(No Model.) 2 Sheets—Sheet 1.

A. THOMAS.

THREE HIGH ROLLING MILL.

No. 553,368. Patented Jan. 21, 1896.

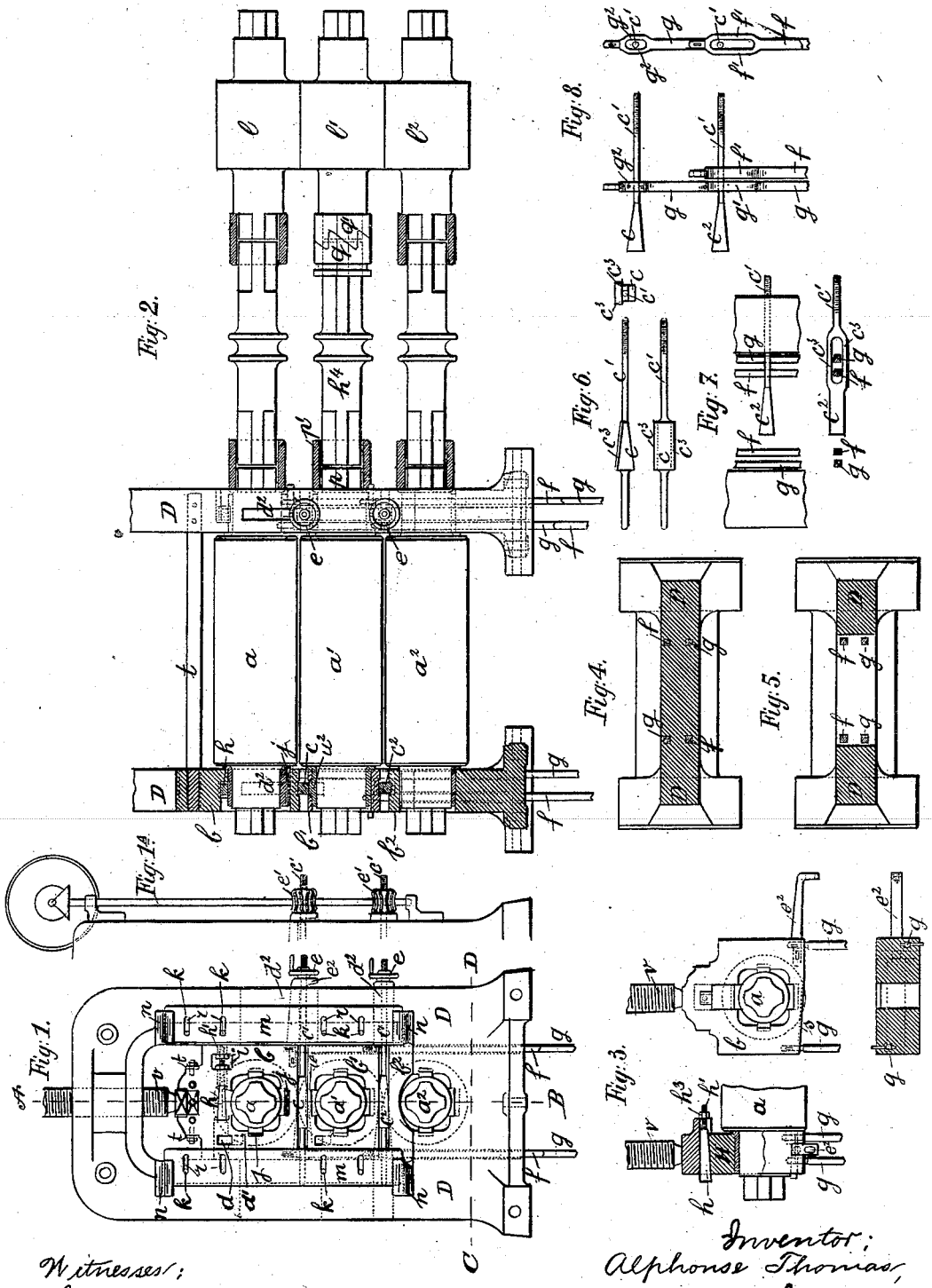

Fig. 1.

Fig. 2.

Fig. 8.

Fig. 6.

Fig. 7.

Fig. 4.

Fig. 5.

Fig. 1a.

Fig. 3.

Witnesses:
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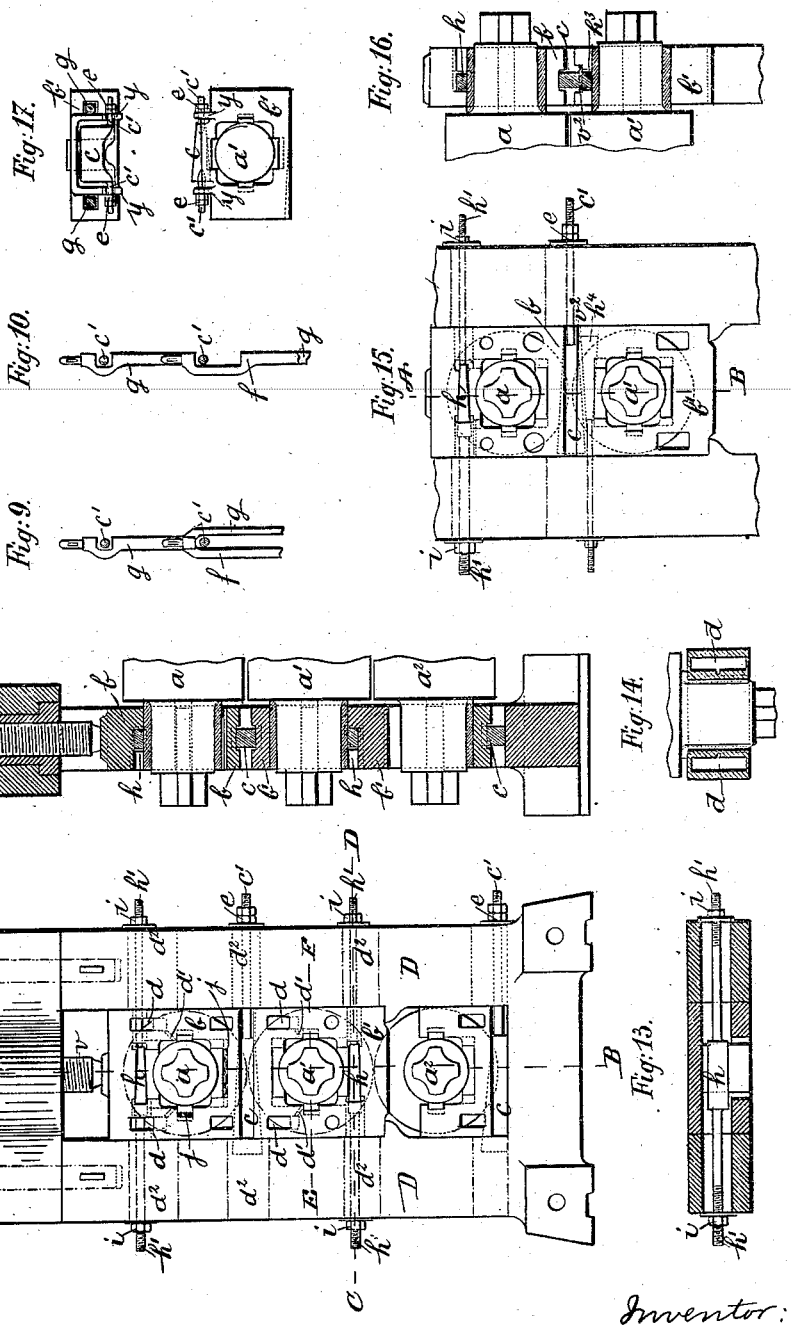

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UNITED STATES PATENT OFFICE.

ALPHONSE THOMAS, OF CLABECQ, BELGIUM.

THREE-HIGH ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 553,368, dated January 21, 1896.

Application filed March 3, 1894. Serial No. 502,278. (No model.) Patented in Belgium March 16, 1892, No. 98,827, April 13, 1892, No. 99,241, April 15, 1892, No. 99,270, April 27, 1892, No. 99,447, October 27, 1892, No. 101,917, August 26, 1893, No. 106,139, and October 18, 1893, No. 106,799; in France March 17, 1892, No. 220,203, and in England July 6, 1892, No. 12,499.

To all whom it may concern:

Be it known that I, ALPHONSE THOMAS, a Belgian subject, residing at Clabecq, Belgium, have invented new and useful Improvements in Rolling-Mills Having Three Superposed Rolls, (for which I have obtained patents in Belgium, No. 98,827, dated March 16, 1892, No. 99,241, dated April 13, 1892, No. 99,270, dated April 15, 1892, No. 99,447, dated April 27, 1892, No. 101,917, dated October 27, 1892, No. 106,139, dated August 26, 1893, and No. 106,799, dated October 18, 1893; in France, No. 220,203, dated March 17, 1892, and certificates of addition dated April 22, 1892, December 2, 1892, August 26, 1893, and October 18, 1893, and in England, No. 12,499, dated July 6, 1892,) of which the following is a specification.

My invention relates to rolling-mills having three superposed rolls; and it consists of the improvements hereinafter described in such rolling-mills, the objects of which improvements are mainly to obviate the rapid deterioration of the rolls and in particular of the intermediate roll when the latter is driven by friction; also to prevent the pressure caused by rolling between two of the rolls from being transmitted to the journals of the third roll; also to provide for rapid rolling of bundles or ingots having a certain thickness, the object last stated being attained by means of an arrangement which admits of much greater pressures being exerted than is possible where the middle roll is driven solely by friction.

My said invention comprises (*a*) improvements in the mode of construction of the bearings that support the journals of the rolls in combination with adjustable wedges used for regulating the distance between the rolls and the pressure of the brasses upon the journals of the cylinders; (*b*) various arrangements of the suspension-rods of the bearings of the rolls in combination with the spindles of the wedges; (*c*) a method of driving the middle roll by means of the middle pinion of the pinion-casing; (*d*) a new arrangement for retaining in place the bearings of the rolls between the standards of the casings and for allowing of easily removing the same; (*e*) means for preventing overpressure of the wedges from causing injury to the machine.

In the accompanying drawings, Figure 1 is an end elevation of a rolling-train of three superposed rolls for rolling sheets, wide plates, and other metal pieces of little thickness, in which the top and middle rolls are movable and change their position vertically at each passage of the metal to be rolled, to which there are applied certain improvements which form part of my invention. Fig. 1[A] illustrates a modification of the mode of adjusting the wedges. Fig. 2 is a front elevation of the three-high train, Fig. 1, partly in section, on the line A B, Fig. 1. Fig. 3 illustrates, respectively, in front elevation, in side elevation, partly in section, and in horizontal section one of the bearings which serve to support the journals of the upper roll of the rolling-mill, showing a special arrangement of wedge which serves to regulate the upper brass of the journals of the upper roll. Fig. 4 is a section on the line C D, Fig. 1, of one of the casings of the rolling-mill, showing the arrangement of the suspension-rods of the upper and middle rolls of Figs. 1 and 2. Fig. 5 is a similar view showing another arrangement of the suspension-rods of the upper and middle rolls. Fig. 6 shows, in side and in front elevations, a wedge furnished with projecting borders at its upper part. Figs. 7, 8, 9, and 10 show various arrangements of suspension-rods for the rolls and of the wedges which regulate their distance apart. Fig. 11 shows, in end elevation, an application of my invention to a rolling-train of three superposed rolls for rolling bars and the like in which the rolls do not change their position vertically during the rolling. Fig. 12 is a vertical section on the line A B, Fig. 11. Fig. 13 is a horizontal section on the line C D, Fig. 11. Fig. 14 is a horizontal section on the line E F, Fig. 11. Fig. 15 shows, in side elevation, a portion of the casing of a rolling-mill of the same kind as that shown in Fig. 11, illustrating a modification of my invention. Fig. 16 is a vertical section of the same on the line A B, Fig. 15. Fig. 17 illustrates, in front elevation and plan view, a wedge of

special form as applied to one of the middle bearings of the rolling-mill, Fig. 1, to regulate the distance apart of the upper and middle rolls.

In Figs. 1 and 2, a and a' are the top and middle rolls of the rolling-mill, the journals of which are carried by the bearings b and b'. The said bearings b and b' are formed in one piece or in two pieces, pedestal and cap, fastened together in such a manner that they shall fill the same office as bearings made in one piece only.

a^2 is the bottom roll, the journals of which are carried by pedestals made in one piece with the standards of the casing and covered with caps b^2.

c c^2 are wedges which can be advanced or withdrawn by means of their screw-threaded spindles c' c', actuated by the nuts e e, Fig. 1, or by endless screws e' e', Fig. 1A, or in any other suitable manner in horizontal grooves d^2 d^2, formed in the standards D between the bearings b and b' and between the bearings b' and the caps b^2 of the bottom roll at the center of the brasses of the journals of the rolls and in the axis of the pressure-screws v. In the faces of the bearings and caps which are in contact with the wedges are formed sloping grooves to receive the thicker portion of the wedges, and the upper face of the middle bearings, b' b', has a central opening, through which passes the top portion of the upper brasses of the journals of the middle roll a'. The lower face of the top bearings, b, is supported upon the upper face of the wedges c, the lower face of which bears upon the upper face of the brasses u^2 of the middle roll b'. The distance between the top and middle rolls as well as the pressure of the brasses of the middle roll can thus be regulated as required by means of a single wedge c to each standard of the casing. The lower face of the middle bearings, b', rests upon the upper face of the wedges c^2, the lower face of which rests upon the upper face of the caps b^2 of the bottom roll.

The nuts e e for actuating the screw-threaded spindles c' c' of the wedges c c bear against rigid arms e^2 e^2, Figs. 1 and 3, fixed to the lower part of each of the top bearings b, as represented, or to the top of the middle bearing b'.

The bearings b b of the top roll a are connected together by stays t t, (Figs. 1 and 2,) so as to form, as it were, one piece.

As shown in Fig. 1A, by means of a very simple arrangement of rods and pinions all the wedges of one casing can be operated together by means of a single hand-wheel. (Not shown.)

f f are the suspension-rods of the middle roll a', and g g the suspension-rods of the top roll a. They are located in vertical grooves or slots in the standards D D, said grooves being arranged in such a manner that the two rods of one and the same bearing shall be situated either diagonally in relation to the lower face of the said bearing and of the standard, as shown in Fig. 4, or, as shown in Fig 5, where the two rods f f of the middle bearing are arranged in such a manner as to correspond to the two ends of one and the same side of the lower face of said bearing, and the two rods g g of the top bearing are arranged in such a manner as to correspond to the two ends of the opposite side of the lower face of the said top bearing. This arrangement allows of arranging the regulating-wedges exactly in the axis of the pressure-screw and in the middle of the brasses, and of causing to pass between the suspension-rods the spindle of the wedge, which causes the latter to advance. Two rods f g might also be arranged one next to the other in one and the same groove in the axis of the standards, in which case I use wedges of the form shown in Fig. 7, having a spindle c' slotted for a certain length at c^3 c^3 in such a manner as to form there a slot or groove, in which passes one of the suspension-rods of each of the top and middle bearings.

Instead of slotting the spindles of the wedges as just stated, I may, as shown in Fig. 8, split one of the suspension-rods of the middle roll for a certain length at f' f', and slot the corresponding suspension-rod of the top roll at g' g' g^2 g^2 on a level with the separating-wedges c of the bearings in such a manner as to there form slots or grooves, in which pass the spindles c' c' of the wedges c. Figs. 9 and 10 show modifications of this system, according to which the rods instead of being split are merely curved or bent for a certain length. The same modification can obviously be applied to the spindle c' of the wedges c in Fig. 7.

In Fig. 17 is shown one of the bearings of the middle roll, Fig. 1, to which is applied a wedge c, having two spindles c' fixed to one side of the wedge, which might be used with casings having no slots or grooves for the passage of the spindles of the wedges. The nuts e take a bearing on lugs y fixed upon or made in one piece with the bearings. By the use of this form of wedges my invention may easily be applied to existing casings.

h, Figs. 1 and 3, is a wedge ending in a screw-threaded spindle h', which works in a horizontal groove formed in the upper portion of the bearings b of the top roll a. The lower face of said wedge h rests upon the upper face of the upper brass of the journals of the top roll a in the axis of the pressure-screw v. This wedge h is caused to advance or to recede, for regulating the tightening and compensate for the wearing of the brass, by means of a nut i screwing upon its screw-threaded spindle h'.

Instead of the nut i being located, as shown, in a recess in the bearing, the spindle h' could be prolonged through the standard D, as is the case with the spindle of the wedges c, and the nut i be placed on the outside of the standard.

In the arrangement shown in Fig. 3 the lower face of the wedge h rests upon a block H inserted between the latter and the upper face of the brass, in order to allow of arranging above the top roll a the nut h^3, which serves to cause the wedge h to advance or to recede when said wedge is arranged to work parallel to the axis of the roll a.

In order to prevent the heating of the journals of the top cylinder resulting from overtightening of the wedge h, which might also produce a powerful brake and the subsequent breaking of the bearings, springs j, preferably of corrugated sheet metal, are placed under the lower brasses and behind the side brasses of the journals of the said cylinder. I also form in the bearings suitable reservoirs or recesses d and channels d' for lubricating the journals of the cylinders.

n n, Fig. 1, are projections or borders cast in one with the standards G and forming grooves, in which slide-plates m are retained against the standards D by bolts k. The holes r, by means of which the said bolts pass through the plates m, are elongated to an extent sufficient to allow of the plates m sliding in the grooves n n, either to enable them to cover the edge of the bearings b b' and of the caps b^2, as shown on the left of Fig. 1, to prevent the same from passing out from between the standards D, or, as shown on the right of the same figure, for completely disengaging the bearings and the caps, in order to allow of their being removed without detaching the plates m.

l l' l^2, Fig. 2, are the pinions corresponding respectively to the rolls a a' a^2. The pinion l' of the middle roll a' is connected to the latter by a shaft h^4, one end of which is connected to the neck p of the roll a' by a sleeve p', while the other end is furnished with a movable claw-coupling or sleeve q, which engages with a fixed claw q' on the neck of the pinion l'. These claws could be replaced by a cone brake or by a sleeve. By means of this arrangement, according as the sheets or wide plates to be rolled are more or less thick, the middle roll a' can be driven by the middle pinion l' by causing the claw-coupling q of the shaft h^4 to engage with the claw q' of the middle pinion l' or by placing the claws out of engagement, leaving the middle roll a' free to revolve by friction on the bottom roll a^2 and top roll a.

For rolling sheets or wide plates of, for instance, seven millimeters thickness or above the middle roll a' is driven by the pinion l' by means of the claws q q' and the wedges c are caused to advance by means of handled nuts or endless screws e or any other suitable mechanism for moving the top bearings to the extent of some millimeters away from the middle bearings—that is to say, the roll a away from the roll a' and the middle bearings away from the bottom bearings—that is to say, the roll a' away from the roll a^2. The consequence is that when the middle and bottom rolls are employed for rolling the top roll will be maintained during the operation out of contact with the middle roll, and if rolling is effected between the top roll and the middle roll the latter will not come into contact with the bottom roll; besides, the mode of driving the middle roll a' by the corresponding pinion l' effects a great economy of power, the friction no longer taking place between the periphery of the middle roll and that of one or the other of the top or bottom rolls, as is the case when the middle roll revolves by friction; but all the friction is transmitted to the lubricated journals—that is to say, upon a surface which is shorter and of less diameter—and the resistance is further reduced by the brasses of the journals; but when, on the contrary, it is desired to roll sheets or wide plates of less thickness, or when the bundle or ingot has become reduced to a thickness less than seven millimeters, for example, and it be desired to still further reduce this thickness, the claws q q' are thrown out of engagement in such a manner as to disconnect the pinion l' and the roll a' and the wedges c are caused to recede until the rolls a a' a^2 come into contact. Rolling is then effected with the middle roll revolving by friction.

Fig. 6 shows a wedge furnished with projecting borders c^3 at its upper part. This wedge is specially designed to be employed between the middle bearing and the top bearing and the lower face of the latter is then formed with a groove s, (indicated in dotted lines in Fig. 3,) in which engage the borders c^3 of the wedge in order that the latter shall follow the ascending movement of the said top bearing when said bearing is moved away from the middle bearing.

Figs. 11, 12, 13, and 14 illustrate my invention as applied to a three-high rolling-mill for rolling bars and the like, in which the rolls do not change their position vertically during the rolling. The distance between the cylinders can be regulated by means of wedges c c, one of which is placed under the lower bearing and the other between the top and middle bearings. The pressure of the brasses of the top bearings is regulated by means of a wedge h inserted in a chamber or groove formed within the bearing, and the lower face of which bears upon the upper face of the upper brass of the said bearing. A similar wedge h is similarly inserted under the lower brass of the middle bearing for regulating the pressure of the brasses of the said middle bearing.

As will be better seen in the section Fig. 13, I prefer to use wedges h having two threaded spindles, one at each end of the wedge, passing through horizontal grooves formed in the standards and actuated by nuts which bear against the outside of the standards.

The section Fig. 14 illustrates the arrangement of the reservoirs or recesses in the bearings for lubricating the brasses.

In Figs. 15 and 16 is shown a modification of the arrangement of Figs. 11 and 12, according to which the arrangement of the wedge h for regulating the pressure of the brasses of the top bearings is the same as in Figs. 11 and 12, but the distance between the top and middle bearings is regulated by means of a wedge c and the pressure of the brasses of the journals of the middle roll is regulated by means of a wedge h^4 placed in a contrary direction to the wedge c. Between the two wedges c and h^3 there is placed a metal sheet or plate v^2, the edges of which rest upon the edges of the upper face of the middle bearing. The lower face of the wedge c bears and slides upon the upper face of the said metal sheet or plate v^2, while the upper face of the wedge h^3 bears and slides against the lower face of the said sheet or plate v^2. It follows that the wedge c will have no action upon the wedge h^3 and upon the brasses of the middle bearing.

The wedges and their screw-threaded spindles may be made of separate pieces fastened together either by screwing the spindle into the wedge or by means of a key or other suitable means. This allows of much wider wedges being used between the bearings, as they can be put in their place when the bearings are being put up in the casing, the spindles being inserted through the grooves in the standards after the casing is completed. The wedges having no longer to be inserted through the said grooves the latter can be made much narrower and the casings remain much stronger.

The mode of construction of the bearings that support the journals of the rolls in one piece or in two pieces fastened together, so that they shall fill the same office as the bearings made in one piece only, with a chamber or groove that uncovers the upper face of the upper brass or the lower face of the lower brass of the journals of the roll, into which is inserted an adjustable wedge for the purpose set forth, and with reservoirs or recesses and channels for lubricating the brasses and springs placed under the lower brass and behind the side brasses, is equally applicable to rolling-mills having two superposed rolls only.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In three high rolling mills generally, in combination with the top roll and the journals and brasses of the said top roll, bearings made in one piece with a horizontal groove, or chamber in their upper part laying bare the upper face of the upper brass, and an adjustable wedge introduced into the said groove, or chamber, and resting upon the said upper brass, substantially as and for the purpose specified.

2. In three high rolling mills generally, in combination with the middle roll and the journals and brasses of the said middle roll, bearings for the said middle roll made in one piece with an opening in their upper face to lay bare part of the upper face of the upper brass of the journals of the said middle roll, and an adjustable wedge introduced into the said opening and resting upon the said upper brass of the journals of the middle roll, substantially as and for the purpose specified.

3. In three high rolling mills generally, in combination with bearings for the top roll made in one piece with a groove, or chamber, laying bare the upper face of the top brass, and with an adjustable wedge introduced into the said groove, or chamber, springs located under the lower brass and behind the side brasses, substantially as and for the purposes specified.

4. In three high rolling mills generally, in combination with the standards of the casing and with the bearings for the rolls, projections or borders formed on the outside of the standards and having grooves made in them, plates or shutters sliding in said grooves, having elongated holes for the passage of bolts fixed in the standards, substantially as and for the purpose described.

5. In three high rolling mills for metal sheets, and wide plates in which the two upper rolls are balanced, in combination with adjustable wedges placed in the axis of the pressure screw between the bearings of the rolls and upon the upper brasses of the said bearings and having screw-threaded spindles passing through horizontal grooves in the middle of the standards, the standards being provided with vertical grooves in their sides for the passage of the suspension rods of the bearings and rolls, substantially as and for the purpose specified.

6. In three high rolling mills for metal sheets, and wide plates in which the two upper rolls are balanced, in combination with adjustable wedges having screw-threaded spindles passing through horizontal grooves in the standards, rigid arms fixed to the bearings of the rolls and passing through the said horizontal grooves parallel to the spindles of the wedges to serve as supports to the nuts, or other parts which cause the wedges to advance, or to recede, substantially as and for the purpose specified.

7. In three high rolling mills for sheet metal, and wide plates in which the two upper rolls are balanced, in combination with bearings for the top roll made of one piece, stays for connecting together the said bearings, substantially as and for the purpose specified.

8. In three high rolling mills for sheet metal, and wide plates in which the two upper rolls are balanced, in combination with bearings made in one piece for the said upper rolls, and adjustable wedges for regulating the distance between the rolls and the tightening of the brasses, a means for driving the middle roll by the middle pinion of the pinion casing, consisting of a shaft, a sleeve connecting one end of said shaft to the neck of the roll, and a movable claw-coupling or sleeve on the other end of said shaft engaging with a fixed claw

on the neck of the pinion, substantially as and for the purpose specified.

9. In three high rolling mills for metal sheets, and wide plates in which the two upper rolls are balanced, in combination with bearings made in one piece for the said rolls, adjustable wedges introduced between the bearings of the rolls and having two screw-threaded spindles, one at each end of the wedge on one and the same side of the said wedge, and lugs fixed upon, or made in one piece with the bearings, substantially as and for the purpose specified.

Dated this 19th day of February, 1894.

ALPHONSE THOMAS.

Witnesses:

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