

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization

International Bureau



(10) International Publication Number

WO 2012/084155 A1

(43) International Publication Date

28 June 2012 (28.06.2012)

WIPO | PCT

(51) International Patent Classification:

B24B 5/04 (2006.01) B24B 41/06 (2012.01)

(21) International Application Number:

PCT/EP2011/006359

(22) International Filing Date:

7 December 2011 (07.12.2011)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

MI2010A002348 22 December 2010 (22.12.2010) IT

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

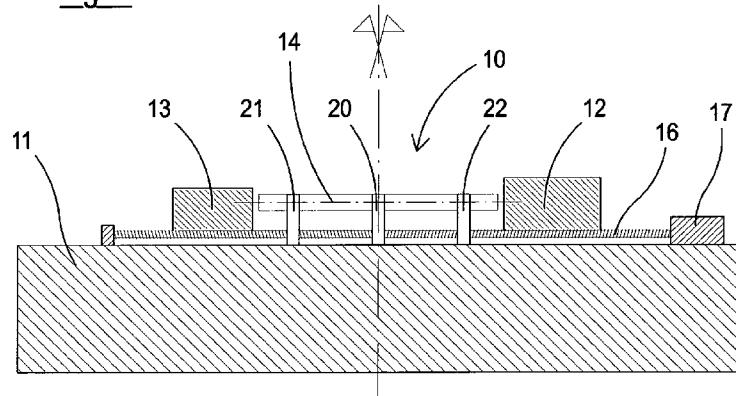
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: METHOD FOR THE POSITIONING OF OPERATIVE CYLINDERS ON A GRINDING MACHINE AND GRINDING MACHINE WHICH IMPLEMENTS THIS METHOD

Fig. 1



(57) Abstract: The present invention relates to a method for positioning operative cylinders, for example of rolling-mills or paper-mills on a grinding machine (10) which comprises effecting at least the following steps: A- positioning the transversal, longitudinal centre-line plane of said cylinder in correspondence with a reference point situated between a movable piece-holder head (13) and tailstock centre (12) of said machine (10); B- moving said piece-holder head (13) and said tailstock centre (12) in the direction of said cylinder until there is a reciprocal coupling. A further object of the present invention relates to a machine for implementing said method.

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METHOD FOR THE POSITIONING OF OPERATIVE CYLINDERS ON A
GRINDING MACHINE AND GRINDING MACHINE WHICH IMPLEMENTS
THIS METHOD

The present invention relates to a method for the
5 positioning of operative cylinders on a grinding machine
and a grinding machine which implements this method; it
should be pointed out that the definition "operative cy-
linders" refers, for example, to cylinders of rolling
mills for the rolling of metals, those used in paper-
10 mills, those used in oil-pressure applications, shafts of
marine motors and in general all cylinders made of metal-
lic and non-metallic materials which are of industrial
interest.

The grinding of the cylinders described above, and
15 in particular cylinders of rolling-mills or paper-mills,
has various drawbacks, associated first of all with the
encumbrance and weight of the same which are often consi-
derable.

The latter, in fact, have dimensions varying from 40
20 mm to 2,300 mm in diameter, 1,000 mm to 12,000 mm in
length and weights ranging from a few tens of daN up to
230-250 t.

The function assigned to these cylinders requires
that they be processed with a precision and accuracy in
25 the order of a few thousandths of a millimeter.

The grinding machines which can be used for these cylinders therefore have specific characteristics and must not be confused with the smaller and traditional lathes or similar machines which, in this sense, are not 5 capable of effecting these grinding processes.

The grinding of a cylinder must always be preceded by a preliminary positioning phase of the latter on the machine, which is effected by inserting the cylinder to be ground between a piece-holder head and a tailstock 10 centre and subsequently supporting it between centres of the machine and, if necessary, tightening it with one or more lunettes or contrast devices, or resting the cylinder itself directly on a pair of supporting lunettes; either of the two solutions is selected in relation to the 15 type of cylinder to be ground and the processing to be effected.

In the case of the processing of so-called "thin" cylinders, for example, or cylinders in which the diameter/length ratio is particularly small (a typical example 20 of these is represented by cylinders of "Sendzimir" rolling mills or, more generally, "cluster" rolling mills), the known art envisages that the cylinder to be ground is first loaded onto the grinding machine with a loading device (such as, for example, a gantry crane, a jib crane 25 or an automatic loading device), it is then moved until

one of its ends is supported by the centre of the piece-holder head, the tailstock centre is then moved until the contact with this supports the opposite end of the cylinder, and finally the lunettes or contrast devices are 5 moved along the cylinder, so as to position them correctly with respect to the part of the cylinder to be ground.

The lunettes or contrast devices are normally produced as supports suitable for opposing the thrusts that the grinding wheel exerts on the piece being processed; 10 they are normally positioned at regular distances along the cylinder, in order to uniformly oppose the forces during the grinding process.

As the piece-holder head is fixed, all the important distances are therefore measured from the piece-holder 15 head and the tailstock centre and lunettes or contrast devices are positioned in relation to this reference, moving them in an axial direction to move them towards or away from the reference, depending on the length of the cylinder.

20 The execution of such operations, typically defined by the term set-up can be manual or automatic. In the former case, the set-up time is extremely important as a series of various operations are required, which must be accurately effected in order to verify their correctness. 25 In the latter case, a reduction in the set-up times jeo-

pardizes the simplicity and reliability of the machine, as both the lunettes and the tailstock centre must be equipped with suitable movement devices and relative control systems.

5 Another drawback linked to the known art relates to the fact that during the loading, the cylinder must be moved in three directions and in particular, among these, also along the longitudinal axis, in order to be correctly positioned on the grinding machine; these regulation
10 movements require the use of a loading device. In manual plants, this device is typically a gantry crane or a jib crane and the precision with which the cylinder must be moved and positioned requires long positioning times, skilled operators and the risk that, with an erroneous
15 manoeuvre, the cylinder, or machine, or both, can be damaged. In automatic plants, the movement of the cylinders is effected with 3-axis loading systems and if, on the one hand, they reduce the manoeuvring times and increase the safety of the same, on the other, they require machines which move the load along 3 axes and are consequently, by nature, complex, costly and require maintenance. The positioning of the lunettes and tailstock centre is also quite lengthy with the traditional technology, in the sense that they must be moved along the cylinder to be correctly positioned, care being taken to
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measure the distances from the side of the cylinder associated with the piece-holder head. Also in this case, if, on the one hand, the manual solution is economical, on the other, it requires time and accuracy on the part of 5 the operator, whereas although the automatic solution guarantees operational velocity and precision, it requires a movement and control mechanism for the tailstock centre and for each of the lunettes.

In the case of manual machines, these problems are 10 even more serious due to the fact that cylinders having different lengths must often be ground consecutively: these set-up operations must therefore be effected for each processing, with considerable time consumption.

In particular, not only must the tailstock centre be 15 moved each time, but also the lunettes, as the distances from the piece-holder head (which serves as a reference) must be measured each time and all the lunettes must therefore be moved along the cylinder.

The general objective of the present invention is 20 consequently to overcome these and other drawbacks of the known art.

This objective is achieved by a grinding method and a grinding machine having the characteristics specified in the enclosed independent claims and in the subclaims, 25 which should be considered as being an integrant part of

the present description.

A positioning method has been conceived for these cylinders which envisages at least the following steps:

- positioning the transversal, longitudinal centre-line plane of the cylinder in correspondence with a reference point situated between a movable piece-holder head and tailstock centre of the machine;
- moving both the piece-holder head and the tailstock centre until they are coupled with the cylinder.

10 The movement of the piece-holder head and tailstock centre is preferably of the same entity, in the same direction and opposite senses.

15 In this way, the reference system is identified specifically by the transversal, longitudinal centre-line plane of the cylinder, and not already by one of its ends, as in the known art.

20 For this purpose, the piece-holder head and tailstock centre are integral in their translation movement with respect to the frame of the machine, for example by coupling them both with the same screw, so that a rotation of the latter causes the same movement of both, in the same direction but in opposite senses.

25 In this way, the advantages obtained are evident: firstly, it is not necessary to axially move the cylinder on the machine to position it on the piece-holder head

and it is therefore sufficient to use a loading device with only two movement axes, simpler and less costly, whether it be manual or automatic.

Furthermore, the central reference system, coinciding with the longitudinal centre-line plane of the cylinder, offers other advantages: if, for example, an odd number of lunettes (one, three, etc.) is used, it is not necessary to reposition the lunette or central contrast device each time, which is preferably fixed on the machine in the position in which the centre-line of the cylinder is assembled.

Similar advantages are also obtained even if the number of lunettes is equal (two, four, etc.) as, also in this case, the positioning of the lunettes must be symmetrical with respect to the centre-line of the cylinder.

This advantage in terms of set-up time saving is verified in each processing and even more so when various consecutive processings of cylinders having different lengths must be effected on the same machine: in this latter case, in fact, it would be necessary in the known art to also reposition the possible central lunette each time, whereas with the present invention, it always remains in the same position.

By using the reference system situated in the centre-line of the cylinder, moreover, an additional advan-

tage is obtained: experience has shown that it is not in fact necessary to move the lunettes when the dimension of the cylinders that must be consecutively processed on the same machine varies within a range of about 0.5 meters.

5 It has been noted, in fact, that if the variation in the longitudinal dimensions of the cylinders remains within this range, all the lunettes (both the central one, if envisaged, and the side ones) can be kept in the same positions, thus drastically reducing the set-up
10 time.

Furthermore, the positioning of the side lunettes is simplified as the distances can be measured by the central reference system, i.e. the centre-line of the cylinder simplifying the movement and avoiding possible errors.
15

The structural and functional characteristics of the invention, as also its advantages with respect to the known art, will appear more evident from the following description, referring to the enclosed drawings which
20 show a possible practical embodiment of the same invention.

In the drawings:

- figure 1 illustrates a machine according to the present invention;
25 - figure 2 illustrates a detail of the machine of

figure 1;

- figures 3 and 4 illustrate details of the machine of figure 1.

Describing first the positioning method, object of 5 the present invention, it always comprises the following steps:

A- positioning the transversal, longitudinal centre-line plane of the cylinder in correspondence with a reference point situated between a movable piece-holder head and 10 tailstock centre of said machine;

B- moving both the piece-holder head and the tailstock centre until they are coupled with the cylinder and supporting it.

An overall version of the positioning method also 15 envisages the following steps:

A1- preparing a rolling cylinder to be ground;

A- positioning the transversal, longitudinal centre-line plane of the cylinder in correspondence with a reference point situated between a moveable piece-holder head and a 20 tailstock centre of the machine,

B- moving both the piece-holder head and the tailstock centre until they are coupled with said cylinder and supporting it;

C- positioning at least two supporting side lunettes or 25 contrast devices of said cylinder at the same distance

from said central contrast lunette.

The reference point mentioned in step A above can possibly coincide with the positioning of the transversal, longitudinal centre-line plane of said cylinder in 5 correspondence with a fixed lunette with respect to the frame of the machine and/or with respect to the side lunettes.

Numerous variants can obviously be applied to the method described, all object of the present invention; in 10 this sense, some of the steps of the method can be inverted (for example steps B. and C. can be exchanged) or other steps of the method, relating to secondary regulations of the machine can be added; or it is also possible that the central lunette, due to a particular form and 15 geometry of the cylinder, may not be used.

With reference to step A, the reference point, this is preferably fixed onto the machine and coincides with a lunette or contrast device, in particular with the central lunette, as will appear more evident below, in the 20 description of the machine. This lunette can obviously be removed to allow the grinding of cylinders having a particular form and geometry.

Both the piece-holder head and tailstock centre can preferably be moved so as to be always equidistant from 25 the reference point: their movement, in other words, is

of the same entity and is always effected in the same direction but in opposite senses.

Also with respect to the side lunettes, or those situated at the sides of the central lunette which coincides with the reference point, these can be advantageously moved to the same degree and in the same direction, but in opposite senses. There can be one or more of these side lunettes but always in the same quantity on both sides with respect to the central lunette.

In this way, the advantages discussed above are obtained, as the reference point for the whole positioning phase is no longer an end of the cylinder but its centre-line, thus allowing the above advantages to be obtained.

As far as the machine is concerned, reference should be made to figures 1 and 2.

The grinding machine 10 comprises a base 11 on which a piece-holder head 13 and tailstock centre 12 are movably assembled, which serve to move and possibly support a cylinder 14 which is positioned between them during the grinding operation.

More specifically, the machine 10 is of the type in which the processing cylinder is supported by two rotating centres 81 and 83 positioned in the piece-holder head 13 and tailstock centre 12.

The lunettes 20, 21, 22 are positioned in contact with

the cylinder and have the function of providing a contrast to the possible bending of the cylinder due to the same processing.

It should be pointed out that the machine 10 can 5 equivalently be of a different type, in which the lunettes, in addition to having the function described above, also have the function of supporting the whole weight of the cylinder being processed, whereas the piece-holder head and tailstock centre only have the 10 function of bringing it into rotation, to allow its grinding.

The piece-holder head 13 comprises a single body which is capable of translating thanks to the presence, in the lower part, of two linear guides 80 with which it 15 is coupled by means of suitable sliding blocks.

The rotating centre 81 can be housed inside the body of the piece-holder head 13, which, in some applications, forms a rest for the cylinder. In the rear part, on the other hand, a motor 71 can be positioned, with the relative transmission, for rotating the cylinder. 20

The tailstock centre 12 also comprises a body which is capable of translating thanks to the presence of two linear guides 80 situated in the lower part of the structure with which it is coupled by means of suitable sliding blocks. 25

The movable centre 83 can be housed inside the tailstock centre 12, which, in some applications, forms a second rest for the cylinder.

Furthermore, if required by the particular application under examination, the tailstock centre 12 can house a device in its lower part, which generates a preloading through a spring device.

This preloading acts in an axial direction and guarantees the continuous contact between the cylinder and two movable centres 81 and 83 and, at the same time, the desired axial preloading, if this is required by the processing, as is the case, for example, in the grinding of so-called "thin" cylinders.

The machine 10 also comprises a grinding wheel which can be moved parallelly to the axis of the cylinder, not shown for the sake of conciseness, and in any case known in itself in this type of grinding machine.

Both the piece-holder head 13 and tailstock centre 12 can be moved linearly along the base 11 so that they can move towards or away from each other, to house cylinders having different lengths.

The piece-holder head 13 and tailstock centre 12 are coupled to movement means which allow their linear approach or withdrawal movement to the same extent, in the same direction and in opposite senses.

The movement means of this example comprise a worm screw 16 engaged with both the piece-holder head 13 and tailstock centre 12, so that, when brought into rotation, the screw 16 actuates both the approach or withdrawal in 5 the same direction along which the screw 16 extends; these movement means are illustrated in more detail in figure 2.

For this purpose, the screw 16, produced in a single piece, has two threaded parts 160 and 161 with which a 10 corresponding female screw of the piece-holder head 13 and tailstock centre 12 is engaged.

In order to allow a movement in the same direction and of the same entity, but in opposite senses, the two threaded parts 160, 161 of the screw 16 have contrasting 15 helicoidal threadings, for example an anticlockwise threading and a clockwise threading, preferably having the same pitch.

It should be pointed out that two separate helicoidal screws with a contrasting threading can be equivalently envisaged, instead of a single screw 16, or the latter 20 may not be in a single piece but separable into two different sections connected with appropriate joints.

The screw 16 is actuated in rotation by a motor 17, for example an electric brushless motor or the like.

25 In this way, by correctly positioning the cylinder

so that its transversal longitudinal centre-line plane is in correspondence with the reference point of the machine 10 and actuating the screw 16, the piece-holder head 13 and tailstock centre 12 move towards the ends of the cylinder, subsequently being coupled with it and possibly supporting it.

It should be noted that this solution also effects a kind of self-centering of the cylinder between the head 13 and tailstock centre 12, if in fact the cylinder were 10 not correctly positioned along its axial direction, as both the head 13 and tailstock centre 12 move with respect to a common central reference to the same degree, in the same direction and in opposite senses, their approach movement would allow a centering of the cylinder.

15 This particular feature, on the one hand makes manual loading of the cylinder simpler, safer and more rapid, whereas on the other, it significantly facilitates the projecting of mechanisms of a possible automatic loading system.

20 The machine 10 also comprises contrast or supporting lunettes 20, 21, 22.

These, in the particular case of the grinding of so-called "thin" cylinders, must at least be present in one unit 20, but generally in at least three units 20, 21 and 25 22 and normally in an odd number. The use of lunettes in

an even number, i.e. without the central lunette, is only envisaged in particular cases, when the geometry of the cylinder requires this. Consequently, except for this particular case, the set of lunettes always comprises a 5 central lunette 20 or, more generally, the central lunette 20 and two side lunettes 21 and 22, or four side lunettes etc.

The cylinder is assembled with its transversal, longitudinal centre-line plane (which, as in the case of so-10 called "thin" or Sendzimir cylinders, often coincides with the symmetry plane passing through the barycentre and perpendicular to the generatrices of the cylinder) in a position corresponding to the central lunette 20.

The latter, at least in the case mentioned above, is 15 consequently generally fixed in position with respect to the machine 10 or at its base destined for resting on the ground, and does not have to be moved when cylinders having different lengths are being processed, as, in any case, the longitudinal centre-line point of the cylinder 20 is always assembled in correspondence with said central lunette 20.

In this sense, it is also possible to mechanically fix the central lunette 20 to the machine 10, for example by means of screws or bolts, or make it integral with at 25 least part of the base 12, so that it represents a cen-

tral and privileged reference point for the measurement and calculation of other dimensions.

Considering the case, for example, of three lunettes, as far as the side lunettes are concerned, 21 and 5 22, their position can be manually regulated or, in more evolved variants of the machine 10, they can be connected to a specific worm screw or to the same screw 16 which activates the piece-holder head 13 and tailstock centre 12, so that they are moved in the same direction and to 10 the same degree, but in opposite senses, by means of a single and simple actuation of the screw with which they are coupled, consequently reducing or eliminating the risks of an incorrect positioning of both: in this way, in fact, they cannot be positioned at different distances 15 from the central lunette 20, but are always advantageously equidistant with respect to the same.

In this sense, a variant envisages controlling the position of both the lunettes 20, 21, 22 and the piece-holder head 13 and tailstock centre 12 by means of a single screw command and a series of threaded sleeves 90 20 (one for each device to be moved) shown in figures 3 and 4 enclosed.

Each sleeve 90 comprises a cylindrical mantle and is engaged with the worm screw 16 by means of a threading 25 inside the same mantle.

Each sleeve 90 can also be connected to the unit to be moved by means of a suitable mechanism. In principle, it should be noted that, as an alternative to the brake blocks described hereunder, in the light of the disclosures provided herein, an expert in the field can also envisage other different solutions; for example, instead of a brake block, the blocking means of the unit to be moved can comprise electromagnets, mechanical coupling means such as fixing pegs, wedges, removable interference profiles or other similar items.

For illustrative and non-limiting purposes, one of these coupling/decoupling means is described hereunder.

The coupling/decoupling means of the sleeve to the part to be positioned comprise two arms 91, 92 pivoted to the structure of the part to be moved (piece-holder head, tailstock centre and lunette) and each provided with an engagement end 93, 94 with said sleeve 90 and an opposite free end 95, 96 coupled with an actuator 97.

The actuator 97 is preferably a linear actuator, for example a gas, pneumatic, hydraulic, electric actuator or similar: in the non-limited embodiment illustrated, it is a hydraulic actuator equipped with a cylinder and piston which protrudes variably from the cylinder.

The actuator 97 is coupled, preferably hinged, to the free ends 95, 96 of the arms 91, 92; each engagement

end 93, 94 of each arm 91, 92 is equipped with a clamp with linings for coupling with the outer cylindrical surface of the sleeve 90.

The two arms 91, 92 have their fulcrum along their 5 body in the points O' and O'' so as to oscillate, so that as the two free ends 95, 96 approach, the opposite ends 93, 94 move away and vice versa.

The machine 10 preferably comprises a single screw 16 and both the head 13 and the tailstock centre 12 and 10 lunettes 20, 21, 22 are equipped with these coupling/decoupling means, each having a specific corresponding sleeve.

In this way, there is a plurality of sleeves along the body of the screw, one for each coupling/decoupling 15 means.

The functioning can be deduced from what has been described so far: when the actuator of one of the coupling/decoupling means is activated to close the linings over the corresponding sleeve, the same part of the machine (head, tailstock centre or lunette) can be controlled in translation as a result of the rotation of the screw 16, by activating the latter, in fact, the sleeve, which is prevented from rotating, moves along the screw 20, entraining in translation the element to which the 25 arms are pivoted.

It is therefore possible, with a simple and accurate system, to move head, tailstock centre and lunette to position them correctly on the base 11, drastically reducing the set-up times of the machine 10.

5 Furthermore, in this way, both the lunette and the head and tailstock centre can be activated contemporaneously or separately with a single command, obtaining an extremely high versatility of the machine.

In short, the connection between each female screw
10 and the part to be moved associated with it, is obtained by means of a system which operates in the following way: if a certain part is to be moved, for example the tailstock centre, said blocking system constrains the threaded sleeve 90 (or female screw) to the body of the tailstock centre itself and, at the same time, prevents its rotation, so that, once actuated, the screw rotates and the female screw, constrained to the tailstock centre, cannot rotate integrally with the screw and consequently causes
15 the tailstock centre to translate.

20 If, on the contrary, the piece-holder head is to be moved and the tailstock centre kept immobile, it is sufficient to disengage the specific sleeve from the body of the tailstock centre and contemporaneously constrain that of the piece-holder head; in this way, once the screw begins to rotate (in this case to move the piece-holder
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head) the sleeve of the tailstock centre will rotate integrally with itself, maintaining the sleeve itself in the same axial position and consequently not causing any movement of the tailstock centre.

5 In this way, either the lunettes or the head or the tailstock centre can be simply and rapidly activated contemporaneously or separately, to allow the cylinder to be suitably positioned and supported.

There can therefore be various movement conditions
10 of the parts, which should be considered as being an integral part of the method described above, for example:

1) Symmetrical positioning of the lunettes, piece-holder head and tailstock centre with respect to the central reference of the machine: if only the
15 female screw of both lunettes is integral with the screw, they will move for the same distance but in opposite senses, due to the constructive form of the worm screw. Contemporaneously the female screws of the piece-holder head and tailstock centre are
20 disengaged from the screw and these two groups consequently remain motionless. After positioning the lunettes, the piece-holder head and tailstock centre are positioned by making the female screws of these integral and disengaging those of the lunettes. This positioning procedure can be useful,
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for example, in the case of the grinding of symmetrical cylinders (for example Sendzimir).

2) Asymmetrical positioning of the piece-holder head and tailstock centre - symmetrical positioning of the lunettes: in this case, the lunettes are synchronously positioned, making both of the female screws of the latter integral with the screw. In this way, by actuating the screw, they will move for the same distance but in opposite senses. After positioning these two groups, their female screws are disengaged from the screw. At this point, the female screw of the piece-holder head and tailstock centre are alternatingly made integral with the screw, moving first one group and then the other.

15 3) Asymmetrical positioning of the lunettes, piece-holder head and tailstock centre with respect to the centre-line of the cylinder: in this case, the groups are positioned, each time making the female screw of one group integral with the screw, whereas the female screws of the other groups not involved in the movement, are disengaged. This procedure can be very useful for moving the above parts in the case of the grinding of asymmetrical cylinders (such as typically hot and cold rolling cylinders), or in applications where the piece-holder head re-

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mains fixed such as, in general, all applications except for the grinding of Sendzimir cylinders.

Numerous alternatives to the machine 10 described so far are possible, all considered as being an integral 5 part of the present invention.

The movement means for the head 13 and for the tailstock centre 12 and/or for the side lunettes 21 and 10 22, for example, can be produced differently, for example by means of a transmission belt coupled with trolleys, so as to enable the movement of the head 13 and tailstock centre 12 and/or lunettes, as envisaged above.

The movement means can equivalently comprise two separate screws and two motors, even if, in this case, the cost of the machine is higher.

15 The centre-line of the whole machine 10 can also advantageously coincide with the central lunette 20, making the positioning of the cylinder even more simple and intuitive.

20 The objectives mentioned in the preamble of the description have therefore been achieved.

The scope of the invention is defined by the following claims.

CLAIMS

1. A positioning method for operative cylinders, for example of rolling-mills or paper-mills on a grinding machine (10) characterized in that it comprises
 - 5 effecting at least the following steps:
 - a. positioning the transversal, longitudinal centre-line plane of said cylinder in correspondence with a reference point situated between a movable piece-holder head (13) and tailstock centre (12) of said machine
 - 10 (10);
 - b. moving said piece-holder head (13) and said tailstock centre (12) towards the direction of said cylinder until there is a reciprocal coupling, for entraining and/or supporting the cylinder itself.
 - 15 2. The method according to the previous claim, wherein said reference point is positioned equidistant from said piece-holder head (13) and said tailstock centre (12).
 - 20 3. The method according to claim 1 or 2, wherein said moving of said step B is the moving of said piece-holder head (13) and said tailstock centre (12) of the same entity, in the same direction and in opposite senses.
 4. The method according to claim 1 or 2, also

comprising the following steps:

- A1. preparing a rolling cylinder to be ground;
 - A. positioning the transversal, longitudinal centre-line plane of the cylinder in correspondence with a reference point situated between a moveable piece-holder head and a tailstock centre of the machine, said reference point preferably coinciding with a supporting lunette (20) of said cylinder;
 - B. moving said piece-holder head (13) and said tailstock centre (12) until it is coupled with said cylinder;
 - C. positioning at least two supporting side lunettes (21, 22) of said cylinder at the same distance from said reference point.
- 15 5. A grinding machine (10) for operative cylinders, for example of rolling-mills or paper-mills comprising a base (11), a piece-holder head (13) and a tailstock centre (12) suitable for being coupled at the opposite ends of a cylinder to be ground, in order to rotate it, characterized in that said piece-holder head (13) and said tailstock centre (12) can be translated with respect to said base (11).
- 20 6. The grinding machine (10) according to the previous claim, wherein said piece-holder head (13) and

said tailstock centre (12) are coupled with moving means to allow their linear translation for their reciprocal approach or withdrawal.

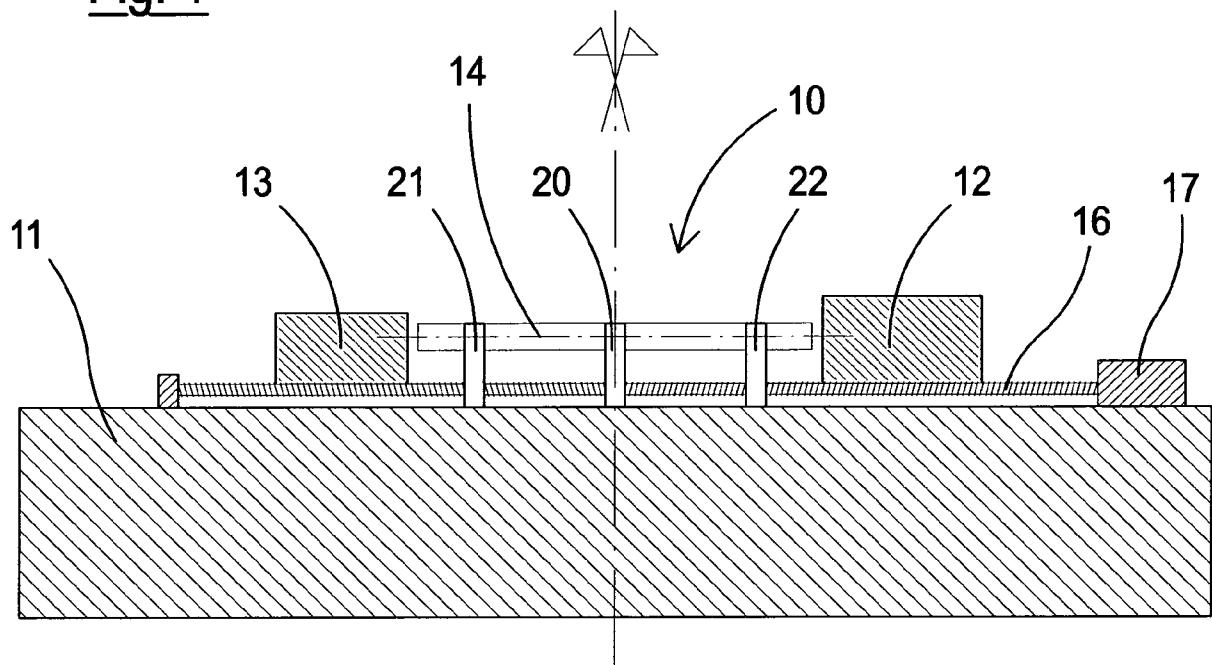
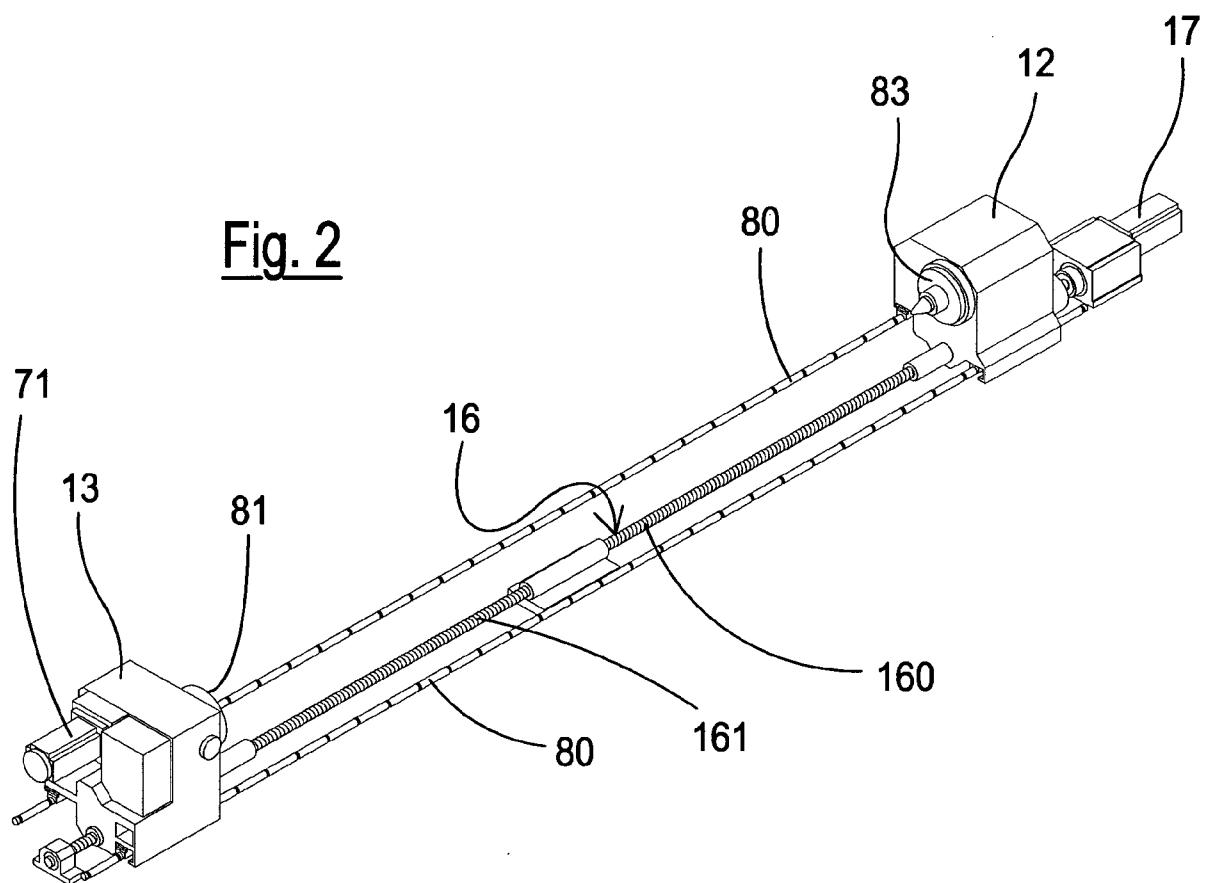
7. The grinding machine (10) according to the 5 previous claim, wherein said moving means are suitable for allowing the movement of said piece-holder head (13) and said tailstock centre (12) in the same direction, of the same entity and in opposite senses.

8. The grinding machine (10) according to claims 6 10 or 7, wherein said moving means comprise an endless screw (16) coupled with the piece-holder head (13) and tailstock centre (12), said screw (16) preferably being composed of a single piece and comprising two threaded parts (160,161), with a discordant, helicoidal 15 threading.

9. The grinding machine (10) according to one or more of claims 5 to 8, also comprising a lunette (20) for central contrast and at least two side lunettes (21, 22) for the contrast and/or supporting of said 20 cylinder, said central lunette (20) being positioned in an equidistant position from said piece-holder head (13) and said tailstock centre (12).

10. The grinding machine (10) according to claim 9, wherein said moving means for the head (13) and

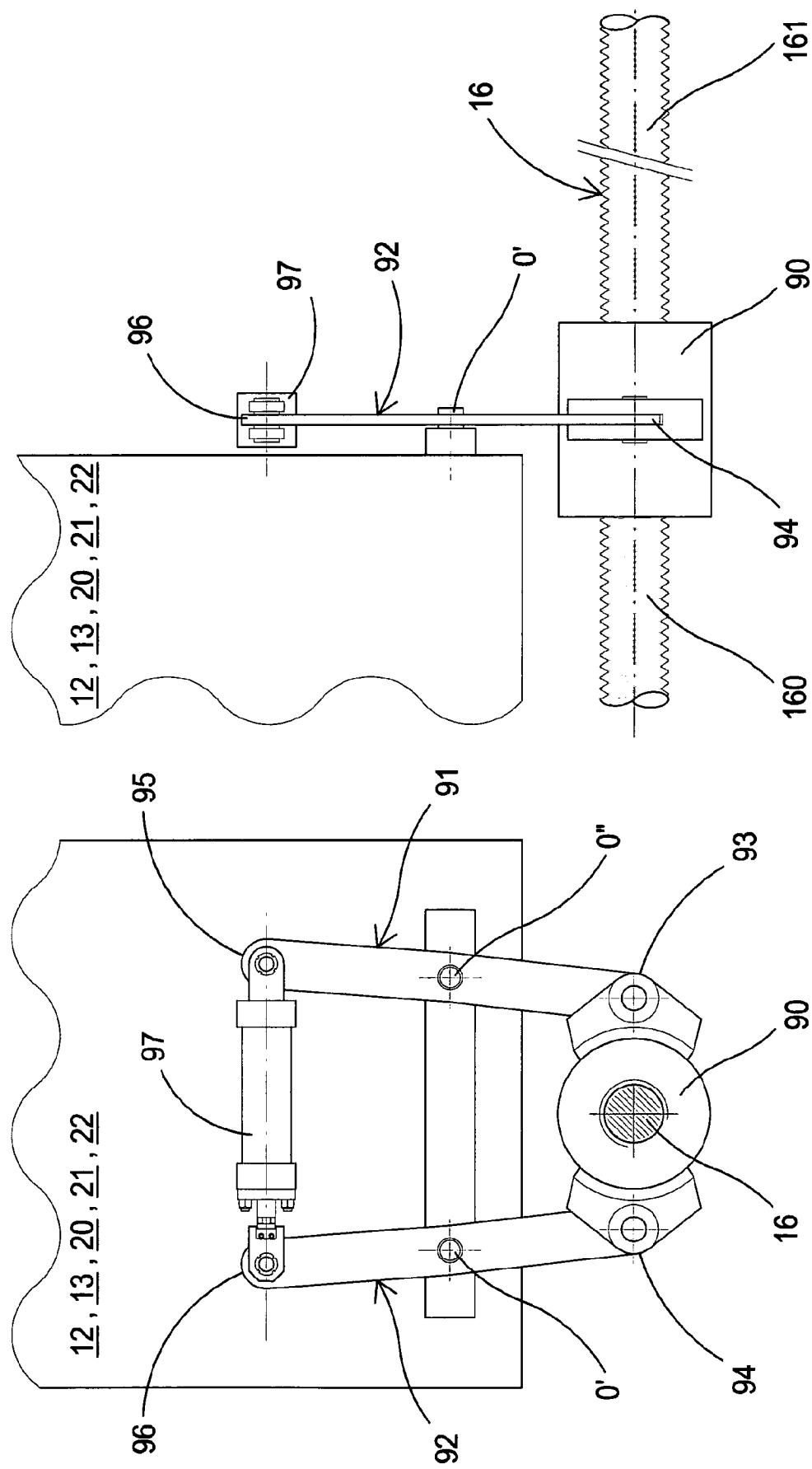
tailstock (12) are coupled with said side lunettes (21, 22), for determining a reciprocal movement in the same direction, of the same entity and in opposite senses.

Fig. 1Fig. 2

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Fig. 3

Fig. 4



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/006359

A. CLASSIFICATION OF SUBJECT MATTER
INV. B24B5/04 B24B41/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B24B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2005 262342 A (TOYODA MACHINE WORKS LTD) 29 September 2005 (2005-09-29) paragraphs [0030] - [0042] figure 3 abstract -----	1-10
X	GB 2 283 192 A (WESTERN ATLAS UK LTD [GB]) 3 May 1995 (1995-05-03) abstract -----	1-10
X	JP 2005 169530 A (NISSAN MOTOR) 30 June 2005 (2005-06-30) paragraphs [0027] - [0030] figure 1 -----	1-10
X	US 4 221 080 A (FAVROT PAUL) 9 September 1980 (1980-09-09) column 2, line 52 - column 4, line 42 ----- -/-	1-10

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 April 2012	12/04/2012

Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Eder, Raimund
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INTERNATIONAL SEARCH REPORTInternational application No
PCT/EP2011/006359

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 142 977 A (RICHARD FARREN; JAMES WOLSTENHOLME) 20 May 1920 (1920-05-20) page 2, lines 22-31 -----	8

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2011/006359

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