June 29, 1937. W. ROHN 2,085,449

MULTIHIGH ROLLING MILL

Filed Aug. 7, 1935 2 Sheets-Sheet 1

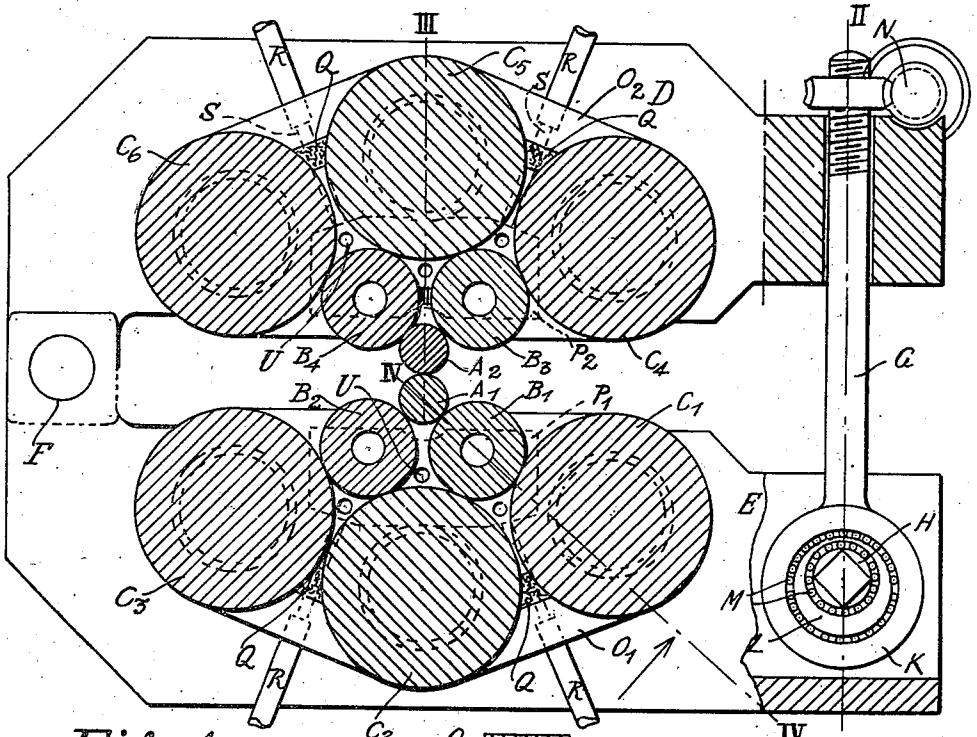

Fig. 1

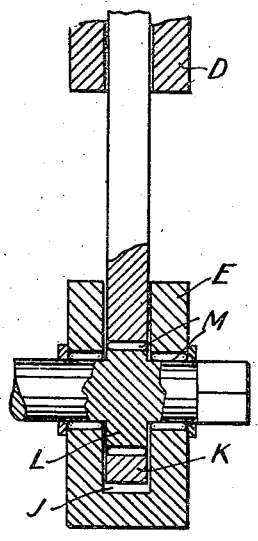

Fig. 2

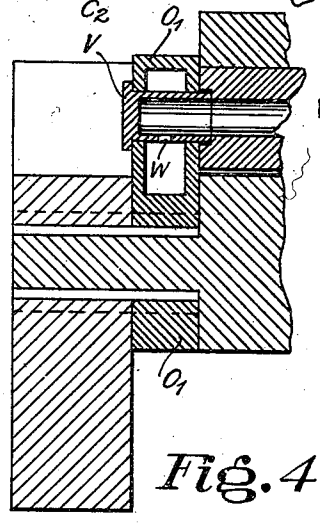

Fig. 4

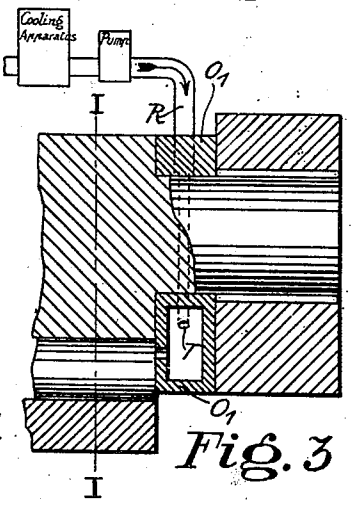

Fig. 3

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MULTIHIGH ROLLING MILL

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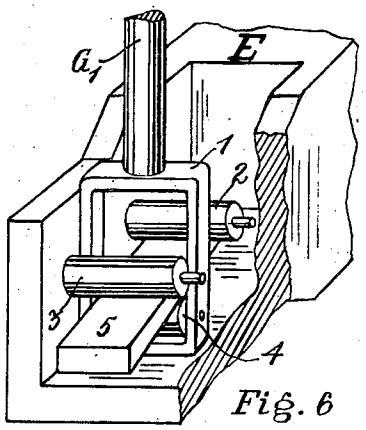

Fig. 6

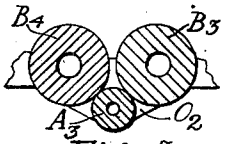

Fig. 5

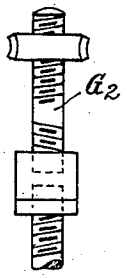

Fig. 7

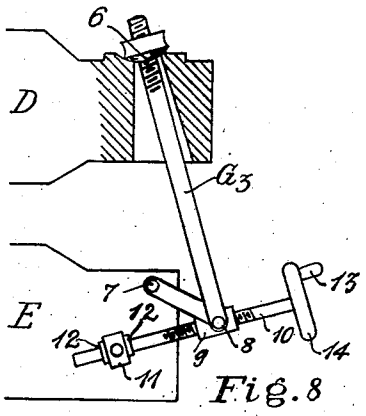

Fig. 8

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UNITED STATES PATENT OFFICE

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MULTIHIGH ROLLING MILL

Wilhelm Rohn, Hanau-on-the-Main, Germany

Application August 7, 1935, Serial No. 35,093
In Germany August 23, 1934

4 Claims. (Cl. 80—38)

This invention relates to multi-high rolling mills in which the working rolls are supported by a certain number of supporting rolls. Whereas six-high rolling mills, having two working rolls supported by four supporting rolls, have been known for a long time it has recently been proposed to support these supporting rolls again by a further set of supporting rolls. Hereby it was made possible to reduce the diameter of the working rolls to an extraordinary extent, yet obtaining a satisfactory stiffness against bending.

The object of the present invention is to improve the operation of such multi-high rolling mills. While I have shown such improvements in this specification and the annexed drawings as applied to twelve-high rolling mills, it is understood that they are likewise applicable to six-high or twenty-high rolling mills or rolling mills having another number of supporting rolls.

The invention is illustrated in the annexed drawings, of which

Fig. 1 is a vertical cross-sectional view of an improved twelve-high rolling mill according to the present invention, taken along the line I—I of Fig. 3;

Fig. 2 is a cross-sectional view taken along the line II—II of Fig. 1;

Fig. 3 is a fractional cross-sectional view taken on the line III—III of Fig. 1;

Fig. 4 is a fractional cross-sectional view taken on the line IV—IV of Fig. 1 and seen in the direction of the arrow.

Fig. 5 is a fractional cross-sectional view corresponding to Fig. 1 and showing a hollow working roll A_3.

Fig. 6 is a perspective detail view showing a wedge-connection between the frame members.

Fig. 7 shows a screw-connection.

Fig. 8 is a diagrammatic view, partly in cross-section, of a toggle-joint connecting the frame members.

One of the objects of the invention is to improve the means for adjusting the working rolls of twelve-high and other multi-high rolling mills.

In the copending application Ser. No. 574,879 filed Nov. 14, 1931 a positioning device for six-high rolling mills has been described consisting therein that the upper and the lower supporting rolls are mounted in an upper (D) and a lower member (E) of the frame respectively, these members being connected by a hinge-like joint F the axis of which is parallel to the axes of the rolls. The positioning is effected by a screw G connecting the free ends of the members D and E of the frame. This method of adjusting the distance between the working rolls has proved very satisfactory not only for six-high rolling mills, but also in connection with twelve-high and twenty-high rolling mills which in the meantime have been developed. The only difficulty arose in this connection when fresh material to be rolled was to be introduced between the working rolls. This difficulty consisted therein that the screws penetrating the ends of the upper and lower members of the frame had to be released in order to open the gap between the working rolls to a sufficient extent. Consequently one was obliged to readjust the gap by means of the screws as often as fresh material to be rolled was introduced which operation demanded too much time.

Now it was found to be an important improvement of the rolling mills equipped with the above described adjusting device to provide means for temporarily rapid opening the gap between the working rolls without altering the adjustment of the screws themselves. Such means will now be described by way of example with reference to Figs. 1 and 2 of the drawings.

A_1, A_2 are the two working rolls, B_1, B_2, B_3, B_4 the middle or primary and C_1, C_2, C_3, C_4, C_5, C_6 the outer or secondary supporting rolls. D is the frame supporting the upper secondary rolls and E the corresponding frame supporting the lower secondary rolls, members D and E being connected by a hinge joint F. G is one of the adjusting screws. The adjustment screws G penetrate the upper members D and engage the lower members E. A shaft H is journaled in this member E which on the other hand is recessed in J to permit of the introduction of an eye K formed at the end of screw G. The shaft H is thickened to form an eccentric collar L which fits into the eye K. Especially in connection with larger rolling mills, in which very high pressures have to be transferred by the eccentric L, needle bearings M should be employed.

For starting the mill the working rollers are adjusted by means of the worm gear N, while the eccentric L is in the position as shown. Now when it is desired to temporarily open the gap between the working rolls in order to introduce, for instance, fresh material to be rolled or to interrupt the work, the shaft H and therewith the eccentric L is rotated whereby the screw is lifted a little, without altering in any way the adjustment proper of the screw G and the worm gear N. Then, for instance, after fresh material has been introduced between the working rolls, the eccentric is swung back to its normal position. The eye K of

the screw G goes down again and the mill is at once properly adjusted.

It has been ascertained that—at least with smaller rolling mills—such eccentric device can be operated merely by hand, even during the running of the rolling mill. Of course, any other suitable device may be used instead of an eccentric to move the lower end of the screw G up and down and therewith opening and closing the gap between the working rolls.

The eccentric device is mentioned above only by way of a specially suitable example. Instead of an eccentric device any other means such as wedges, screws may be used to effectuate the opening of the gap between the working rolls independent of the adjustment of the working rolls. Such means are shown by way of example in Figures 6, 7, and 8.

In Fig. 6 the screw G_1 carries at its lower end a frame 1 in which a roll 4 is journaled. Two other rolls 2 and 3 are placed in a cavity of the frame member E and journaled in its walls (the right hand wall is shown partly broken away). Between the rolls 2, 3, and 4 a wedge 5 is inserted which may be removed for instantaneously opening the rolls of the mill.

Fig. 7 shows the screw G_2 divided into two parts provided with right-hand and left-hand thread respectively and connected by a screw-nut.

Fig. 8 shows a toggle-joint between the frame members. G_3 is the screw corresponding to screw G in Fig. 1. The nut 6 forms a spherical segment fitting into a corresponding recess in the member D. The other end of the screw G_3 is linked at 8 to a nut 9 screwing on a spindle 10. The shorter arm of the toggle-joint is linked at 8 to the nut 9 and at 7 to the member E. The spindle 10 is rotatable in a nut 11 bolted on the member E, the displacement of the spindle in the nut 11 being prevented by flanges 12 fixed on the spindle 10.

The functions of the nuts 8 and 11 may be exchanged.

By rotating the wheel 14 by means of the handle 13 the tongs formed by the members D and E may be opened or closed.

Another difficulty especially in connection with twelve-high and twenty-high rolling mills arose from the fact that the working rolls became excessively hot when the rolling operation is carried out at high speed.

Care should be taken to prevent this heat from reaching such a degree that the working and the supporting rolls lose their hardness. The cooling methods hitherto known were found unsatisfactory for rolling mills of this kind. Especially watercooling was found objectionable, as the working rolls and also the middle supporting rolls are extremely thin (the diameter of the working rolls in smaller rolling mills amounting to a fraction of an inch only) and therefore there was a risk of the cooling holes in the interior of the rolls becoming subject to corrosion fatigue and also of the cooling water entering the spaces between the rolls and forming an undesired emulsion with the lubricating oil. Moreover there is the danger of the rolls and the strip to be rolled becoming rusty by the escaping water.

A further object of the present invention is to avoid these drawbacks by employing an improved cooling method which is especially adapted for cooling multi-high rolling mills.

Between the inner sides of the frame members D and E and the ends of the supporting rolls the bronze plates O_1 O_2 are inserted in which cavities P_1 P_2 are provided. The same bronze plates extend between the ends of all the primary and the secondary supporting rolls and the frame members supporting the latter (not shown). The cavities P_1 and P_2 communicate on the one hand by ports U with the hollow spaces formed between the supporting rolls (see Figs. 1 and 3). On the other hand, the cavities P_1, P_2 communicate with the bores of the hollow supporting rolls B_1 etc. by sleeves or boxes V (see Fig. 4) inserted with some clearance into the bores of the rolls B_1 etc. and provided with ports W. Q, Q, Q, Q designate tightening strips consisting, for instance, of felt. Oil is pumped, for instance, into the cavities of the bronze plates through pipes R and bores S in the plates ending, for instance, at T. The bronze plates at the opposite end of the rolls are provided with bores and outlet pipes similar to R and S for leading off the cooling oil. Thus the latter first enters the cavity in one of the bronze plates from where it is pressed into the bores of the rolls B and also into the triangular hollow spaces formed between the rolls, and then the oil is collected in the cavity of the bronze plate at the opposite end of the rolls. Outside the rolling mill the oil is made to run through any of the well-known recooling devices whereupon it is returned to the mill. By the tightening strips Q the cooling oil is prevented from flowing out between the outer supporting rolls C.

By employing cooling oil or a nonrusting mixture of water with an emulsive oil instead of cooling water the danger of the water mixing with the lubricating oil in form of an emulsion is avoided. The cooling is extraordinarily effective, and by using oil instead of water any corrosion of the rolls is prevented, an important result owing to the fact that corroded rolls are liable to break.

In case the working rolls have a sufficient diameter, they may also be provided with bores and cooling oil may be passed through them, but in general it is recommendable to keep the very thin working rolls solid and to provide only the middle supporting rolls with bores.

I claim:—

1. A multi-high rolling mill comprising two pairs of frame members, a number of hollow rolls, hollow plates placed between the inner side faces of the frame members and both end faces of the rolls, there being ports in the said plates connecting the hollow spaces in the plates with the hollow spaces in the rolls and with the spaces bordered by the cylindric surfaces of adjacent rolls, and means for circulating oil from the hollow spaces in the plates at one side of the rolls to the hollow spaces in the plates at the other side.

2. A multi-high rolling mill comprising two pairs of frame members, a number of hollow rolls, hollow plates placed between the inner side faces of the frame members and both end faces of the rolls, there being ports in the said plates connecting the hollow spaces in the plates with the hollow spaces in the rolls and with the spaces formed between the rolls, means for circulating oil from the hollow spaces in the plates at one side of the rolls to the hollow spaces at the other side, and tightening strips inserted between the outermost rolls to prevent the oil from leaking from the spaces between the rolls.

3. A multi-high rolling mill comprising two pairs of frame members, a number of hollow rolls,

hollow plates placed between the inner side faces of the frame members and both end faces of the rolls, there being ports in the said plates connecting the hollow spaces in the plates with the hollow spaces in the rolls and with the spaces bordered by the cylindric surfaces of adjacent rolls, means for circulating oil from the hollow spaces in the plates at one side of the rolls to the hollow spaces at the other side, and means for recooling the oil outside the mill.

4. In a multi-high rolling mill an adjusting device comprising two pairs of upper and lower frame members, two screws adjustably held in the upper members, the other ends of the screws being shaped to form eyes, a shaft journaled in the lower frame members having a smaller diameter than the said eyes, eccentric enlargements on the shaft fitting into the said eyes, and means for rotating the said shaft.

WILHELM ROHN.