of the pipe (2) end designed to be worked;
 - causing translation of the rolls (6) from an open position, at which the rolls (6) lie spaced apart from each other and from the pipe (2), to a closed position at which the rolls (6) lie close to each other in the vicinity of a rolling axis (X) and encompass the pipe (2) to be rolled;
 - rotating a rotating body (3) belonging to the rolling head (1) and supporting the rolls (6), around the rolling axis (X);

characterised in that the steps of actuating the head (1), causing translation of the rolls (6) and rotating the rotating body (3) are carried out at least partly simultaneously, being controlled by a CNC control device (10).

14. A method as claimed in claim 13, **characterised in that** the steps of actuating the head (1) and causing translation of the rolls (6) are carried out simultaneously, to speed up engagement of the head (1) on the pipe (2), and **in that** the step of rotating the rotating body (3) is carried out subsequently.
15. A method as claimed in claim 13, **characterised in that** the steps of actuating the head (1), causing translation of the rolls (6) and rotating the rotating body (3) are carried out simultaneously, and **in that** working of the pipe (2) is obtained through the combination of said three steps.

FIG 1



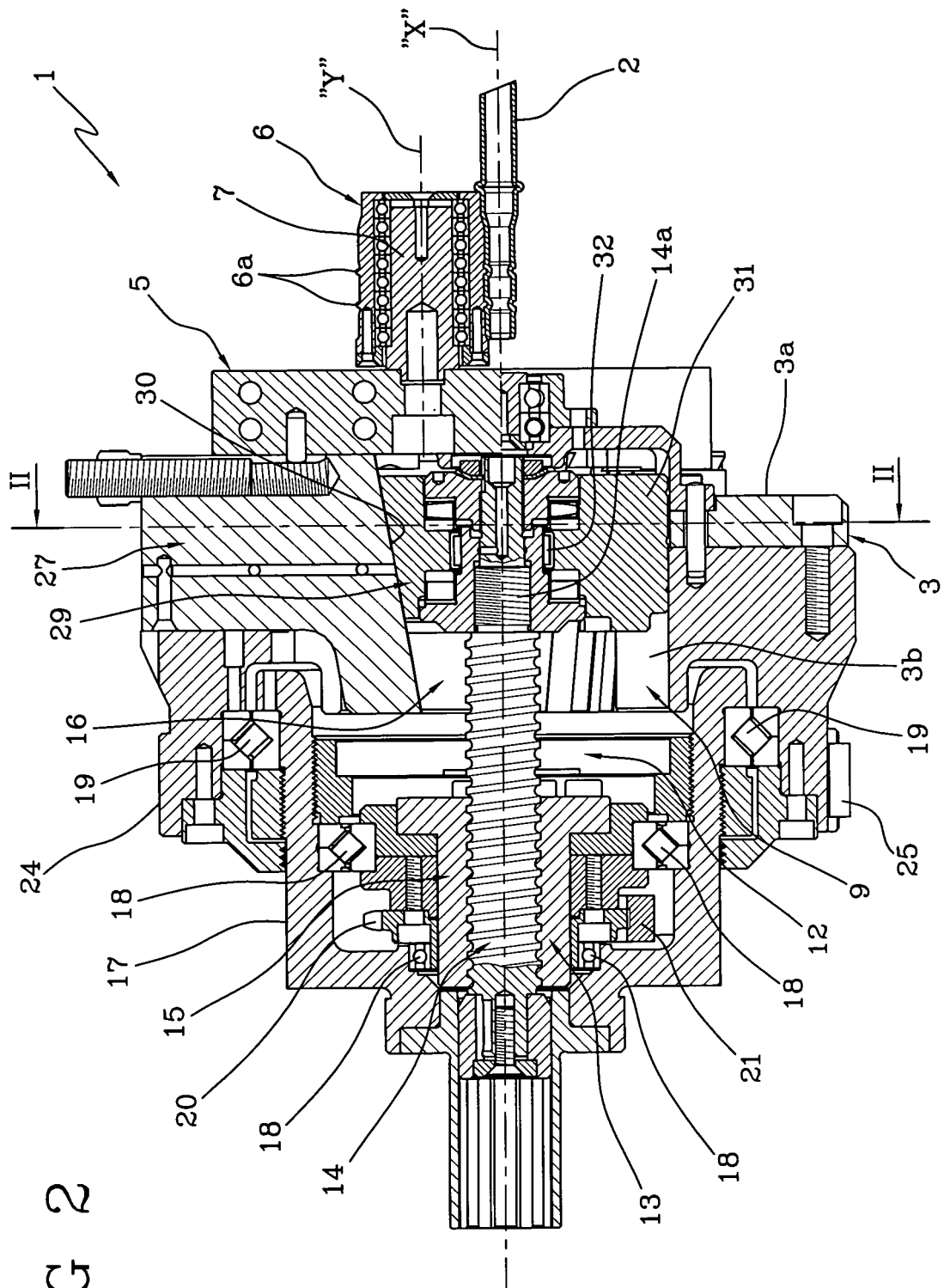


FIG 2

FIG 3

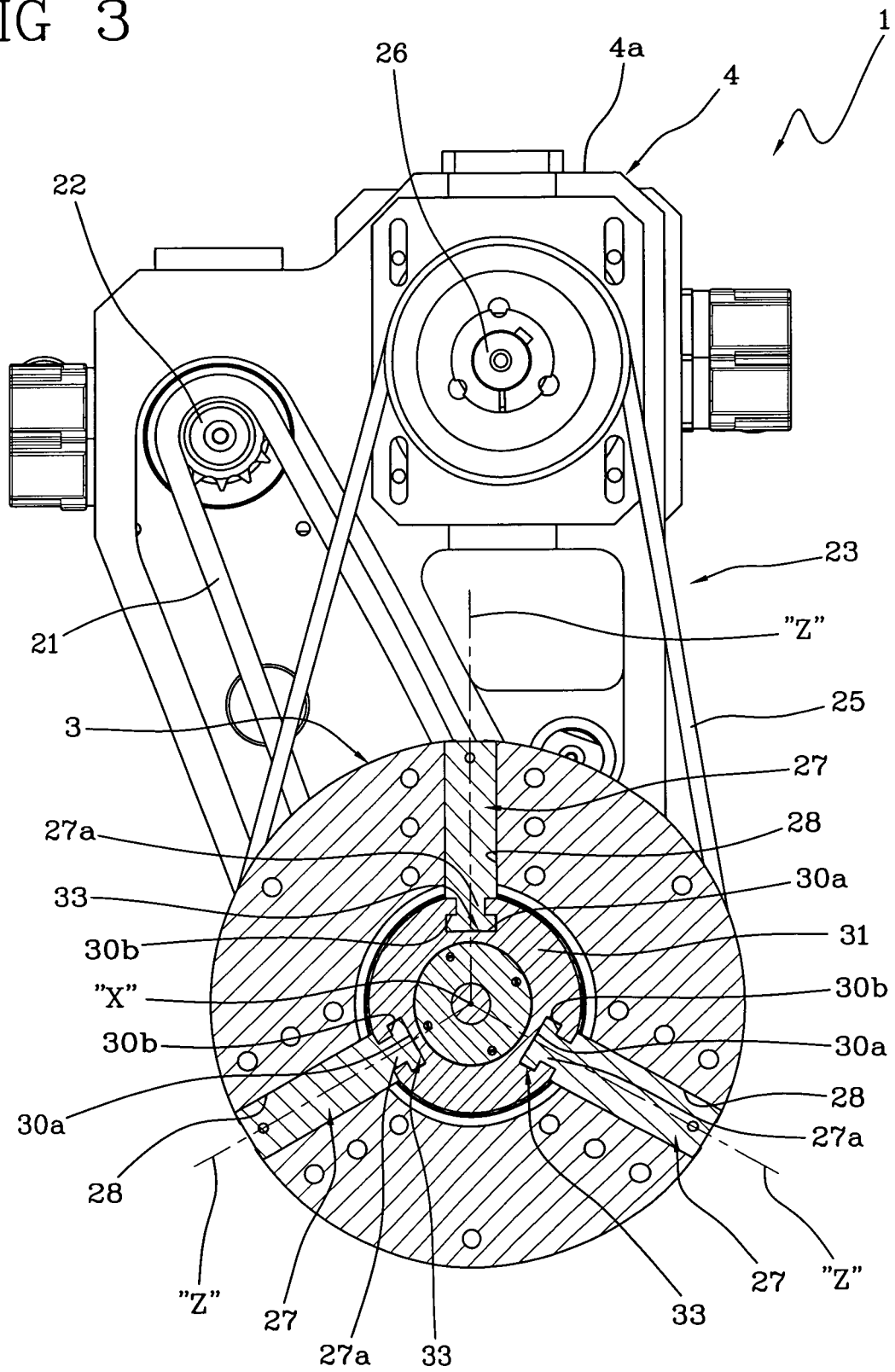
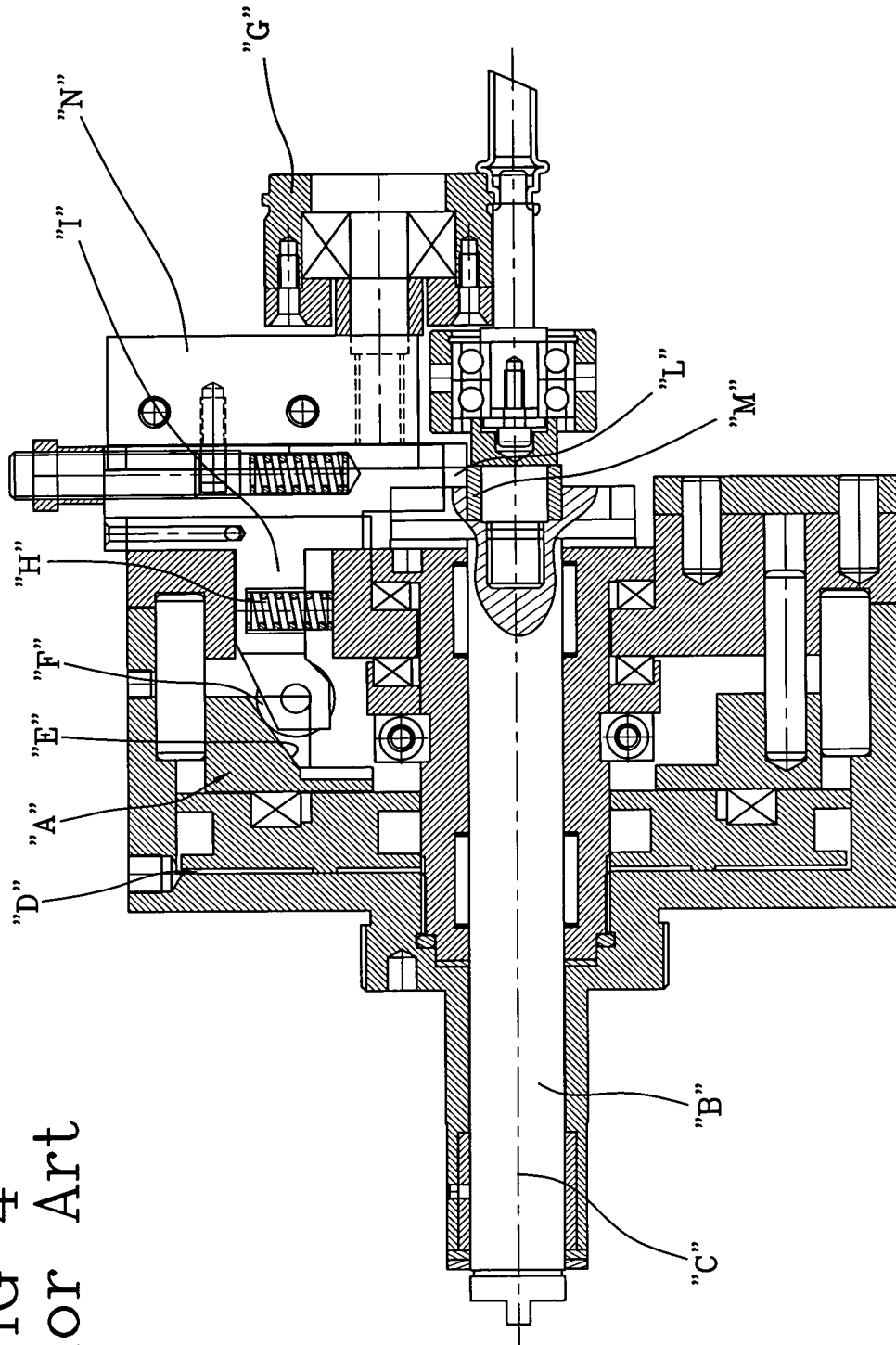


FIG 4
Prior Art





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 42 5533

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X A	US 6 216 512 B1 (IRIE TOHRU) 17 April 2001 (2001-04-17) * column 6, line 10 - column 7, line 18; figures 1-4 *	1-4, 10-15 5-8	B21D41/04
X A	----- US 6 233 993 B1 (IRIE TOHRU) 22 May 2001 (2001-05-22) * column 5, line 30 - column 6, line 65; figures 1,2,4 *	1-3, 10-15 4-7	
X	----- PATENT ABSTRACTS OF JAPAN vol. 2000, no. 10, 17 November 2000 (2000-11-17) -& JP 2000 190031 A (TOYOTA MOTOR CORP), 11 July 2000 (2000-07-11) * abstract; figures 1,3 *	1-7,9-15	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B21D B23D B21H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 8 December 2004	Examiner Meritano, L
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

1
EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 42 5533

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-12-2004

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 6216512	B1	17-04-2001	JP	2957154 B2		04-10-1999
			JP	11151535 A		08-06-1999
			DE	69814305 D1		12-06-2003
			DE	69814305 T2		25-03-2004
			EP	0916428 A2		19-05-1999
			US	6067833 A		30-05-2000

US 6233993	B1	22-05-2001	AT	251513 T		15-10-2003
			DE	60005741 D1		13-11-2003
			DE	60005741 T2		19-08-2004
			EP	1053799 A2		22-11-2000
			ES	2203371 T3		16-04-2004
			JP	3390725 B2		31-03-2003
			JP	2001025826 A		30-01-2001
			TW	454081 B		11-09-2001

JP 2000190031	A	11-07-2000	JP	3546937 B2		28-07-2004
