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(54) **ENHANCED BENDING MACHINE**
VERBESSERTE BIEGEMASCHINE
MACHINE DE PLIAGE AMÉLIORÉE

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Description

[0001] The present invention refers to an enhanced bending machine.

[0002] More specifically, the present invention refers to an enhanced manually-operated or electrically-operated bending machine, and, even more specifically, it refers to a bending machine of a three-shaft type.

[0003] As is known, pipe bending or rounding aims at realizing well determined forms and/or patterns for a pipe (for instance, in the case of pipes used in heat exchangers or the like) or, also, at imparting greater strength to a tubular structure.

[0004] A tubular element bending or rounding process can be implemented by using either manually-operated bending machines or electrically-operated/motorized bending machines.

[0005] The bending machines typically known on the market and which reference will be made to in the present invention consist of so-called "three-driving-roller" bending machines, said grooved or race rollers being mounted on an equal number of shafts substantially arranged in a triangle or delta (Δ) configuration so as to define a passage for the profile to be bent/rounded that goes through said rollers and engages the grooves or races of said rollers which co-operate in defining a matrix-countermatrix system for the through-passing profile, which is progressively bent thanks to the pressure exerted thereon.

[0006] The traditional bending machines of the type mentioned above, if of the electrically-operated/motorized types, are characterized in having a greater power with respect to the manually-operated ones and allow to save workforce. However, because of the greater number of component parts, they tend to be rather bulky and expensive and, consequently, not to be in line with the needs and resources of users whose production is not a large scale one.

[0007] As a matter of fact, in electrically-operated/motorized bending machines, which possibly include two or three driving rollers, the rollers are driven by way of reducers or electric motors directly mounted on the shafts or, even, by way of electric motors in combination with actuators of an oil-pressure type.

[0008] The manually-operated bending machines don't have the drawbacks considered above when speaking about electrically-operated/motorized bending machines.

[0009] However, they are rather bulky, even though not so bulky as automatically-operated bending machines, because of the transmission systems used to transmit motion to the bending rollers.

[0010] Also, the traditional three-roller bending machines make it difficult to realize very short bending radii because, especially in the case of very thin pipes and profiles, they don't allow to minimize the deformations taking place in the pipes during the bending step due to the pressure exerted onto the pipe being enclosed between the movable roller and the fixed rollers.

[0011] A further drawback experienced in traditional three-roller bending machines and, in particular, in the manually-operated ones, is in that two or all three rollers thereof perform a driving function and, in the case of three driving rollers, it is complex to be able to adjust the position of the third roller in such a way that it is driving in any adjustment positions without having problems related to pipe slippages during the bending step.

[0012] An example of a traditional bending machine is described in document JP60-108119, on which the preamble of independent claim 1 is based, which makes reference to a pipe bending machine comprising three bending rollers, a first roller of which is driven into rotation by way of an electric motor which transmits rotational motion to said one first roller by way of a pulley transmission (first pulley) which drives a gear transmission, the remaining two rollers being driven into rotation by way of the second pulley which drives a second roller into rotation, said further pulley receiving motion from the rotational motion of the shaft of the first roller, the third roller being driven into rotation by a third pulley, which receives motion from the second pulley and from a gear system.

[0013] An object of the present invention is to obviate the above-mentioned drawbacks.

[0014] More specifically, an object of the present invention is to provide an enhanced bending machine of a manually-operated or electrically-operated three-shaft type, all three shafts being driving, and such as to allow to permanently have a constant pressure on the pipe or profile during the bending step without any slippages thereof.

[0015] A further object of the present invention is to provide a bending machine that allows an easy adjustment of the position of the third shaft in order to make it permanently driver in any adjustment positions without causing variations in the pressure exerted onto the pipe or profile to be bent.

[0016] A further object of the present invention is to provide a three-driving-shafts bending machine featuring reduced space occupation and such as to allow an easy transportation thereof.

[0017] A further object of the present invention is to put at users' disposal an enhanced, manually-operated or electrically-operated bending machine suitable for providing high strength and reliability over time and also such as to be implemented in an easy and cost-effective manner.

[0018] These objects and others are achieved by the invention that has the characteristics according to claim 1.

[0019] According to the invention, an enhanced bending machine is provided suitable for performing bending operations in accordance with well determined forms and/or patterns for a tubular element or profile, comprising a framework which supports and accommodates the working members suitable for bending a pipe or profile, driving and moving members for driving and moving said working members, and adjustment members for adjust-

ing the working members, the working members comprising three operating rollers or pulleys supported by their respective shafts, one shaft being movable, hence capable of getting closer to/moving away from the fixed-position shafts, the bending machine being characterized in that all three output shafts supporting the operating rollers or pulleys are driven by way of the same driving member.

[0020] Advantageous embodiments of the invention are apparent from the dependent claims.

[0021] The constructional and functional characteristics of the enhanced manually-operated or electrically-operated bending machine according to the invention can be better understood from the following detailed description, wherein reference is made to the attached drawings, which illustrate one embodiment given for explanatory, non-limitative purposes only, and wherein:

figure 1 schematically shows a top view of an enhanced bending machine according to the invention;
figure 1A schematically shows a side view of the bending machine according to the invention;
figure 2 schematically shows a partially cross-sectional top view of one portion (the framework) of a bending machine according to the invention;
figure 3 schematically shows a cross-sectional view of a bending machine according to plane B-B in figure 2,
figure 4 schematically shows a cross-sectional view of a bending machine according to plane A-A in figure 2;
figure 5 schematically shows a top view of a bending machine according to the invention during the pipe or profile bending step;
figure 6 schematically shows a side view of the bending machine depicted in figure 5.

[0022] With reference to the mentioned figures, an enhanced bending machine according to the present invention, indicated by the reference numeral 10 as a whole, comprises a framework 12, which supports and accommodates the working members suitable for bending a tubular element or profile 13, driving and moving members for driving and moving said working members, and adjustment members for adjusting said working members.

[0023] The working members comprise three operating rollers or pulleys, namely one movable roller 14 and two fixed rollers 14' and 14'', arranged in a triangle or delta "Δ" configuration, stabilized externally to the framework 12, by way of a key connection, by interference, or another known mode, on their respective output shafts 16, 16', and 16'', of which the output shaft 16 is mounted on the framework 12 so as to be movable and be capable of getting closer to/moving away from the output shafts 16' and 16'' which, on the contrary, are mounted fixed with respect to the framework, said shafts also having axes of rotation parallel to each other.

[0024] The operating rollers or pulleys 14, 14', and 14'' are each provided with a circumferentially developed groove or race 15, the shape of which corresponds to the diameter and/or geometry of the tubular element or profile to be bent.

[0025] The output shaft 16 is movable, hence capable of getting closer to/moving away from the output shafts 16' and 16'' by way of the working member adjustment means, said adjusting means comprising a guide 18 slidable with respect to the framework 12.

[0026] On the framework 12, externally thereto and on the same side with respect to which the operating rollers or pulleys are arranged, there is stabilized a pair of opposing side rollers 20 spaced away from each other in such a way that the operating rollers or pulleys are positioned in the region interposed between said side rollers.

[0027] Said side rollers 20 feature an axis of rotation perpendicular to the axis of rotation of the operating rollers or pulleys and are rotationally arranged idle with respect to the support elements 22, whose inclination in a plane perpendicular to the axes of rotation of the operating rollers or pulleys can be adjusted by way of an adjustment ring nut 23, which each individual support element is provided with.

[0028] Internally to the framework 12 there is arranged a rotatably supported, worm-toothed shaft 26, the axis of rotation of which is perpendicular to that of the shafts of the operating rollers or pulleys by way of bearings 27 or equivalently known rotational support elements.

[0029] The function of said worm-toothed shaft 26 is, as better described below, to allow for a simultaneous rotational driving of the operating rollers or pulleys, namely the movable one 14 and the fixed ones 14' and 14'', so as to bend tubular elements or profiles.

[0030] The movement of the guide 18 and, consequently, of the output shaft 16 which supports the operating roller or pulley 14, i.e. the movable roller, with respect to the fixed rollers 14' and 14'' is performed manually by way of an adjustment knob or handwheel 30 (an adjustment vernier) which allows for an accurate and micrometric adjustment (along a graduated scale 18') of the position of the guide 18 between a maximum separation position with respect to the fixed rollers or pulleys 14' and 14'' (position A) and a minimum separation position from the mentioned rollers (position B) so as to define a displacement indicated by "X" in figure 2.

[0031] The rotation of the operating roller or pulley 14 takes place by way of a toothed wheel 32 which meshes the worm-toothed shaft 26 (in any positions determined by adjusting the guide 18), said toothed wheel being secured to the movable shaft 16; the same toothed wheel 32 forces the movable output shaft 16 to rotate with respect to its own axis as described below in details.

[0032] The rotation of the output shafts 16' and 16'', which are fixed with respect to their own axes and, consequently, of the operating rollers or pulleys 14' and 14'' takes place by way of a transmission 34, which comprises

a transmission shaft 36, a first toothed transmission wheel 38 put in said transmission shaft and mesh-coupled with the worm-toothed shaft 26, a second toothed transmission wheel 39 which is coupled with a first gear-roller 40 and with a second gear-roller 42 secured onto the fixed output shaft 16' and output shaft 16'' respectively.

[0033] The driving of the transmission 34 and, consequently, the rotation of the output shafts 16' and 16'' takes place by way of a further handwheel or handle 46 arranged on the opposite side with respect to the knob or handwheel 30 and secured to the worm-toothed shaft 26.

[0034] The worm-toothed shaft 26 and the transmission 34 make up the member that drives the bending machine according to the invention which, owing to its own rotation, allows to simultaneously and synchronously move the movable output shaft 16 counterclockwise, in a direct manner, and the fixed shafts 16' and 16'' clockwise, in an indirect manner, by way of the transmission 34.

[0035] The operation of the enhanced bending machine, as described in details above with respect to its constructional characteristics, is described below.

[0036] A tubular element 13 to be bent is loaded onto the bending machine and arranged between the operating rollers or pulleys 14, 14', and 14'', as shown in figure 1, the outer surface of said tubular element coupling with the grooves or races 15 of the mentioned operating rollers or pulleys and is also being in contact with the surfaces of the opposed side rollers 20.

[0037] The position of the fixed operating roller or pulley 14 is manually adjusted by an operator by way of the guide 18, by acting on the knob or handwheel 30 which, by rotating according to the direction of the arrow "Y" in figure 5, causes a translational movement of the guide 18 according to the direction "X" and, consequently, the movement of the output shaft 16 which the operating roller or pulley 14 is put in; in this way, the operating roller or pulley 14 exerts a pressure onto the tubular element 13.

[0038] At this point the operator rotates the further handwheel 46 according to the direction indicated by the arrow "P" in figure 5 and in figure 6 to forcedly rotate the worm-toothed shaft 26 with respect to its own longitudinal axis, said rotation determining a rotation of the toothed wheel 32 put in the movable output shaft 16 (a rotation according to the direction indicated by the arrow "K" in figure 5) and meshing the worm-toothed shaft 26, as well as a rotation of the transmission 36 and, more specifically, a rotation of the first toothed transmission wheel 38, which meshes the worm-toothed shaft 26 and, by rotating, drives into rotation the transmission shaft 36 which supports the second toothed transmission wheel 39 which, being mesh-coupled with the first gear-roller 40 and with the second gear-roller 42, drives into rotation the fixed output shafts 16' and 16'' and, consequently, the operating rollers or pulleys 14' and 14'' according to the directions indicated by the arrows "M" and "M'" in figure 5,

respectively.

[0039] The tubular element 13 is bent by making it slide between the operating rollers or pulleys by increasing or decreasing the distance of the movable operating roller or pulley 14 with respect to the fixed rollers or pulleys 14' and 14'' between position A and position B; as the guide 18 moves from position A to position B, the distance between the movable roller or pulley 14 and the fixed rollers or pulleys 14' and 14'' decreases and, in this way, the bending radius to be given to the tubular element becomes smaller.

[0040] The operator will bend a tubular element through a number of successive passages by varying each time the value for the displacement "X", i.e. by varying the position of the movable shaft 16 which supports the movable roller or pulley 14 with respect to the shafts 14' and 14'' by acting on the adjustment knob or handwheel 30.

[0041] The enhanced bending machine as described above with reference to one manual operation embodiment can also be implemented in an electrical operation mode, which comprises an electric driving suitable for rotationally driving the worm-toothed shaft 26 which drives all three output shafts 16, 16', and 16'' into rotation.

[0042] The advantages achievable with an enhanced bending machine according to the invention are apparent from the foregoing. An enhanced bending machine according to the present invention, of a three-shaft manually-operated or electrically-operated type, has all three shafts, drivers and is such as to allow to permanently have a constant pressure on the tubular element or profile during the bending step, while preventing it from slipping.

[0043] Further advantageous is the fact that the bending machine according to the invention, having all three shafts drivers, one of which in position-adjustable and driver in any positions, makes it possible to realize smaller bending radii, the capacity or characteristic of the profile or tubular element being equal, as compared to a three-shaft bending machines of a traditional type.

[0044] A further advantage is in that an enhanced bending machine according to the invention, wherein there are three driving shafts and the third shaft is simultaneously driver and movable, hence capable of getting closer to/moving away from the remaining two shafts, makes it possible to exert a pressure onto the tubular element in the bending step while preventing the latter from slipping and, consequently, residual deformations present in the tubular element during the bending step will be minor and reduced.

[0045] Further advantageous is the fact that a bending machine structured as described above makes it possible to perform bending operations on a tubular element while preventing oscillations from occurring in the tubular element itself in correspondence with its terminal part not held between the operating rollers or pulleys.

[0046] A further advantage is in that the use of a worm screw makes it possible to have a bending machine featuring reduced space occupation and also easy to

transport.

[0047] Even though the invention has been described above with reference to one embodiment thereof given for explanatory, non-limitative purposes only, numerous modifications and variants will be apparent to those skilled in the art in the light of the above description. Therefore, the present invention is to be construed to embrace any modifications and variants that fall in the scope of the following claims.

Claims

1. An enhanced bending machine (10) suitable for performing bending operations according to determined forms and/or patterns for a tubular element or profile (13), comprising a framework (12) which supports and accommodates working members suitable for bending a tubular element or profile (13), driving and moving members for driving and moving said working members, and adjustment members for adjusting the working members, the working members comprising three operating rollers or pulleys (14, 14', 14'') supported by their respective output shafts (16, 16', 16''), one output shaft (16) being movable hence capable of getting closer to/moving away from the output shafts (16', 16'') whose position is fixed by means of adjustment members which comprises a guide (18) supporting said output shaft (16) and slidable with respect to the framework (12), the bending machine being **characterized in that** all three output shafts (16, 16', 16'') supporting the operating rollers or pulleys (14, 14', 14'') are drivers by way of the same driving member that comprises a worm-toothed shaft (26) arranged internally to the framework (12) and rotatably supported, the axis of rotation being perpendicular to that of the output shafts (16, 16', 16''), the rotational driving of the movable output shaft (16) being performed by way of a toothed wheel (32), which meshes said worm-toothed shaft (26) and which is secured to the movable shaft (16) and with said toothed wheel (32) which forces the movable output shaft (16) to rotate with respect to its own axis, and the rotational driving of the fixed output shafts (16', 16'') being performed by way of a transmission (34), which receives motion from the same worm-toothed shaft (26).
2. The bending machine according to claim 1, **characterized in that** the three operating rollers or pulleys (14, 14', 14'') are arranged in a triangle or delta "Δ" configuration, stabilized externally to the framework (12) and put in their respective output shafts (16, 16', 16'') whose axes of rotation are parallel to each other.
3. The bending machine according to claim 1 or 2, **characterized in that** said guide (18) being adjustable by way of a vernier, along a graduated scale (18'), between a maximum separation position with respect to the fixed rollers or pulleys (14', 14'') (position A) and a minimum separation position with respect to the mentioned rollers (position B), so as to define a displacement indicated by "X".
4. The bending machine according to one or several of the previous claims, **characterized in that** the transmission (34) comprises a transmission shaft (36) whose axis of rotation is perpendicular to the axis of rotation of the worm-toothed shaft (26), a first toothed transmission wheel (38) being put in said transmission shaft and mesh-coupled with the worm-toothed shaft (26), a second toothed transmission wheel (39) being put in the same transmission shaft (36) and coupled with a first gear-roller (40) and with a second gear-roller (42) fixed onto the fixed output shaft (16') and output shaft (16'') respectively.
5. The bending machine according to one or several of the previous claims, **characterized in that** it comprises, externally to the framework (12) and on the same side with respect to which the operating rollers or pulleys (14, 14', 14'') are arranged, a pair of opposed side rollers (20) spaced away from each other so that the operating rollers or pulleys are positioned in the region interposed between said side rollers (20), said side rollers having an axis of rotation perpendicular to the axis of rotation of the operating rollers or pulleys (14, 14', 14'') and being rotationally supported idle with respect to support elements (22).
6. The bending machine according to claim 5, **characterized in that** the support elements (22) supporting the side rollers (20) feature an adjustable inclination in a plane perpendicular to the axes of rotation of the operating rollers or pulleys (14, 14', 14''), which is adjustable by way of an adjustment ring nut (23) secured to each support element.
7. The bending machine according to one or several of the previous claims, **characterized in that** it is a manually-operated one and comprises an adjustment knob or handwheel (30) rotatable according to an axis of rotation perpendicular to the axis of rotation of the output shafts (16, 16', 16'') suitable for performing an adjustment of the position of the guide (18) so as to make it get closer to/move away from the fixed output shafts (16', 16'') and comprising a further handwheel or crank (46), the axis of rotation of which is perpendicular to the axis of rotation of the output shafts (16, 16', 16''), arranged on the opposite side with respect to the knob or handwheel (30) and secured to the worm-toothed shaft (26).
8. The bending machine according to one or several of

the previous claims 1 thru 7, **characterized in that** it is an electrically-operated one, operated by way of a motor secured to the worm-toothed shaft (26).

Patentansprüche

1. Verbesserte Biegemaschine (10), geeignet zum Ausführen von Biegevorgängen gemäß bestimmter Formen und/oder Muster für ein rohrförmiges Element oder Profil (13), umfassend ein Rahmengestell (12), das Arbeitselemente, die zum Biegen eines rohrförmigen Elements oder Profils (13) geeignet sind, stützt und aufnimmt, Antriebs- und Bewegungselemente zum Antreiben und Bewegen der Arbeitselemente und Einstellelemente zum Anpassen der Arbeitselemente, wobei die Arbeitselemente drei Betriebsrollen oder Riemenscheiben (14, 14', 14'') umfassen, die von ihren jeweiligen Ausgangswellen (16, 16', 16'') getragen werden, wobei eine Ausgangswelle (16) beweglich ist und sich dadurch näher an die Ausgangswellen (16', 16'') herانبewegen/von diesen entfernen kann, deren Position mittels Einstellelementen befestigt ist, die eine Führung (18) umfasst, die die Ausgangswelle (16) stützt und in Bezug auf das Rahmengestell (12) verschiebbar ist, wobei die Biegemaschine **dadurch gekennzeichnet ist, dass** alle die Betriebsrollen oder Riemenscheiben (14, 14', 14'') stützenden drei Ausgangswellen (16, 16', 16'') über dasselbe Antriebselement angetrieben werden, das eine Schneckenwelle (26) umfasst, die in dem Inneren des Rahmengestells (12) angeordnet und drehbar gelagert ist, wobei die Drehachse senkrecht zu der Ausgangswellen (16, 16', 16'') verläuft, wobei der Drehantrieb der beweglichen Ausgangswelle (16) über ein Zahnrad (32) erfolgt, das in die Schneckenwelle (26) eingreift und an der beweglichen Welle (16) befestigt ist, und mit dem Zahnrad (32), welches die bewegliche Ausgangswelle (16) zwingt, sich in Bezug auf ihre eigene Achse zu drehen, und der rotierende Antrieb der befestigten Ausgangswellen (16', 16'') wird mittels eines Getriebes (34) durchgeführt, welches die Bewegung von derselben Schneckenwelle (26) erhält.
2. Biegemaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** die drei Betriebsrollen oder Riemenscheiben (14, 14', 14'') in einer Dreieck- oder Delta-"Δ"-Konfiguration angeordnet sind, die außerhalb des Rahmengestells (12) stabilisiert ist und in ihre jeweiligen Ausgangswellen (16, 16', 16'') eingesetzt ist, deren Drehachsen parallel zueinander sind.
3. Biegemaschine gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Führung (18) mittels eines Nonius entlang einer abgestuften Skala (18') zwischen einer maximalen Abstandsposition in Bezug auf die befestigten Betriebsrollen oder Riemens-

scheiben (14', 14'') (Position A) und einer minimalen Abstandsposition in Bezug auf die erwähnten Rollen (Position B) angepasst werden kann, um eine durch ,X' angegebene Verschiebung zu definieren.

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4. Biegemaschine gemäß einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** das Getriebe (34) eine Getriebewelle (36) umfasst, deren Drehachse senkrecht zur Drehachse der Schneckenwelle (26) ist, wobei ein erstes Zahnrad (38) in die Getriebewelle eingesetzt und mit der Schneckenwelle (26) in Eingriff steht, wobei ein zweites Zahnrad (39) in derselben Getriebewelle (36) angeordnet ist und mit einer ersten Antriebsrolle (40) und einer zweiten Antriebsrolle (42) gekoppelt ist, die jeweils an der befestigten Ausgangswelle (16') und der Ausgangswelle (16'') befestigt sind.
5. Biegemaschine gemäß einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** sie außerhalb des Rahmengestells (12) und auf derselben Seite, auf der die Betriebsrollen oder Riemenscheiben (14, 14', 14'') angeordnet sind, ein Paar gegenüberliegender Seitenrollen (20) umfasst, die voneinander beabstandet sind, so dass die Betriebsrollen oder Riemenscheiben in dem Bereich zwischen den Seitenrollen (20) positioniert sind, wobei die Seitenrollen eine Drehachse senkrecht zur Drehachse der Betriebsrollen oder Riemenscheiben (14, 14', 14'') aufweisen und in Bezug auf die Stützelemente (22) leerlaufend drehbar gelagert sind.
6. Biegemaschine nach Anspruch 5, **dadurch gekennzeichnet, dass** die Stützelemente (22), die die Seitenrollen (20) stützen, eine einstellbare Neigung in einer Ebene senkrecht zu den Drehachsen der Betriebsrollen oder Riemenscheiben (14, 14', 14'') aufweisen, die über eine an jedem Stützelement befestigte Einstellringmutter (23) angepasst werden kann.
7. Biegemaschine gemäß einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** sie manuell betrieben wird und einen Einstellknopf oder ein Handrad (30) umfasst, das gemäß einer Drehachse senkrecht zur Drehachse der Ausgangswellen (16, 16', 16'') drehbar ist und dazu geeignet ist, die Position der Führung (18) so anzupassen, dass sie näher an die /von den befestigten Ausgangswellen (16', 16'') weg bewegt wird, und ein weiteres Handrad oder eine Kurbel (46) umfasst, deren Drehachse senkrecht zur Drehachse der Ausgangswellen (16, 16', 16'') steht, auf der gegenüberliegenden Seite in Bezug auf das Handrad oder den Knopf (30) angeordnet und an der Schneckenwelle (26) befestigt ist.

8. Biegemaschine nach einem oder mehreren der vorstehenden Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** es sich um eine elektrisch betriebene handelt, die über einen an der Schneckenwelle (26) befestigten Motor betrieben wird.

Revendications

1. Machine de pliage améliorée (10) appropriée pour effectuer des opérations de pliage selon des formes et/ou des motifs déterminés pour un élément tubulaire ou un profilé (13), comprenant un cadre (12) qui supporte et reçoit des éléments de travail appropriés pour plier un élément tubulaire ou un profilé (13), des éléments d'entraînement et de déplacement pour entraîner et déplacer lesdits éléments de travail, et des éléments de réglage pour régler les éléments de travail, les éléments de travail comprenant trois rouleaux ou poulies de fonctionnement (14, 14', 14'') supportés par leurs arbres de sortie respectifs (16, 16', 16''), un arbre de sortie (16) pouvant donc se rapprocher/s'éloigner des arbres de sortie (16', 16'') dont la position est fixée au moyen d'éléments de réglage qui comprennent un guide (18) supportant ledit arbre de sortie (16) et pouvant coulisser par rapport au cadre (12), la machine de pliage étant **caractérisée en ce que** les trois arbres de sortie (16, 16', 16'') supportant les rouleaux ou poulies de fonctionnement (14, 14', 14'') sont entraînés par le même élément d'entraînement qui comprend un arbre à vis sans fin (26) disposé à l'intérieur pour le cadre (12) et supporté de manière rotative, l'axe de rotation étant perpendiculaire à celui des arbres de sortie (16, 16', 16''), l'entraînement en rotation de l'arbre de sortie mobile (16) étant effectué au moyen d'une roue dentée (32), qui engrène ledit arbre à vis sans fin (26) et qui est fixée à l'arbre mobile (16) et à ladite roue dentée (32) qui force l'arbre de sortie mobile (16) à tourner par rapport à son propre axe, et l'entraînement en rotation des arbres de sortie fixes (16', 16'') étant effectué au moyen d'une transmission (34), qui reçoit le mouvement du même arbre à vis sans fin (26).
2. Machine de pliage selon la revendication 1, **caractérisée en ce que** les trois rouleaux ou poulies de fonctionnement (14, 14', 14'') sont disposés dans une configuration triangulaire ou delta « Δ », stabilisés à l'extérieur du cadre (12) et placés dans leurs arbres de sortie respectifs (16, 16', 16'') dont les axes de rotation sont parallèles les uns aux autres.
3. Machine de pliage selon la revendication 1 ou 2, **caractérisée en ce que** ledit guide (18) étant réglable au moyen d'un vernier, le long d'une échelle graduée (18'), entre une position de séparation maximale par rapport aux rouleaux ou poulies fixes

(14', 14'') (position A) et une position de séparation minimale par rapport aux rouleaux mentionnés (position B), de manière à définir un déplacement indiqué par « X ».

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4. Machine de pliage selon une ou plusieurs des revendications précédentes, **caractérisée en ce que** la transmission (34) comprend un arbre de transmission (36) dont l'axe de rotation est perpendiculaire à l'axe de rotation de l'arbre à vis sans fin (26), une première roue dentée de transmission (38) étant placée dans ledit arbre de transmission et couplée en prise avec l'arbre à vis sans fin (26), une seconde roue dentée de transmission (39) étant placée dans le même arbre de transmission (36) et couplée à un premier rouleau d'engrenage (40) et à un second rouleau d'engrenage (42) fixés sur l'arbre de sortie fixe (16') et l'arbre de sortie (16'') respectivement.

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5. Machine de pliage selon une ou plusieurs des revendications précédentes, **caractérisée en ce qu'elle** comprend, à l'extérieur du cadre (12) et du même côté par rapport auquel les rouleaux ou poulies de fonctionnement (14, 14', 14'') sont disposés, une paire de rouleaux latéraux opposés (20) espacés l'un de l'autre de sorte que les rouleaux ou poulies de fonctionnement soient positionnés dans la région interposée entre lesdits rouleaux latéraux (20), lesdits rouleaux latéraux ayant un axe de rotation perpendiculaire à l'axe de rotation des rouleaux ou poulies de fonctionnement (14, 14', 14'') et étant supportés de manière rotative à l'état libre par rapport aux éléments de support (22).

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6. Machine de pliage selon la revendication 5, **caractérisée en ce que** les éléments de support (22) supportant les rouleaux latéraux (20) présentent une inclinaison réglable dans un plan perpendiculaire aux axes de rotation des rouleaux ou poulies de fonctionnement (14, 14', 14''), qui est réglable au moyen d'un écrou annulaire de réglage (23) fixé à chaque élément de support.

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7. Machine de pliage selon une ou plusieurs des revendications précédentes, **caractérisée en ce qu'elle** est à commande manuelle et comprend un bouton ou un volant de réglage (30) pouvant tourner selon un axe de rotation perpendiculaire à l'axe de rotation des arbres de sortie (16, 16', 16'') approprié pour effectuer un réglage de la position du guide (18) de manière à le rapprocher/s'éloigner des arbres de sortie fixes (16', 16'') et comprenant un autre volant ou manivelle (46), dont l'axe de rotation est perpendiculaire à l'axe de rotation des arbres de sortie (16, 16', 16''), disposé du côté opposé par rapport au bouton ou au volant (30) et fixé à l'arbre à vis sans fin (26).

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8. Machine de pliage selon une ou plusieurs des revendications précédentes 1 à 7, **caractérisée en ce qu'elle** est à commande électrique, actionnée au moyen d'un moteur fixé à l'arbre à vis sans fin (26).

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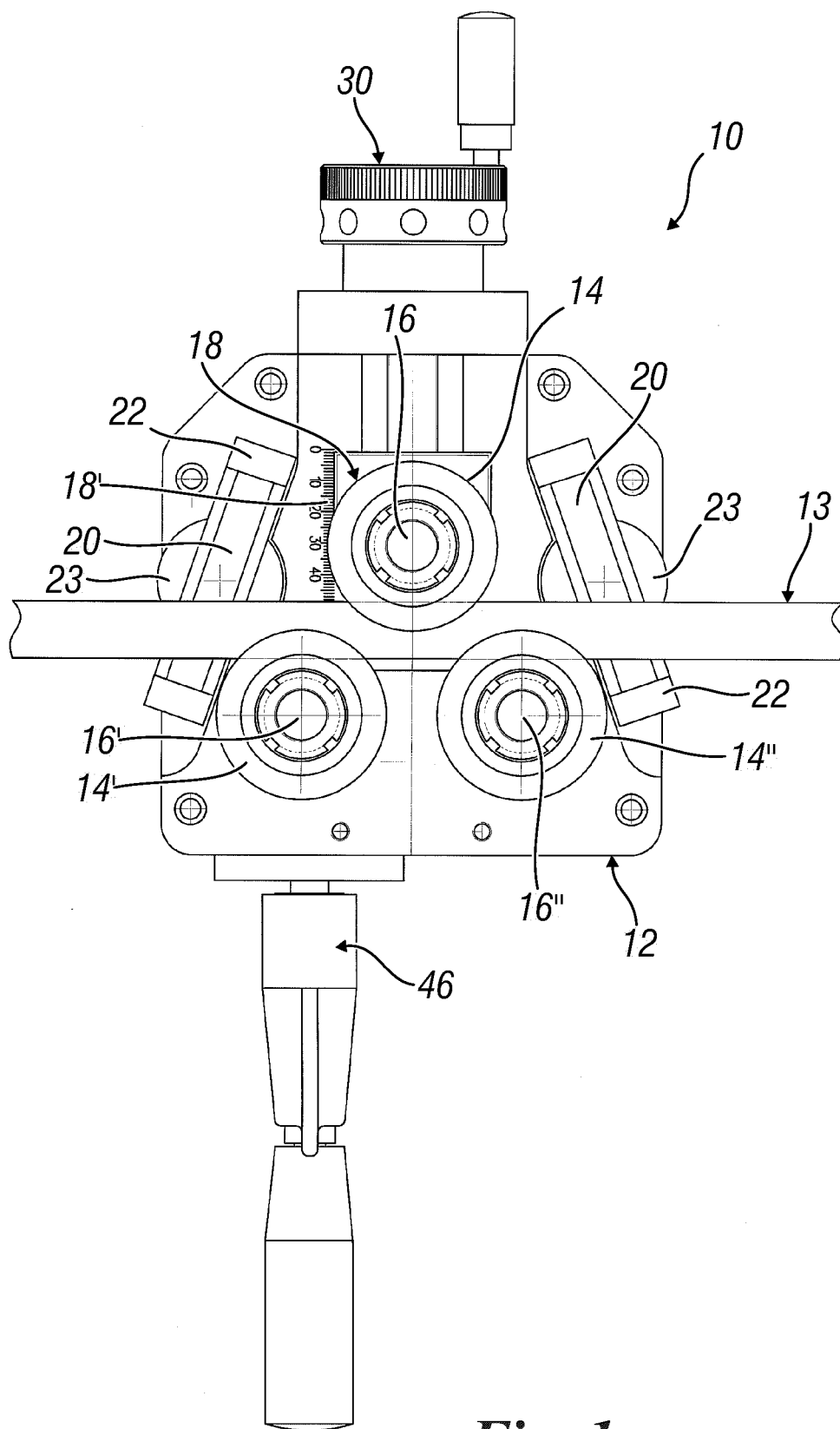


Fig. 1

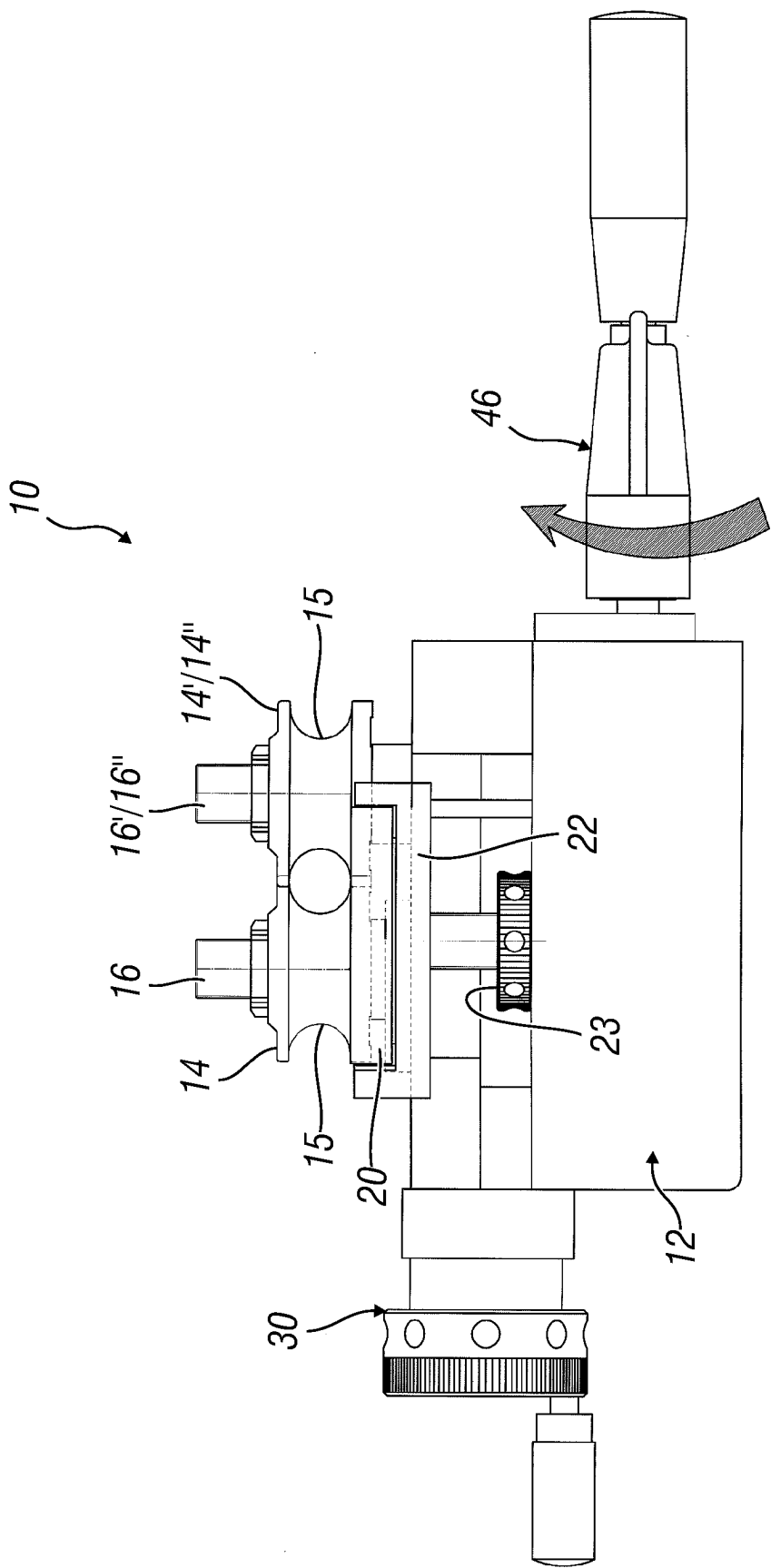
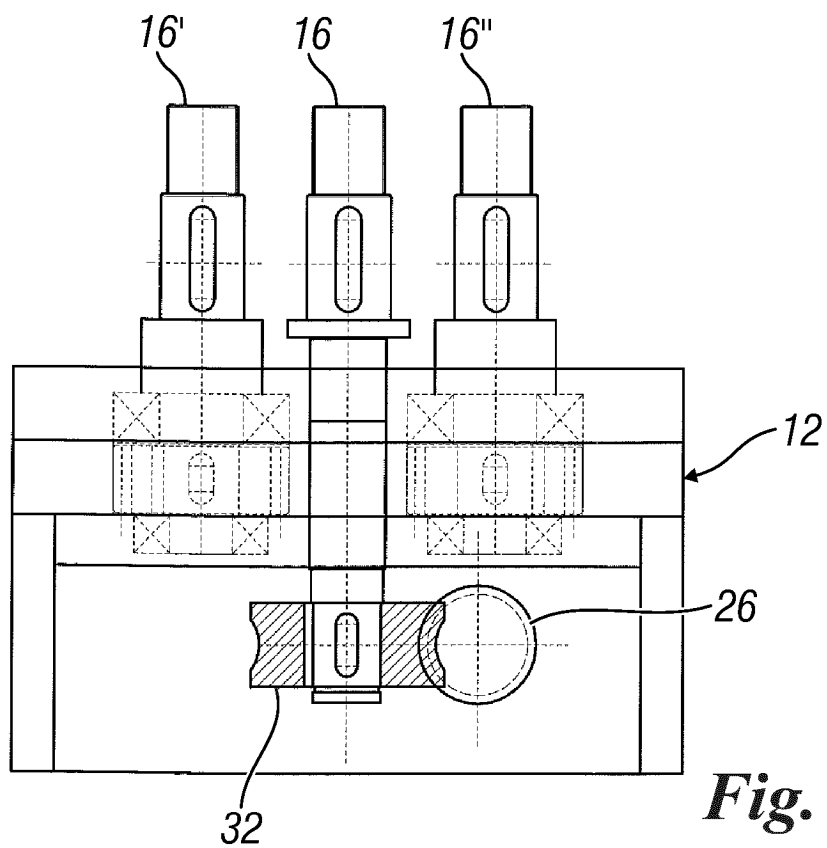
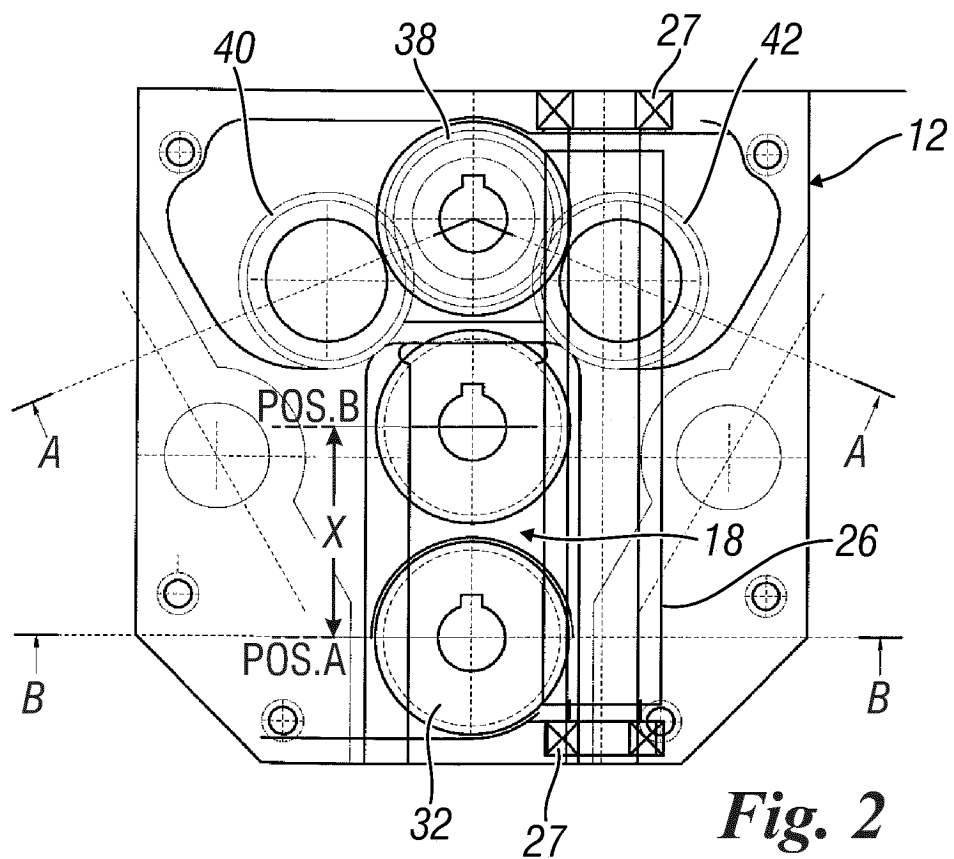
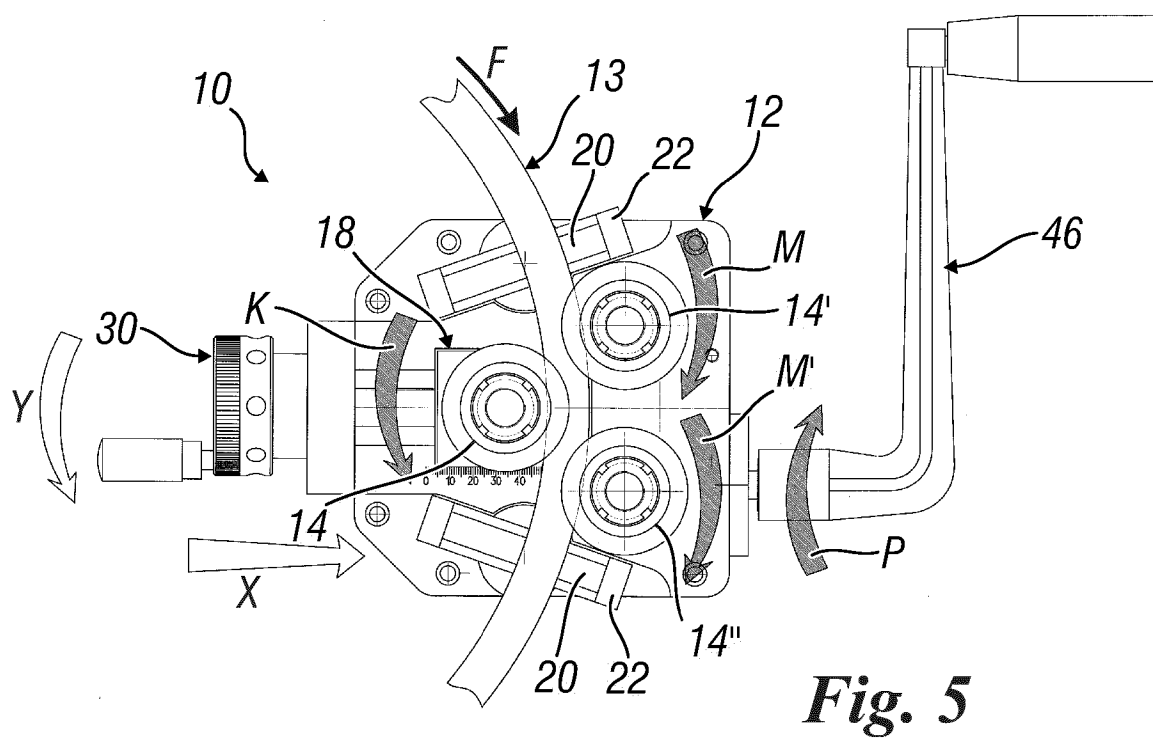
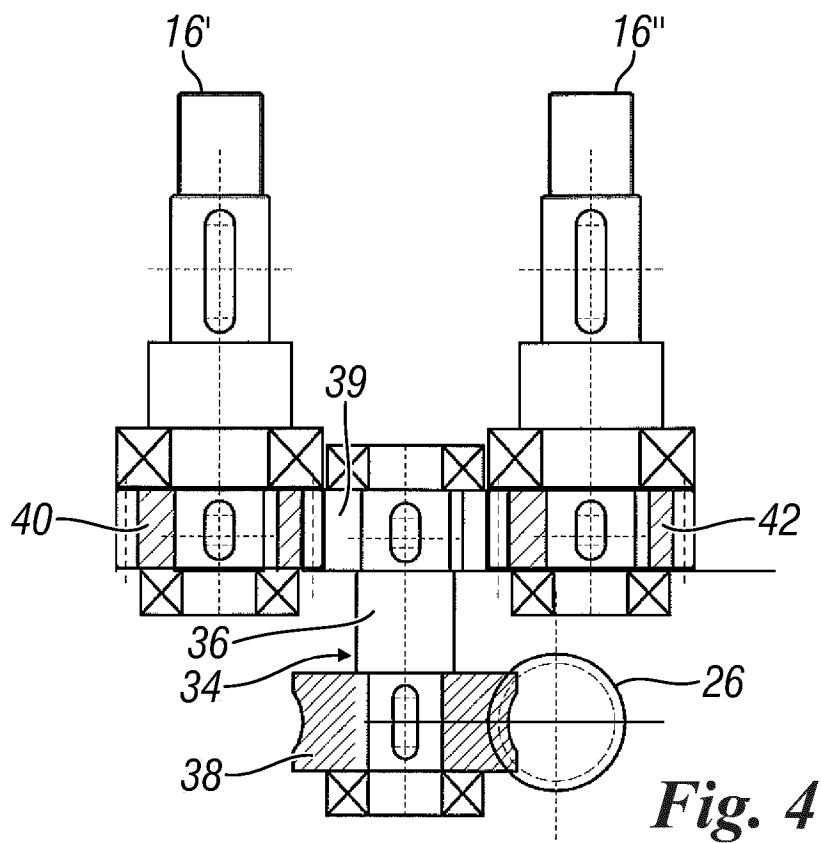


Fig. 1A





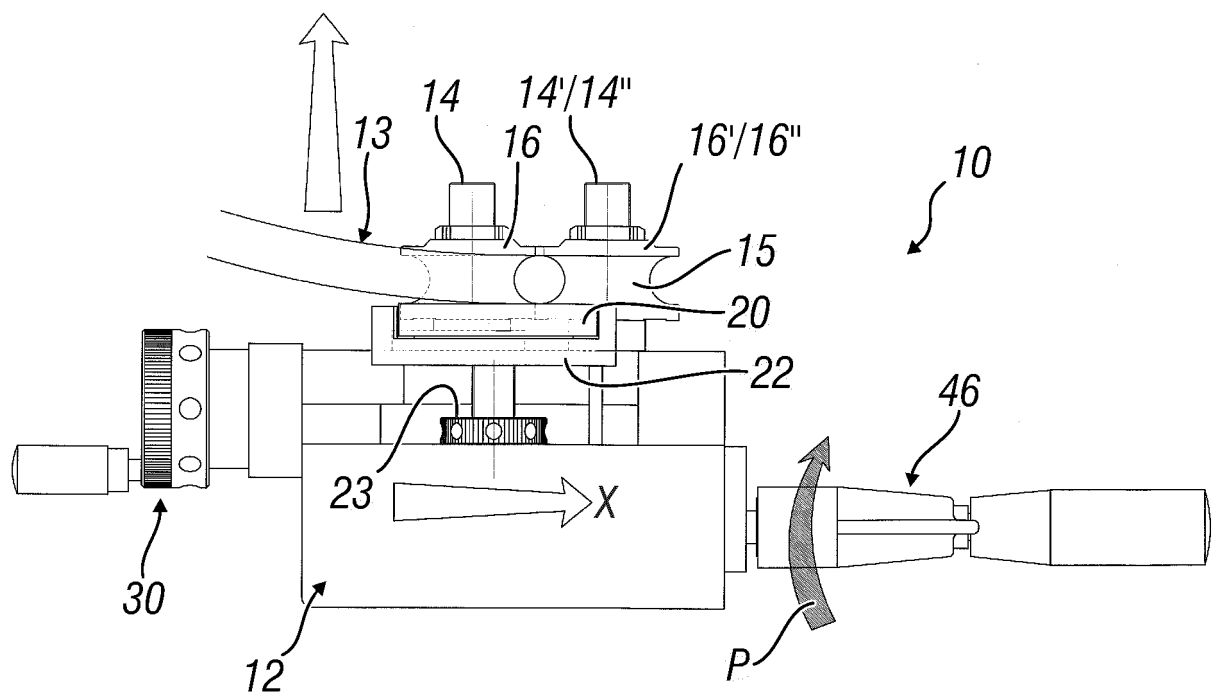


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 60108119 A [0012]