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Metzger

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[54] ROLLING MILL OR CALENDAR WITH CROWN CONTROL OF THE ROLLS FOR ROLLING FLAT MATERIAL

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[51] **Int. Cl.** **B21b 31/32**

[58] **Field of Search** 72/237, 245, 248

[56] **References Cited**

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3,373,588 3/1968 Stone 72/237

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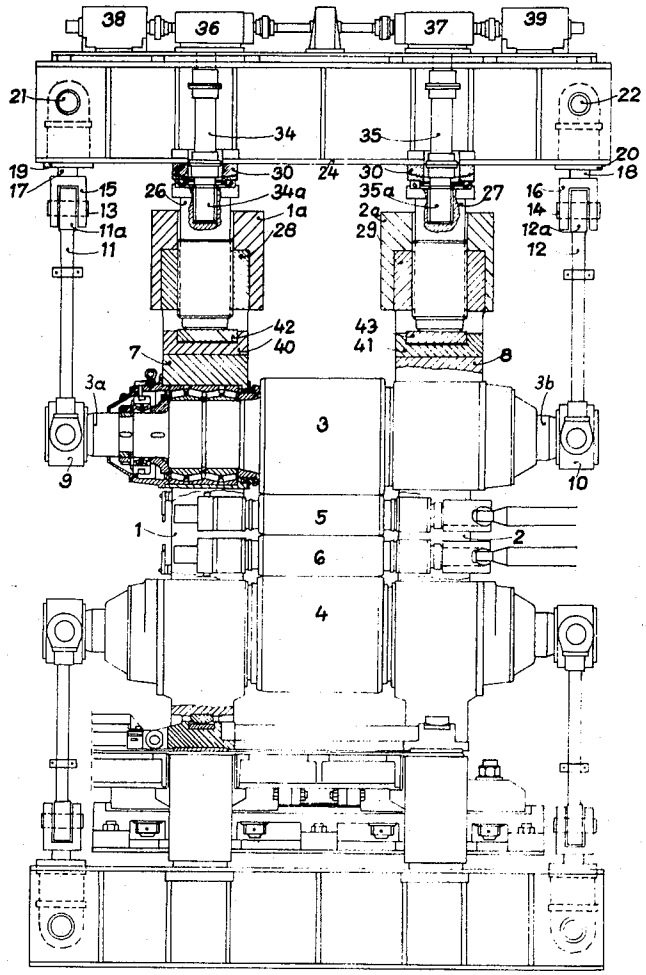
[57] **ABSTRACT**

In a rolling mill or calender for flat material, such as sheets or strips, a bridge member is disposed transversely across the rolling mill frames and is supported by the upper end faces of the screwdown pressure screws and is secured thereto so as to follow the screwdown movement while hydraulic pressure units attached to the bridge member and neck extensions of one of the rolls exert roll bending pressure thereon for the purpose of crown control.

5 Claims, 2 Drawing Figures



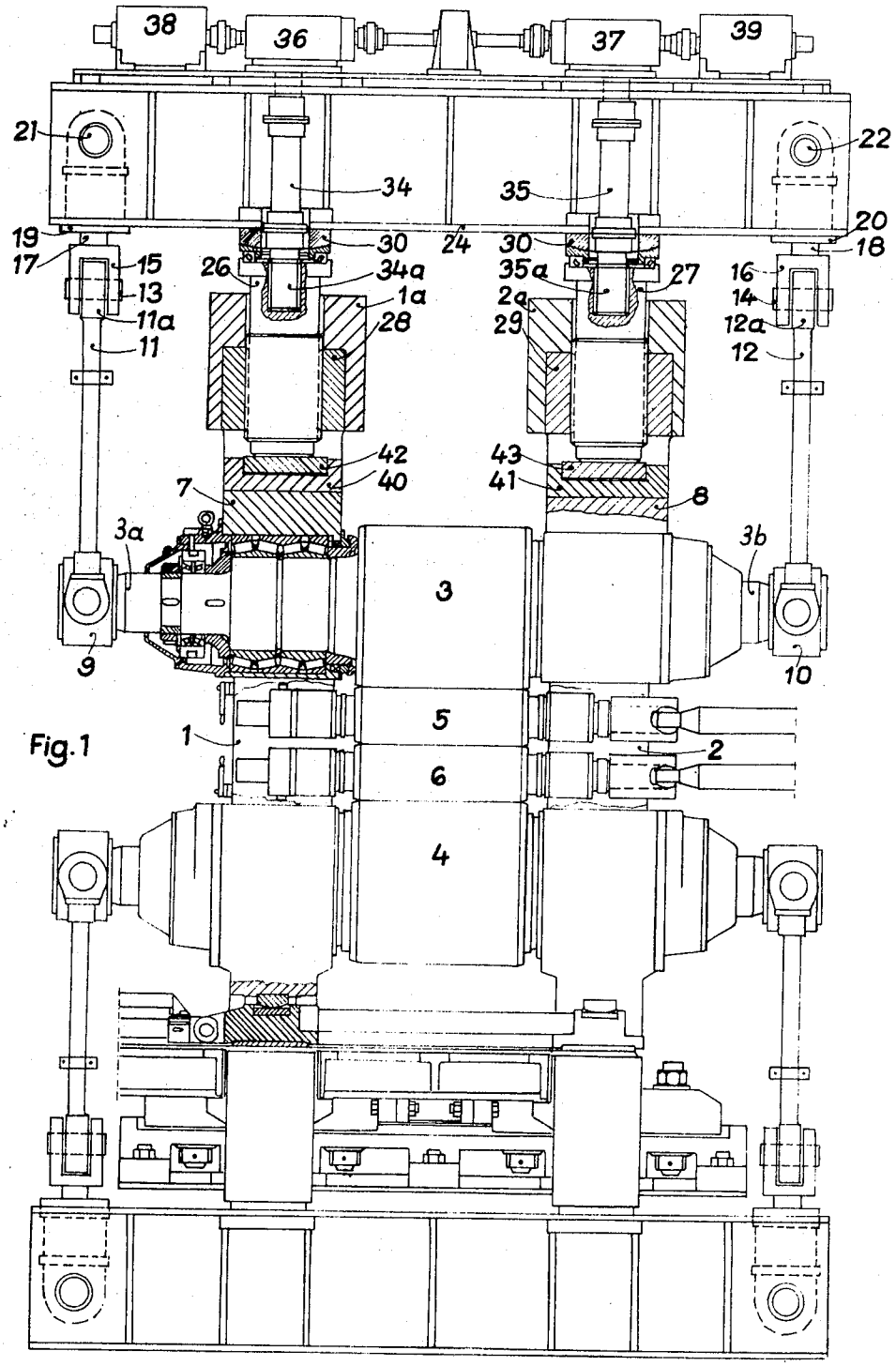

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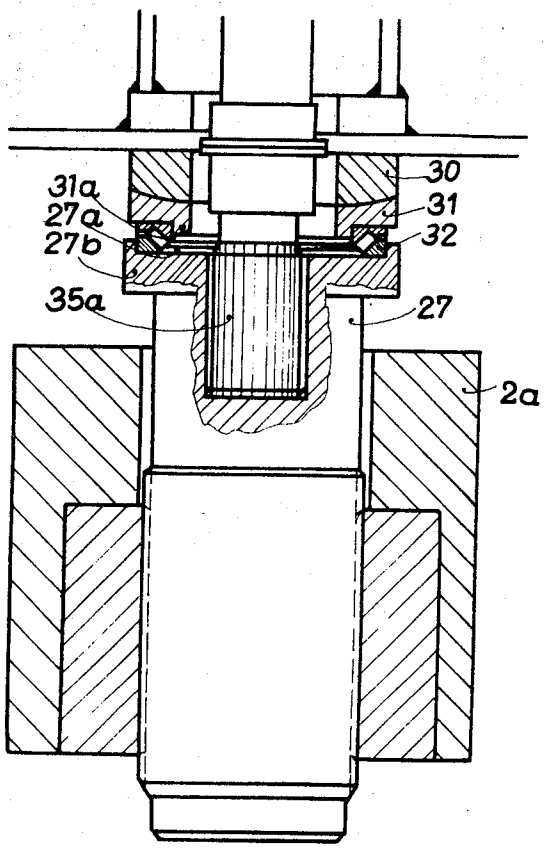
Fig. 1

Fig.2



ROLLING MILL OR CALENDAR WITH CROWN CONTROL OF THE ROLLS FOR ROLLING FLAT MATERIAL

This invention relates to a rolling mill or calender for rolling flat material, in particular sheets and strips, having hydraulic power units which engage the extended necks of a single roll or an outer back-up roll, which change the contour of the roll or rolls and which are supported for each roll on a respective bridge member which links the two rolling mill frames, wherein the bridge member associated with the adjustable upper roll follows the screwdown movements of the screwdown pressure screws. The connection between the hydraulic power units and bridge members or transverse members inserted in window openings of a rolling mill frame was effected for the purpose of keeping the reaction forces which originate from the hydraulic power units when the back up rolls are bent and which are quite considerable in a closed system within the associated rolls and the bridge member, in order that the pressure screws of the screwdown device are free of the bending force (French Pat. No. 1,503,268). The bridge members inserted between the chocks and the upper and lower transverse yokes of the rolling mill frames, however, increase the length of the frame windows and thus also the elongation of the rolling mill frames whereby the elongation property thereof is unfavorably affected. Admittedly fixing the hydraulic power units for crown control of the adjustable upper backing roll to a bridge member is advantageous because the transverse member located below the screwdown pressure screws follows all screwdown movements of the upper set of rolls, so that there is no need for stroke movement within the hydraulic power units when the rolling gap is changed. The hydraulic pressure for counter bending the upper support or back up roll can thus be maintained during screwdown movement.

The invention aims at retaining this advantage for a rolling mill or a calender with pressure screw adjustment, however, without the disadvantage of a change of the elongation length of the rolling mill frames. This object is attained in that the upper bridge member rests on the outer end faces of the pressure screws and is secured in its position relatively to the latter. Thereby the upper bridge member attains a location outside the frame windows and can be dimensioned for any desirable strength, in spite of the fact that it follows the screwdown movement of the pressure screws because it is supported on the upper ends of the latter.

Also the advantage is retained that the screw connection between the pressure screws and the pressure nuts thereof is free of the counter bending forces for the crown control.

The means for securing the position of the bridge member which are necessary because the upper bridge member is disposed above the outer end faces of the pressure screws, consist preferably of a centering device between the outer ends of the pressure screws and pressure members of the bridge member resting thereon.

Since a certain amount of bending of the upper bridge member under the reaction force of the hydraulic power units cannot be avoided, the invention proposes further that each pressure member is in two parts and consist of an upper hemispherical member which is attached to the bridge member and a lower cup shaped member. Thereby the respective cooperating parts of the pressure member can move relatively to each other when the upper bridge member is bent, in such manner that the rolling mill frames need not absorb any laterally directed forces which would bend them away from their upright parallel position.

In order to reduce friction between the upper or outer end faces of the pressure screws and the bridge member or the upper pressure members thereof, the upper bridge member is supported on each pressure screws by a roller thrust bearing.

The drive for rotating the pressure screws may be of any desirable kind. According to a further development of the invention, however, the end faces of the pressure screws supporting the bridge member are of a ring-shaped construction

and the pressure screws are driven through splined shafts by drives which are carried by the bridge member.

In this manner the rolling mill frames are relieved of their task to carry the drives for rotating the pressure screws, whereby they can be constructed more simply.

One embodiment of a four-high cold rolling mill is described below by way of example with reference to the accompanying drawings, in which:

FIG. 1 illustrates a side view of the rolling mill in the direction of rolling, partly in section, and

FIG. 2 is an enlarged illustration of the support of the upper bridge member on one of the two screwdown pressure screws.

A rolling mill comprises two rolling mill frames **1** and **2** and has a pair of outer back-up rolls **3,4** as well a pair of working rolls **5, 6**. The upper back-up roll **3** is mounted in chocks **7** and **8** and has extended roll necks **3***a*, **3***b* on the ends of which further bearings **9, 10** are mounted. These bearings **9, 10** are engaged by tie rod pairs **11, 12** which are pivotally connected through upper bearing eyes **11***a*, **12***a* to fork members **15, 16** by means of round pins **13, 14**. These fork members are the ends of pistons **17, 18** which together with cylinders **19, 20** constitute hydraulic power units for crown control of the upper back-up roll **3**. These cylinders are mounted at **21, 22** for rocking movement in a bending resistant bridge member **24**.

This bridge member **24** rests on the upper ends faces of two screwdown pressure screws **26, 27** pressure nuts **28, 29** of which are supported in upper transverse frame members **1***a* and **2***a*.

In order to explain in detail the support of the upper bridge member **24** on the outer end faces of the pressure screws **26, 27** reference is made to FIG. **2**. As may be seen therefrom, the support is effected by a ring-shaped divided pressure member having a hemispherical part **30** and a corresponding cup-shaped lower part **31** and includes a roller thrust bearing **32** on a ring-shaped outer end face **27***a* of the one pressure screw **27**. The pressure bearing **32** is centered within a collar or flange **27***b* of the pressure screw **27**. Furthermore the lower cup-shaped part **31** of the pressure member is provided with an inner centering ring **31***a* by means of which it is centered within the thrust bearing **32**. In this manner the bridge member **24** with the part **30** of the pressure members connected thereto is secured in its position relative to the pressure spindles **26, 27**.

In the example splined shafts **34, 35** serve for rotating the pressure screws **26, 27** outer splines **34***a*, **35***a* of the shafts engaging in corresponding internal splines of the pressure screws **26, 27**. Because of this splined shaft drive of the pressure screws the outer ends faces of the pressure screws receiving the bridge member **24** are ring-shaped.

The splined shafts **34, 35** extend into drives **36, 37** which are carried by the bridge member **24**, as are also screwdown motors **38, 39**.

When the hydraulic power units are operated so as to retract the pistons **17, 18** a bending moment is produced in the upper back-up roll **3** which opposes the bending of the roll under rolling pressure and can thus control the contour of the cylindrical back-up roll. The tension forces exerted by the hydraulic power units on the tie rods **11, 12** flow through the chocks **7, 8** and the screwdown pressure screws **26, 27** into the bridge member **24** and back to the hydraulic power units attached to the latter. Thus the counter bending forces extend within a closed system which does not comprise the pressure nuts **28, 29** of the screwdown pressure screws. This means that the screw connections between the pressure screws and their pressure nuts are not stressed by these counter bending forces, but are loaded only by the weight of the backing roll **3**, its chocks **7, 8**, the bridge member **24** with the screwdown device as well as the counter bending device **9** to **22**.

Of more importance however is the fact that all these parts follow the screwdown movement of the pressure screws **26, 27** so that the stroke of the bending cylinders **19, 20** can be small; above all the hydraulic pressure in these cylinders can be

maintained during screwdown movement. All this is attained without lengthening of the rolling mill frames, because the bridge member **24** which moves together with these parts and which carries the bending cylinders **19,20** is disposed outside the frame windows.

It must be noted that hydraulic pressure capsules consisting of cylinders **40,41** and pistons **42, 43** are disposed between the chocks **7, 8** of the upper backing roll **3** and the screwdown pressure screws **26, 27** and serve for controlling the rolling gap.

When the rolling mill is to be utilized for hot rolling, it is preferable to provide balancing means for the upper set of rolls **3, 5** in order to make the screw threads between the pressure screws **26, 27** and their pressure nuts **28, 29** free of play in the direction of the prevailing rolling pressure.

I claim:

1. A rolling mill for rolling flat material, comprising:

frames;

upper and lower working rolls mounted in said frames;

upper and lower back-up rolls mounted in said frames;

at least one of said upper rolls being provided with a neck extension;

pressure screw means mounted in said frames for effecting downward movement of said upper rolls, said pressure screw means having upper supporting surfaces;

a bridge member positioned above said pressure screw means linking said frames and supported by said upper surfaces of said pressure screw means so as to follow the movement thereof;

means forming a part of said upper supporting surfaces of said pressure screw means and said bridge member for securing said bridge member in position relative to said pressure screw means; and

hydraulic power units mounted to said bridge member and engaging said neck extension of one of said upper rolls for effecting crown control bending thereof.

2. A rolling mill as in claim **1**, including pressure members positioned below said bridge member, said means for securing said bridge member in position relative to said pressure screw means comprising a centering device means positioned between said upper supporting surfaces of said pressure screw means and said pressure members.

3. A rolling mill as in claim **2**, said pressure members each comprising an upper hemispherical part secured to said bridge member and a lower cup-shaped part adjacent said centering device means, said upper and lower parts moving relative to each other when said bridge is bent in such manner that said frames do not absorb laterally directed forces.

4. A rolling mill as in claim **2**, including a thrust bearing positioned between said pressure screw means and said pressure members.

5. A rolling mill as in claim **1**, said upper supporting surfaces of said pressure screw means being ring-shaped in configuration and said pressure screw means being driven by splined shafts having drives carried by said bridge member.

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