

[54] **RING ROLLING MILL**

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[58] Field of Search..... 72/10, 17, 19, 84, 105,
72/106, 107, 110; 29/148 AR

[56] **References Cited**

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Primary Examiner—Lowell A. Larson

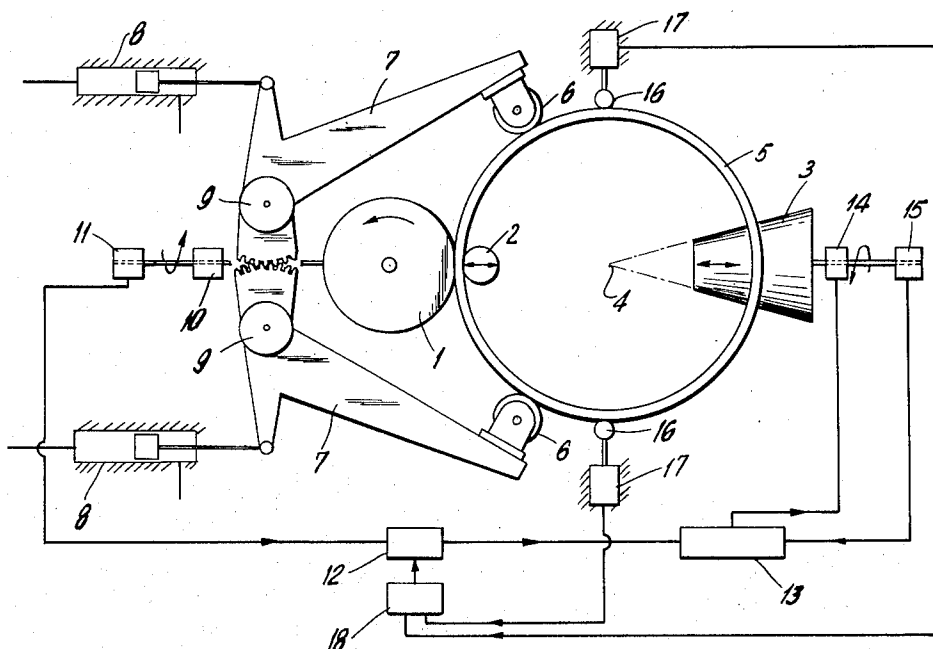
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[57]

ABSTRACT

A ring rolling mill has a pair of radial rolls acting on a workpiece ring by engaging radially opposite peripheries thereof, and a pair of axial rolls, which are preferably truncated conical rolls, acting axially on the ring by engaging axially opposite end surfaces thereof. The two rolls of each pair are adjustable toward each other and at least one roll of each pair is driven by associated adjustable speed driving means. One driving means is adjustable to a preselected nominal peripheral speed of the roll driven thereby, and a control adjusts the other driving means to set the peripheral speed of the roll driven thereby in accordance with the peripheral speed of the roll driven by the one driving means. Sensors engageable with the ring detect power transmission, through the ring, between the two driving means, and a second control is operable, responsive to detection of such power transmission by the sensors, to restore the peripheral speeds of the driven rolls into accordance with each other.

17 Claims, 6 Drawing Figures



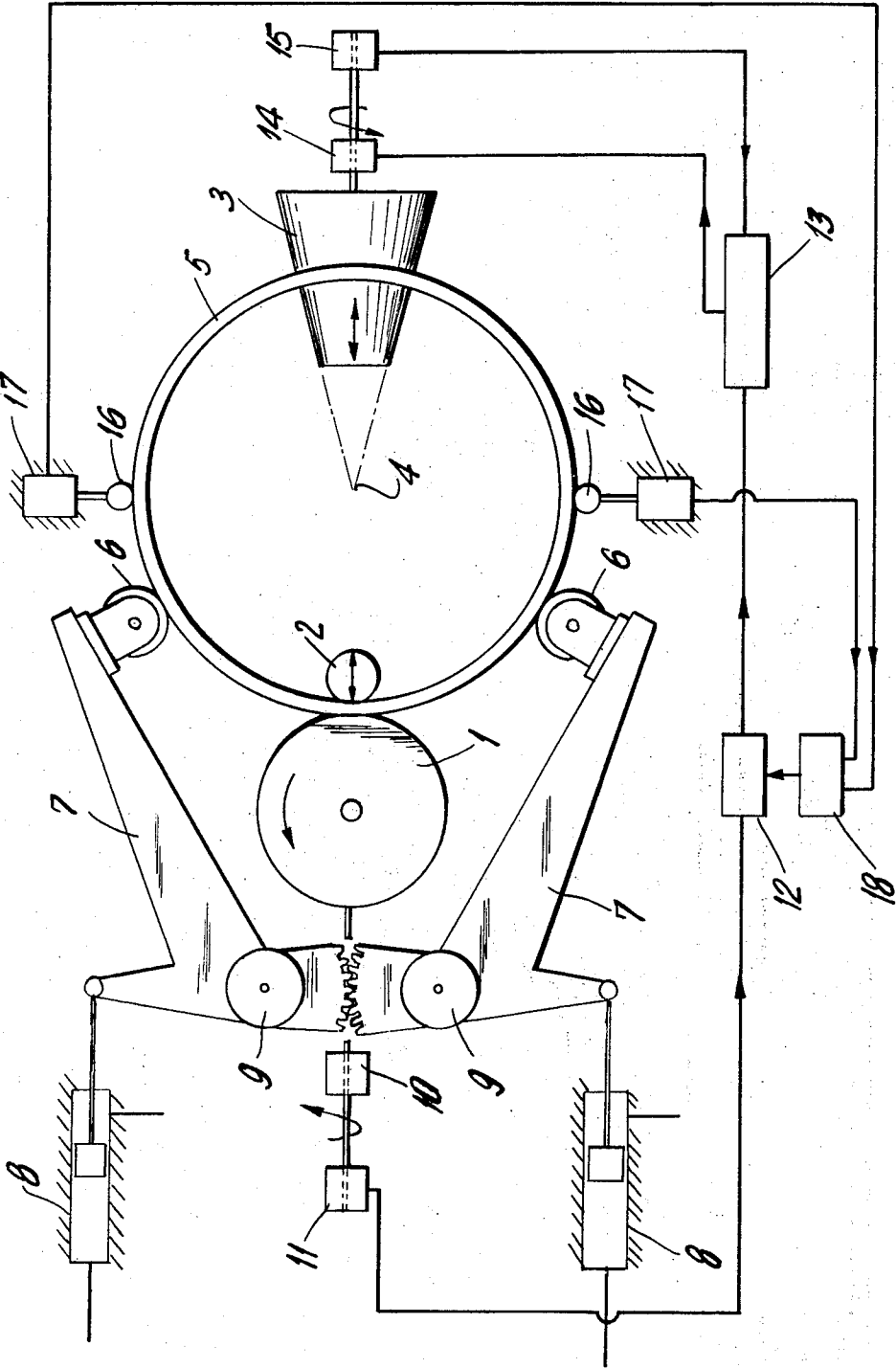


FIG. 1

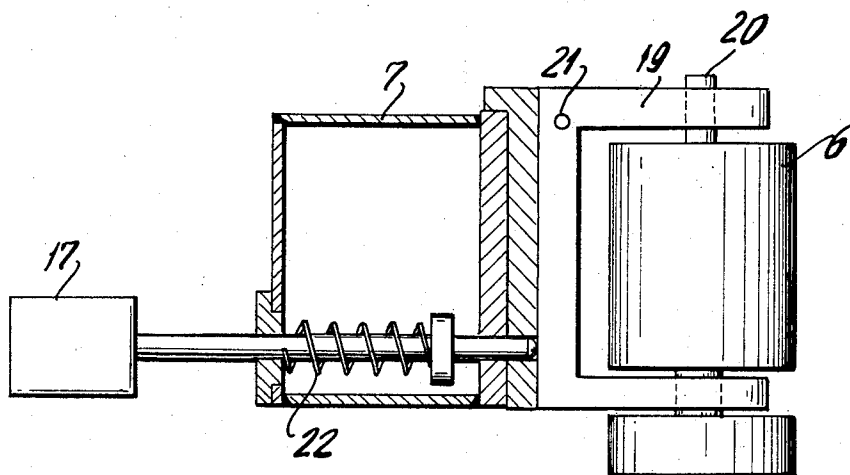


FIG. 2

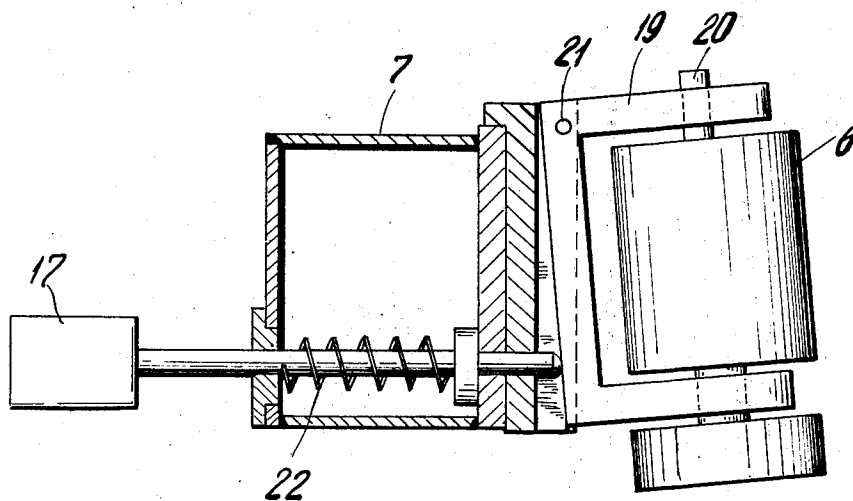


FIG. 3

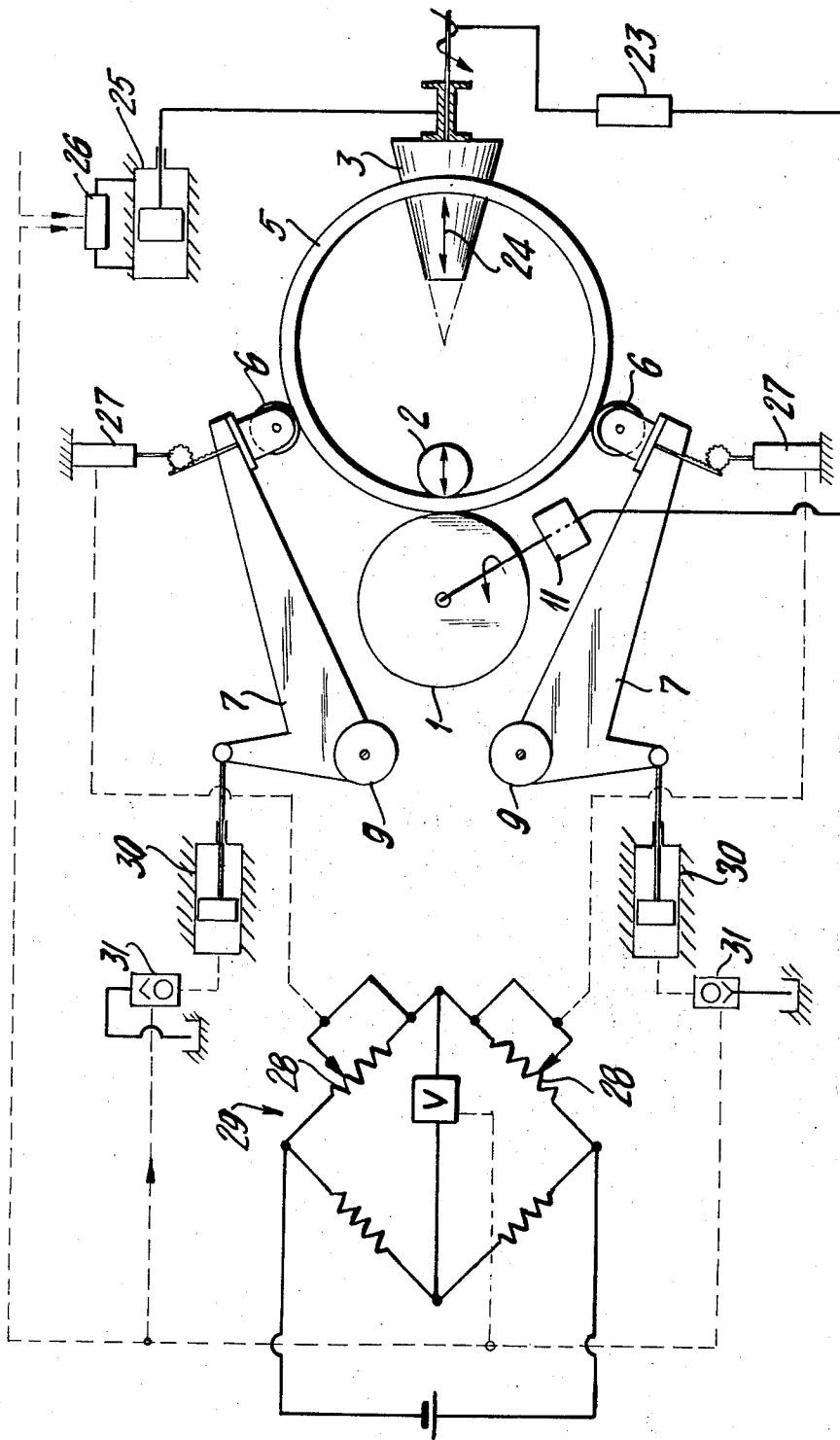


FIG. 4

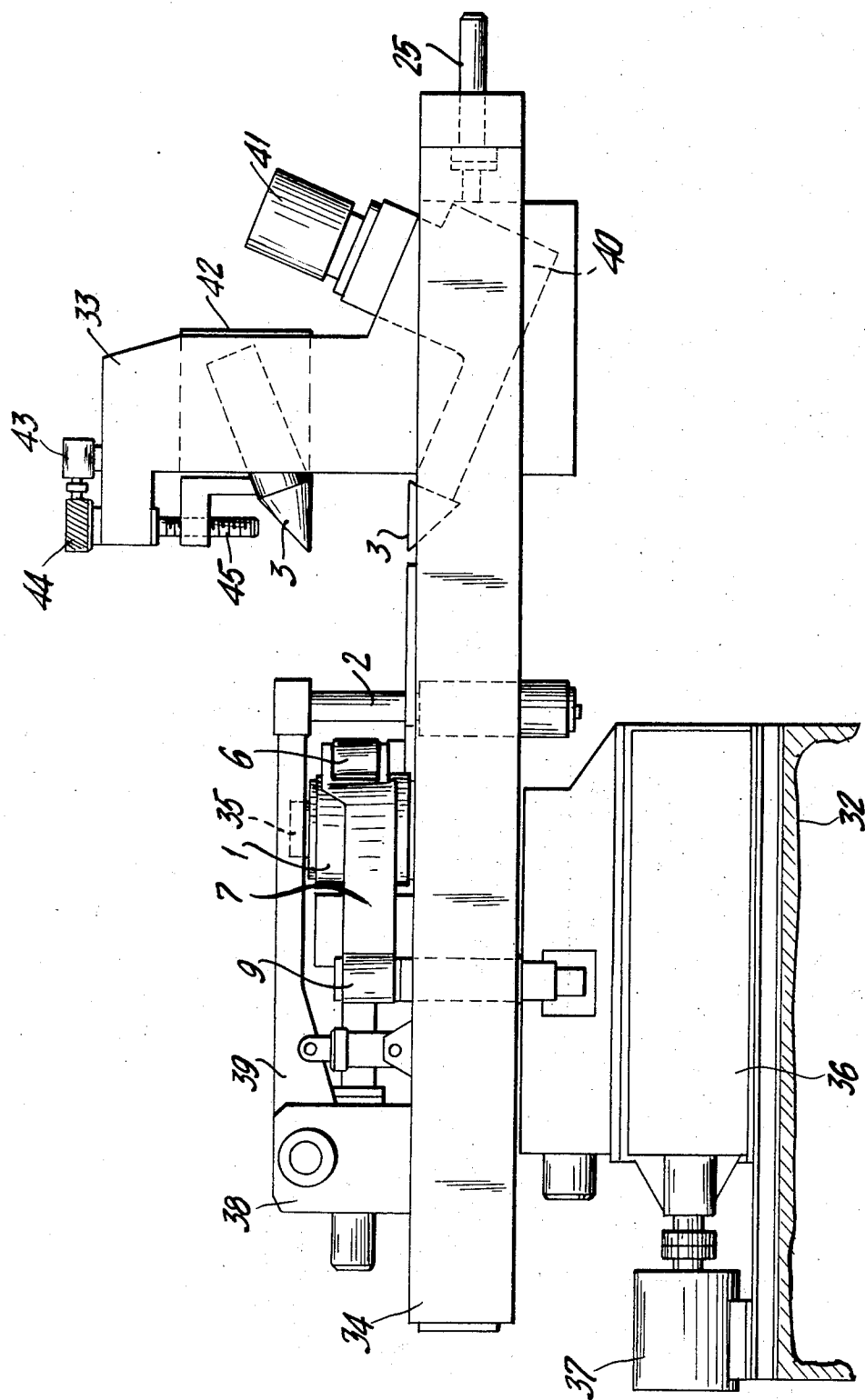


FIG. 5

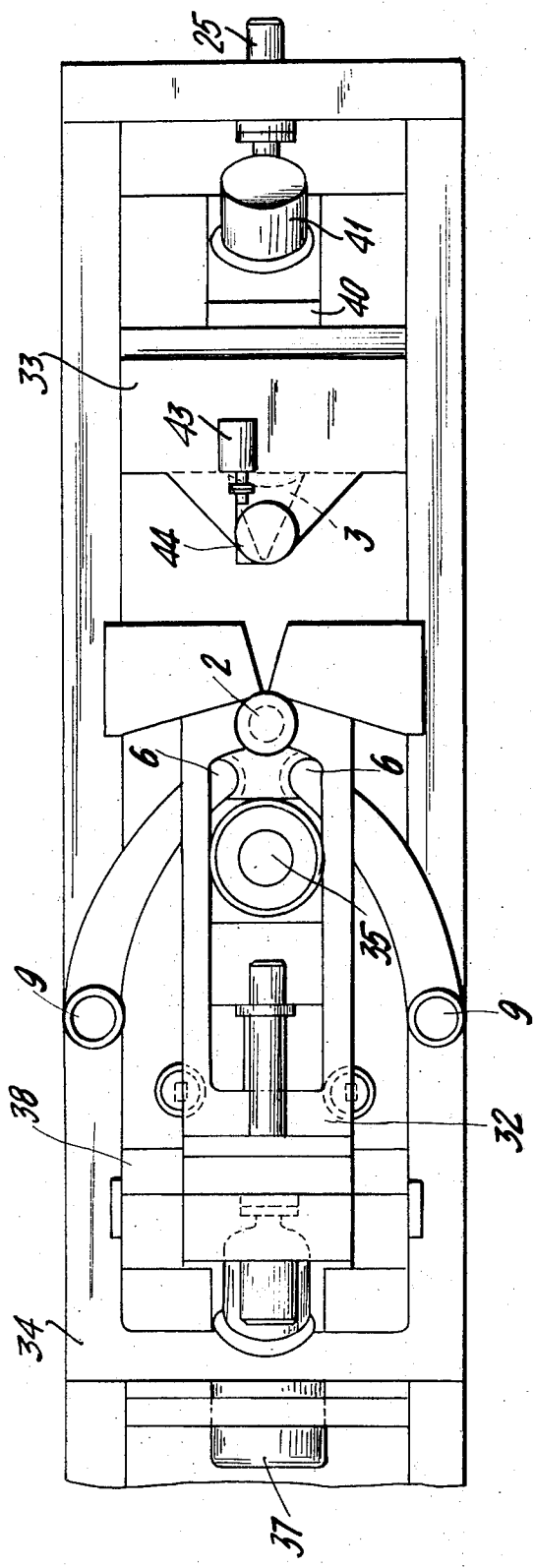


FIG. 6

RING ROLLING MILL

FIELD AND BACKGROUND OF THE INVENTION

This invention relates to a ring rolling mill including a pair of radial rolls acting on a workpiece ring by engaging radially opposite peripheries of the ring and a pair of axial rolls, which are preferably truncated conical rolls, acting axially on the ring by engaging axially opposite end surfaces thereof, with the rolls of each pair being adjustable toward each other and at least one roll of each pair being driven.

Such four-roll ring rolling mills are used to roll out, by radial expansion under a press or a hammer, ring blanks produced from ingots by upsetting and punching, to form rings of rectangular or profiled cross-section. The radial expansion of the ring is effected by the radial roll pair, of which the so-called disc roll is driven and the so-called mandrel, for exerting the radial rolling force, is displaceable relative to the disc roll. The axial rolls, acting on the axially end faces of the ring, serve mostly to calibrate the ring in height, that is, in the axial direction, and to eliminate the constriction of the ring end faces occurring during the rolling process. If, in addition to this, a considerable axial rolling of the ring is to be effected with a high rolling force, there occurs a rather difficult problem that the ring must have, in both roll gaps, identical circumferential speeds, and consequently, the actual speeds of the drives of both roll pairs must be matched within narrow tolerance limits. If this is not achieved, a loop formation, rendering the ring unserviceable, or other ring formations, are inevitable, or at least there occurs, at the rolls, in the case of very form-stiff rings which are adjusted by centering wheels, a slip resulting in considerable load on the roll drives.

An attempt has already been made to avoid, or keep within harmless limits, the roll slip with its disadvantageous consequences for the rolling process and for the work result, by design and by control means. For this purpose, in consideration of the different circumferential speeds on the inner and outer peripheries of the ring, conical axial rolls have been used, and the geometry of the axial rolls, their displacement radially of the ring, and/or their drive speed have been so selected or controlled that, on the basis of the geometric relationships, rolling with little or no slip during the rolling process was to be expected. In this connection, attention is directed to West German Pat. No. 1,188,544 and to German laid open for inspection application No. 1,752,887.

However, such ring rolling mills have not been satisfactory in practice either. Due to the narrow matching tolerances between the roll speeds, because of the flexibility of the roll drives, the influence of the deformation of the ring on the latter's circumferential speed and, in particular, because of the load-dependent contact point displacements in the roll gaps resulting from the respective geometric conditions, difficulties still occur in the known ring rolling mills. These difficulties interfere with the desired progress of the rolling operation in that, from one of the roll grooves, forces act on the ring and which strive to push it out of the normal position determined by the roll grooves and possibly by the centering wheels, that is, the center of the ring in the longitudinal axis of the rolling mill. These forces must

be absorbed by corresponding counter forces of the centering wheels or of the other roll groove. As soon as the moment of these forces subjects the ring to higher stress than the resistance moment of the ring cross-section decreasing during the rolling operation, the increasing lever arm and the strength of the ring material permit, the ring is deformed, sometimes suddenly, to complete uselessness.

SUMMARY OF THE INVENTION

The problem to which the present invention is directed is that of designing a ring rolling mill of the above-mentioned type so that, during the rolling, the rings do not leave their mirror-symmetrical position relative to the longitudinal axis of the ring rolling mill, and the danger of ring deformation can be reliably avoided even if the rings are not very stiff.

The invention is based upon the realization that, for a disturbance-free rolling operation, it is not sufficient to match the speeds of the driven rolls mutually according to the geometric design of the rolls. Instead, it is necessary to effect, during the rolling operation, a correction of the ratio of the roll drive speeds in a manner which corresponds to the conditions of force, friction and contact, varying during the rolling operation. The point of contact between the rolls and the ring end faces depends on the respective rolling force, the geometry of the ring cross-section, the friction value, etc., and shifts, during the rolling operation, in accordance with variations of these factors. When rolling with profiled disc rolls, that is, when rolling flanges, contact point shifts result not only in the axial groove but also in the radial groove.

It is a concrete object of the invention, therefore, to provide, by automatic correction of at least one roll drive speed or by corresponding displacement of the conical axial rolls relative to the ring, that the circumferential speeds of the driven rolls of both roll grooves are adapted to each other so that no forces that would disturb the roundness of the ring act on the ring.

In accordance with the invention, the problem is solved in that the drive of one roll pair is adjustable to a selectable nominal speed, a guide control sets the circumferential speed of the other roll pair in accordance with this nominal speed or in accordance with the actual speed to be measured, and one or more sensors, which detect a power transmission from one roll pair to the other roll pair, restore the circumferential speeds of the ring at both roll pairs into coincidence through a control or regulating device.

The ring rolling mill embodying the invention may be designed in various embodiments, in particular with respect to the form of the sensors and the setting members for the regulating device.

When, for example, as a result of a variation of the radial rolling force, a displacement of the contact point toward the outer periphery occurs in a flanged ring, the circumferential speed of the ring at the radial roll pair increases, while it remains unchanged at the axial roll pair. As a result, at constant drive speeds, the ring migrates out of its position of symmetry on one side, and transmits a portion of the drive power of the radial roll pair to the axial roll pair, the portion transmitted depending on the respective conditions. To avoid this, there may be provided, in a ring rolling mill embodying the invention, two sensors, in particular two feeler wheels bearing against the outer circumference of the

ring, which detect the position of the two circumferential points of the ring perpendicular to the common axial plane of the two radial rolls. Lateral migration of the ring causes unsymmetrical deflections of the two sensors which, through a measuring transformer, supply corresponding input signals to the regulating device. As the two sensors pick up at the same time, directly or indirectly, the ring diameter and thus also its diameter increase during rolling, the signals associated with the sensors can be used additionally for displacing the axial roll pair in accordance with the ring diameter increase, preferably so that the cone tips always lie on the central axis of the ring or in the close vicinity thereof. If the central axis of the ring is to remain stationary during rolling, the sensors can further effect a displacement of the radial roll pair corresponding to the increase in the ring size.

Ring rolling mills often are provided with two centering wheels which are arranged in mirror-symmetrical relation to the plane defined by the axes of the two radial rolls, and which bear against the outer circumference of the ring. In accordance with the invention, one or both centering wheels may be designed as sensors, preferably so that the centering wheels pick up the displacing force of the ring exerted on the centering wheels. This can be attained, for example, by providing a centering wheel suspension which is rotatable about a pivot axis arranged normal to the centering wheel axis and counter to the action of a spring member, and that the displacement of the member is an input quantity for a measuring transformer of the regulating device.

The centering wheels bear against the outer circumference of the ring, so that the displacing force of the ring, as its diameter increases, loads the spring members of both centering wheels uniformly. Lateral migration of the ring causes opposite load variations of the spring members, so that either by absolute measurement or by relative measurement a control signal is available for the regulating device.

Instead of the mentioned steady regulation by means of measuring transformers, an unsteady regulation may be provided in that each of the two centering wheels, designed as a sensor, acts on a respective single setting member, so that, upon unsymmetrical actuation due to the ring position having become unsymmetrical, the setting members effect, through a control device, either a corresponding variation of the speed of one driven roll or a displacement of the conical axial rolls relative to the ring.

In a ring rolling mill embodying the invention, alternatively only one centering wheel may be provided, preferably on that side of the ring rolling mill from which the ring enters the radial roll pair, because the drive and friction forces transmitted to the ring by the radial rolls exert a moment which strives to pivot the ring toward this side.

A ring rolling mill embodying the invention, in fact, makes possible so exact a matching as to identical circumferential speeds of the ring at both roll pairs that additional centering of the ring with two centering wheels, and possibly high bearing pressure, may not be necessary.

Different circumferential speeds of the ring at the two roll pairs, for example, because of insufficient matching of the roll speeds, causes, in particular in the case of stiffer rings, a transmission of drive power from one roll pair to the other. In accordance with the inven-

tion, this can be avoided when the drive motor of each of the two roll pairs has associated therewith a measuring device which picks up the electrical effective power used by the motors. By comparison of the output signals of both measuring devices, a control signal can be obtained and expresses deviations from the nominal value, for example, of the numerical ratio of the two drive powers, and can annul undesired, non-static processes.

In the ring rolling mill, there may be arranged also, on at least one of the two roll pairs, a measuring device for picking up the effective electric power of the drive motor and another measuring device for picking up the rolling force. By comparison of the output signals of the two measuring devices, there is again available a control signal which, upon a deviation from the nominal value, indicates an undesired state of the rolling operation, and which consequently can be used for a corresponding correction of the factors involved. In ring rolling mills, it is desirable to transfer as high as possible a share of the drive power into shaping power acting on the ring. If the particular ratio between drive power and rolling force is disturbed, for example, due to contact point displacement in the roll gap because of lateral migration of the ring and power transmission from one roll drive to the other, then this disturbing quantity is picked up by the control. The necessary correction of the selectable factors for the state of the rolling mill can be effected in various ways. In one embodiment of the invention, the regulating device comprises a setting member whose value influences the speed of the drive of one roll pair. For this purpose, the regulator may be designed so that its output signal is supplied as a correction factor to that part of the apparatus with which the basic matching of the speeds of the two roll pairs is selectably set and automatically varied as the rolling operation progresses.

Alternatively, the regulating device may comprise a setting member which effects a displacement of the axial roll pair relative to the ring. In this case also, the regulator is advantageously designed so that its output factor serves as a correction signal for that apparatus part which controls the shift drive of the axial roll pair when the latter is shifted outwardly following the increasing ring diameter.

The regulating device also may comprise one or two setting members which influence the rolling force exerted on the ring by one or both roll pairs. Such a regulated variation of the rolling force makes it possible to annul or to render harmless an undesired contact point displacement which would cause a lateral migration of the ring and power transmission between the two drives.

An object of the invention is to provide an improved ring rolling mill.

Another object of the invention is to provide such a ring rolling mill in which, during rolling, the rings do not leave their mirror-symmetrical position relative to the longitudinal axis of the ring rolling mill.

A further object of the invention is to provide such a ring rolling mill in which the danger of ring deformation can be avoided reliably even if the rings are not very stiff.

For an understanding of the principles of the invention, reference is made to the following description of typical embodiments thereof as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 somewhat diagrammatically illustrates, in principle, the construction of a ring rolling mill embodying the invention, and in which the speed of the axial rolls is regulated;

FIGS. 2 and 3 are part sectional and part elevational views illustrating details of the centering wheels in a modified embodiment;

FIG. 4 is a view similar to FIG. 1 illustrating regulated displacement of the axial roll pair;

FIG. 5 is a side elevation view illustrating the mechanical construction of a ring rolling mill embodying the invention, with the control means omitted; and

FIG. 6 is a top plan view corresponding to FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1, the ring rolling mill shown therein comprises a pair of radial rolls consisting of a disc roll 1 and a mandrel 2 which is adjustable relative to disc roll 1. Opposite the pair of radial rolls, there is a pair of axial rolls consisting of two rolls 3 of truncated cone form, of which the lower conical roll is driven while the upper conical roll, which has not been shown, runs along and is adjustable relative to the lower roll. In order that, with disc roll 1 held fixed in the roll stand, the cone tips 4 of conical rolls 3 can be maintained always on the center axis of the ring as the diameter of the ring increases, and so that thus also rings can be rolled out whose final radius is greater than the generatrix of conical rolls 3, the pair of conical rolls is mounted to be horizontally displaceable in the roll stand. This has not been specifically shown in FIG. 1. Alternatively, for sufficiently long cones, conical rolls 3 may be arranged fixed in the roll stand and radial roll pair 1, 2 may be displaceable outwardly in the roll stand as the ring diameter increases.

The rolling mill has two centering wheels 6 rotatable on pivot arms 7 arranged mirror-symmetrically to the common axial plane of radial rolls 1 and 2, and which are pressed against the outer periphery of ring 5 so that, upon increase of the ring diameter, wheels 6 are moved outwardly counter to the action of the pistons of hydraulic systems 8, by pivoting of arms 7 about fixed pivot axes 9. On the shaft of drive motor 10 connected to disc roll 1, there is arranged a tachometer generator 11 whose output voltage is proportional to the actual speed of disc roll 1 and influences, through a control device 12, the nominal value of speed regulator 13 for drive motor 14 of lower conical roll 3. On the shaft of drive motor 14, a tachometer generator 15 is arranged, whose output voltage is proportional to the actual speed of conical roll 3 and which may cause a speed correction through speed regulator 13.

Two sensors 16 with respective measuring transformers 17 are designed as feeler wheels engaging the outer circumference of the ring, and these sensors sense a diameter or a chord of the ring perpendicular to the common axial plane of radial rolls 1 and 2. The ring diameter-dependent output value of a control device 18 connected to measuring transformers 17 represents a second control quantity for control device 12 for influencing the speed of drive motor 14 of conical roll 3. Thus, the basic matching of the two speeds, as a function of the actual speed of disc roll 1 and of the relative posi-

tion between ring 5 and conical rolls 3, is made feasible.

If ring 5 leaves its symmetrical centered position by migrating, for example upwardly in FIG. 1, because, in the pair of radial rolls 3, a contact point shift increasing the circumferential speed of the ring at an unchanged actual speed of disc roll 1, has occurred, then upper sensor 16 is deflected outwardly while lower sensor 16 follows the ring circumference inwardly. Control device 18 then generates, from the signals of the two measuring transformers 17, a difference signal which, through control device 12, so influences the nominal value for speed regulator 13 that the speed of lower driven conical roll 3 is increased by an adequate amount and thus the ring is brought back to its central position. Control device 12 includes an electrical holding member so that the disappearance of the difference voltage of control device 18, connected with the return of the ring to its centered position, again causes a change of speed of the conical rolls. Only after a renewed migration of the ring upwardly, or in the opposite direction downwardly, has occurred, is the output of control device 12 again influenced by a difference signal of control device 18 building up, and the speed of drive motor 14 of conical roll 3 is corrected accordingly.

In another embodiment of the invention, the centering wheels 6 are designed as sensors so that sensors 16 of the arrangement of FIG. 1 becomes superfluous. As shown in FIGS. 2 and 3, the suspensions 19 of centering wheels 6 are pivotable about respective pivot axes 21 of pivot arms 7 normal to centering wheel axes 20. This pivoting is opposed by spring members 22, whose displacement constitutes and input value for the respective measuring transformer 17 of the regulating device. The spring force of members 22 can be relatively small so that, as the ring grows or expands radially in its centered position, each suspension 19 applies against the lateral wall of the pivot arm 7 toward centering wheel 6, and the contact pressure of the centering wheels is determined by the hydraulic systems 8 of FIG. 1. If the ring migrates unilaterally upwardly, as viewed in FIG. 1, then the upper centering wheel 6 remains in its normal position supported against the wall of pivot arm 7, while the lower centering wheel 6 pivots outwardly. As a result, difference signals are available at measuring transformers 17, and these are used for the correction of the speed of one roll drive through the regulating device in the manner already described in connection with FIG. 1. For axial rolls fixed in the longitudinal direction of the rolling mill, scanning of the instantaneous ring diameter is dispensed with. Due to the increase in ring diameter, the ring migrates outwardly between the conical rolls 3, with the result that, starting from the initial basic matching of the speeds, the drive speed of the conical rolls 3 must be continuously reduced in an adequate manner. For this continuous speed reduction, there is again used the unilateral migration of ring 5.

In the ring rolling mill shown in FIG. 4, the basic matching of the speed of the two roll drives again is effected in that the output voltage of the tachometer generator 11, proportional to the actual peripheral speed of disc roll 1, is used with the aid of the speed regulating device 23, not shown in detail, for the basic matching of the roll drives. The conical rolls 3 are guided, for longitudinal displacement, in a slide in the roll stand,

this being indicated only by the double arrow 24 in FIG. 4. This longitudinal displacement of conical rolls 3 occurs, in a manner known per se and not illustrated in detail, by a setting member, for example, a hydraulic system 25 which is actuated by a control device, for example, a follow-up regulator 26, so that conical rolls 3 shift in the direction of the double arrow 24 in accordance with the respective ring diameter. The guide value for the position regulating circle of the conical roll displacement may be the signal of a device not shown, but known in itself, influenced by the ring diameter, such as a feeler wheel or the like or, alternatively, the deflection of the sensors 27 mentioned hereinafter.

Through pivot arms 7 of centering wheels 6, there are actuated two sensors 27 with associated respective measuring transformers 28, which pick up the position of the centering wheels 6. The two measuring transformers 28 of this position measuring unit are branches of a measuring bridge 29. With the pivot arms 7 of centering wheels 6, in this case acting as measuring sensors, there are engaged respective hydraulic systems 30 with adjustable throttles 31. At a diameter increase in the symmetrical ring position, sensors 27 provide identical control signals, so that measuring bridge 29 remains tuned and the two throttles 31, controlled by the voltage in a neutral branch of measuring bridge 29, maintain the coincident state. Both throttles 31 are open to a large degree, so that the contact pressure of centering wheels 6 at ring 5 is accordingly low.

If the ring migrates out of the symmetrical position unilaterally, then sensors 27 cause a detuning of measuring bridge 29 proportional to the migration as to direction and magnitude. The voltage in the neutral branch of measuring bridge 29 is used for controlling throttles 31. The passage resistance of that throttle 31 associated with the centering wheel 6 which receives an additional deflection by the migration of ring 5 is increased. Thereby, the pressure of this centering wheel 6 against the ring is adequately increased and a corresponding force is exerted on the ring. Above all, however, the voltage in the neutral branch of measuring bridge 29 is supplied, as an additional guide or control value, to the followup regulator 26 for the displacement of conical rolls 3 in the direction of double arrow 24. The signal from the neutral branch of measuring bridge 29 is superimposed on the signal which effects displacement of the conical rolls 3 in dependence only on the ring diameter. The signal resulting from the superposition is the total guide value for the position control circuit of the conical roll displacement. In this way, the signal in the neutral branch of measuring bridge 29 effects a return of the ring to its central position, by variation of the peripheral speed of the driven conical roll 3 counter to or codirectionally with the ring growth. It is thus readily possible to bring the peripheral speed of ring 5 at the roll pairs 1, 2 and 3, 3 into coincidence with one another within narrow limits so extensively that, during rolling, ring 5 migrates only slightly to either side, and the danger of ring deformations is practically eliminated.

FIGS. 5 and 6 illustrate the mechanical structural design of a ring rolling mill shown diagrammatically in FIG. 4, the means, in accordance with the invention, for the control of the rolling mill and of the ring to be rolled being omitted for greater clarity. The rolling mill comprises the horizontal roll stand 32 and the vertical

edging stand 33. In mill frame 34, common to both stands, the kingpin 35, with disc roll 1, is mounted fixedly and is driven by an electric motor 37 through a transmission 36. Opposite disc roll 3 and displaceable relative to this disc roll, the mandrel roll 2, which is not driven, is mounted in a hydraulic slide 38 which is adjustable. At its upper end, mandrel 2 is supported by the hydraulically raisable and lowerable frame type bracket 39. The two centering wheels 6 are rotatable in pivot arms 7 which are swingable about pivot axes 9, so that centering wheels 6 can be applied against the ring to be rolled, which has not been shown in FIGS. 5 and 6. Edging stand 33 is arranged for horizontal displacement in slideways along frame 34, with such displacement being effected by means of a double-acting hydraulic system 25. In the power part of edging stand 33, lower conical roll 3 is fixedly mounted and is driven by an electric motor 41 through a fixed transmission 40. The transmission and motor are so designed that the speed of lower conical roll 3 can be regulated so that the peripheral speed of this conical roll can be adapted continuously to the rolling speed of the disc roll 1 over the entire length of its conical surface. The upper conical roll 3 is mounted freely rotatable in a slide 42, which can be positioned in the axial direction of the workpiece ring to be rolled, through a worm gear 44, driven by a motor 43, and a worm drive 45. Additionally, slide 42 can be also lowered hydraulically, which has not been shown, to exert a vertical rolling force axially of the ring.

The ring rolling mill of FIG. 1 is designed, in its mechanical construction, substantially the same way as that shown in FIGS. 5 and 6, with differences in certain parts.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In a ring rolling mill including a pair of radial rolls acting on a workpiece ring by engaging radially opposite peripheries of the ring, and a pair of axial rolls, which are preferably truncated conical rolls, acting axially on the ring by engaging axially opposite end surfaces thereof, the two rolls of each pair being adjustable relatively to each other and at least one roll of each pair being driven, the improvement comprising, in combination, respective adjustable speed driving means for each pair; means operable to adjust one driving means to a preselected nominal peripheral speed of the associated driven roll; first control means operable to adjust the other driving means to set the peripheral speed of the driven roll associated with said other driving means in accordance with the peripheral speed of the roll driven by said one driving means; sensor means operable to detect power transmission, through the ring, between said driving means; and second control means operable, responsive to detection of such power transmission by said sensor means, to restore the peripheral speeds of said driven rolls into such accordance.

2. In a ring rolling mill, the improvement claimed in claim 1, in which said sensor means comprises two sensors determining the position of two circumferential points of the ring at opposite ends of a line extending

across the ring perpendicularly to the common axial plane of said two radial rolls.

3. In a ring rolling mill, the improvement claimed in claim 2, in which said two sensor means are two feeler wheels engaging the outer surface of the ring.

4. In a ring rolling mill, the improvement claimed in claim 1, including two centering wheels arranged mirror-symmetrically to the common axial plane of said two radial rolls and engaging the outer periphery of the ring; at least one centering wheel constituting a sensor sensing the displacement force of the ring exerted thereon.

5. In a ring rolling mill, the improvement claimed in claim 4, in which both centering wheels are designed as sensors sensing the displacement force of the ring exerted on the centering wheels.

6. In a ring rolling mill, the improvement claimed in claim 5, including a respective suspension rotatably mounting each centering wheel; means mounting each suspension for swinging about a pivot axis spaced from the axis of the associated centering wheel; a spring biased member engaging each suspension and biasing the suspension to rotate about its pivot axis in a direction to maintain the associated centering wheel in engagement with the periphery of the ring; and a respective measuring transformer associated with each centering wheel and forming part of said second control means; the displacement of each spring biased member providing the input value for the associated measuring transformer.

7. In a ring rolling mill, the improvement claimed in claim 6, in which each said pivot axis extends perpendicularly to the axis of the associated centering wheel.

8. In a ring rolling mill, the improvement claimed in claim 6, in which each pivot axis extends parallel to the axis of the associated centering wheel.

9. In a ring rolling mill, the improvement claimed in claim 5, including a respective switch element operatively associated with each centering wheel; and a control device connected to said switch elements; said switch elements producing a signal in said control device responsive to unsymmetrical actuation of said

switch elements.

10. In a ring rolling mill, the improvement claimed in claim 9, in which each switch element is a pressure switch actuated upon contact of the associated centering wheel with the ring.

11. In a ring rolling mill, the improvement claimed in claim 1, including a single centering wheel engaging the outer periphery of the ring and positioned at that side of the ring rolling mill from which the ring enters between the rolls of said pair of radial rolls.

12. In a ring rolling mill, the improvement claimed in claim 1, in which each driving means includes a respective electrical motor; and a respective measuring device operatively associated with each electric motor and detecting the effective electric power drawn by the associated motor.

13. In a ring rolling mill, the improvement claimed in claim 1, in which each driving means includes a respective electric motor; a respective measuring device operable to detect the effective electric power drawn by each motor; and a respective measuring device at each pair of rolls operable to sense the rolling force thereof.

14. In a ring rolling mill, the improvement claimed in claim 1, in which each driving means includes a respective electric motor; said second control means including a setting member whose setting value influences the speed of the drive motor of one pair of rolls.

15. In a ring rolling mill, the improvement claimed in claim 1, in which said second control means includes a setting member operable to effect axial displacement of said conical axial rolls relative to the ring.

16. In a ring rolling mill, the improvement claimed in claim 1, in which said second control means comprises at least one setting member influencing the rolling force exerted on the ring by at least one of said pairs of rolls.

17. In a ring rolling mill, the improvement claimed in claim 1, in which said second control means comprises two setting members each influencing the rolling force exerted on the ring by a respective one of said pairs of rolls.

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