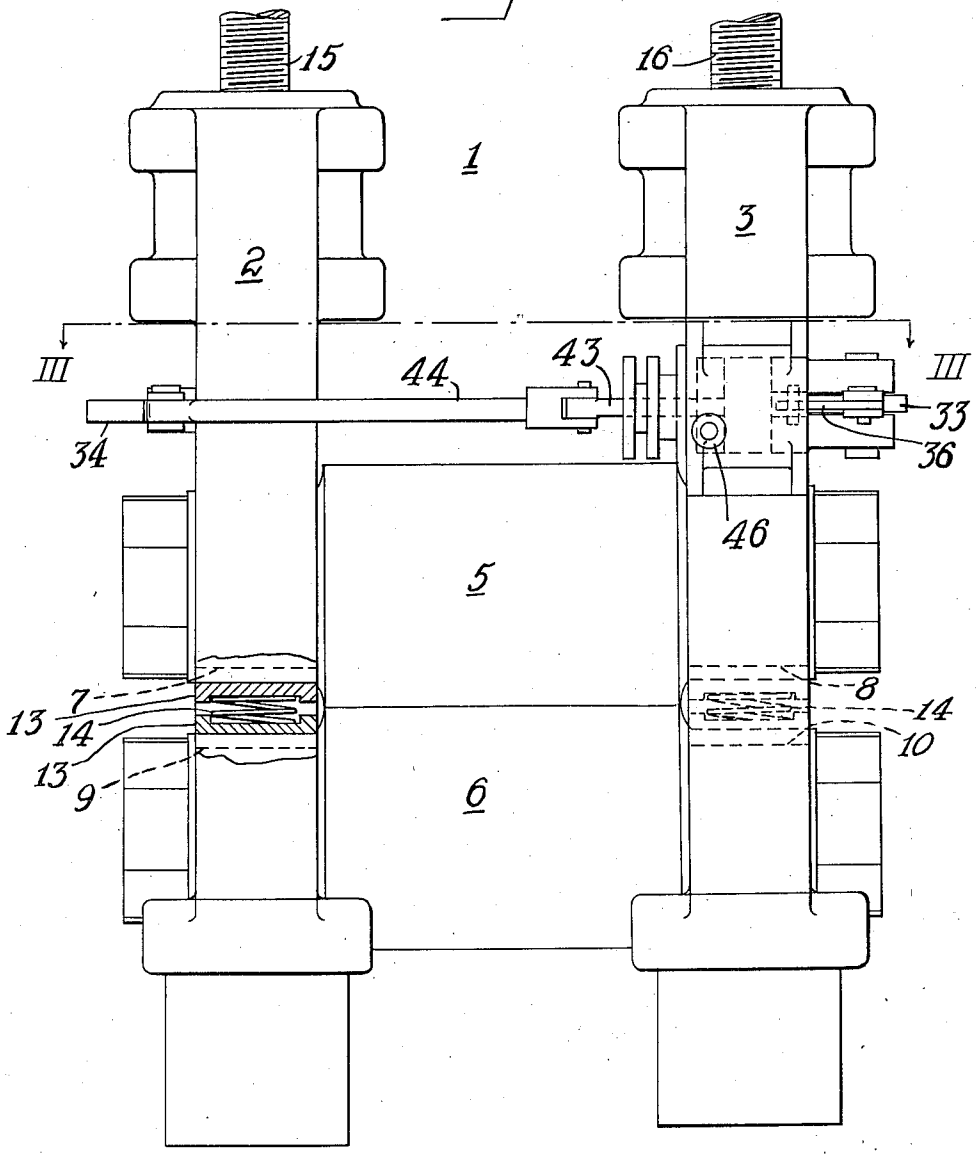
Sept. 1, 1931. B. R. SHOVER ET AL 1,821,483

ROLLING MILL

Filed Nov. 25, 1929 4 Sheets-Sheet 1

Fig. 1.



INVENTORS

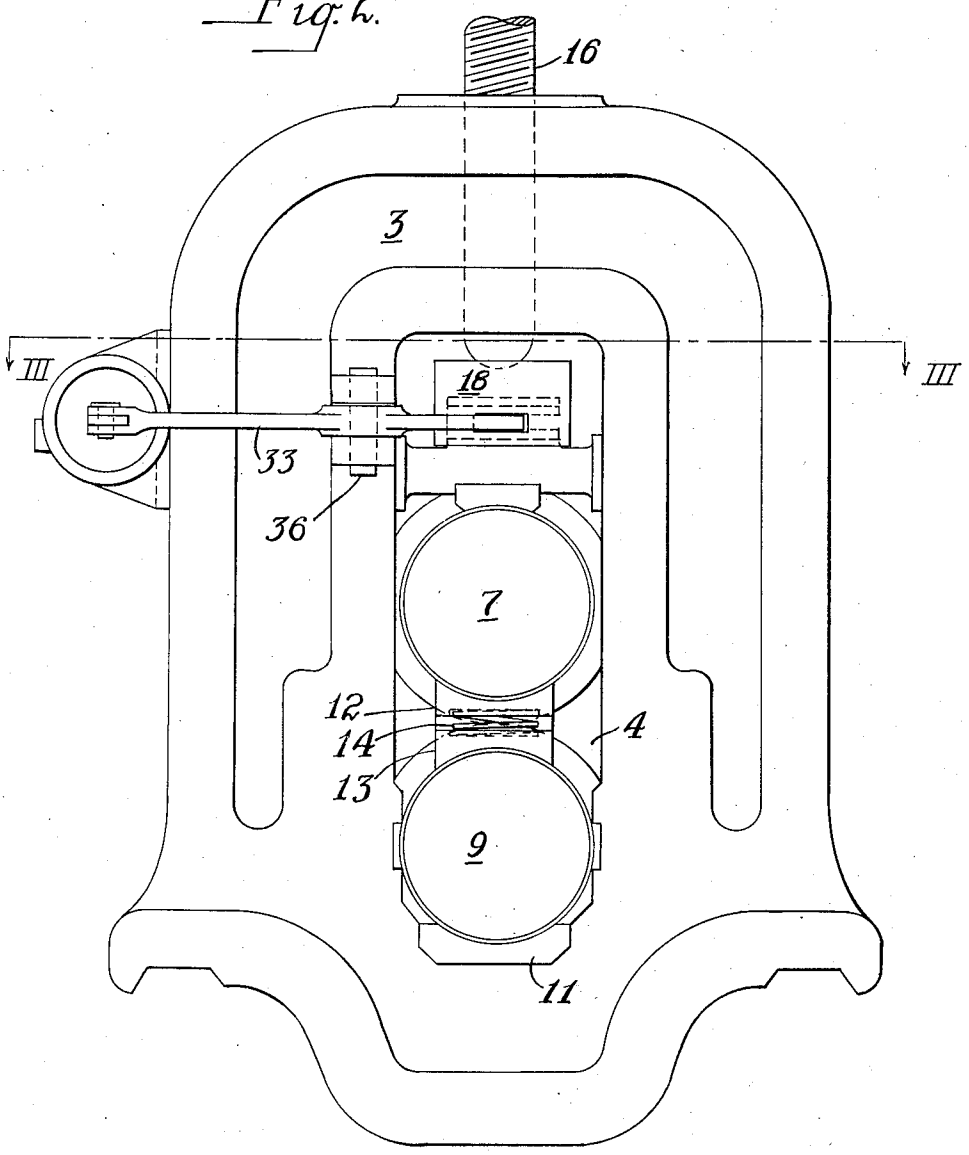
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ROLLING MILL

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Fig. 2.



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Fig. 3.

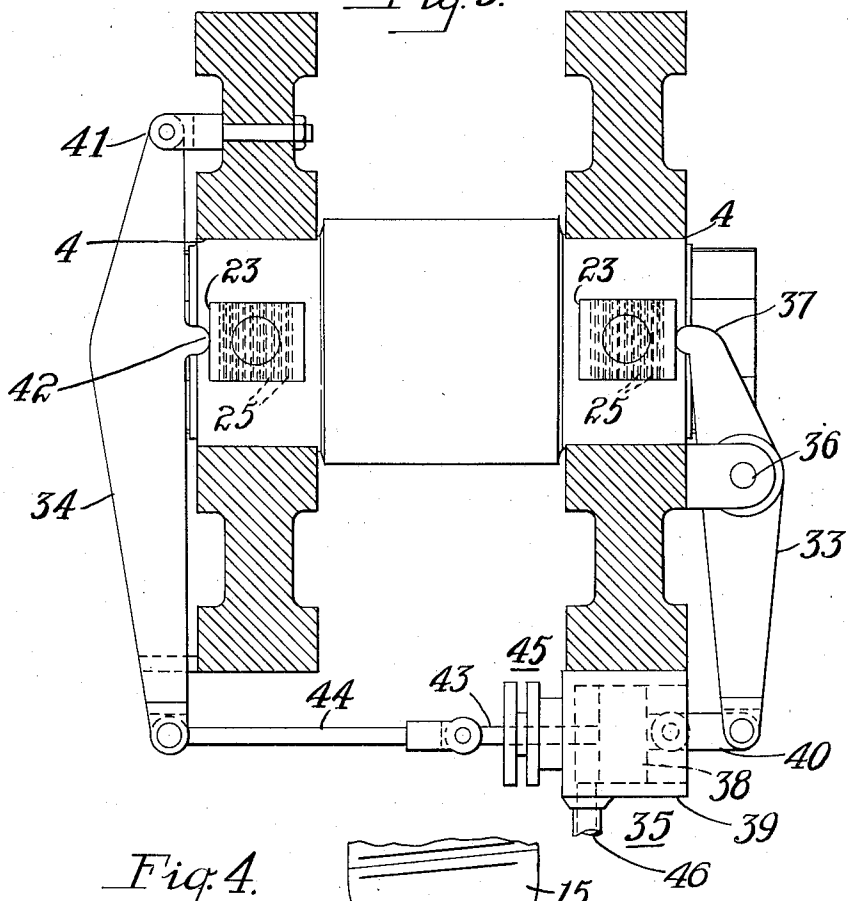
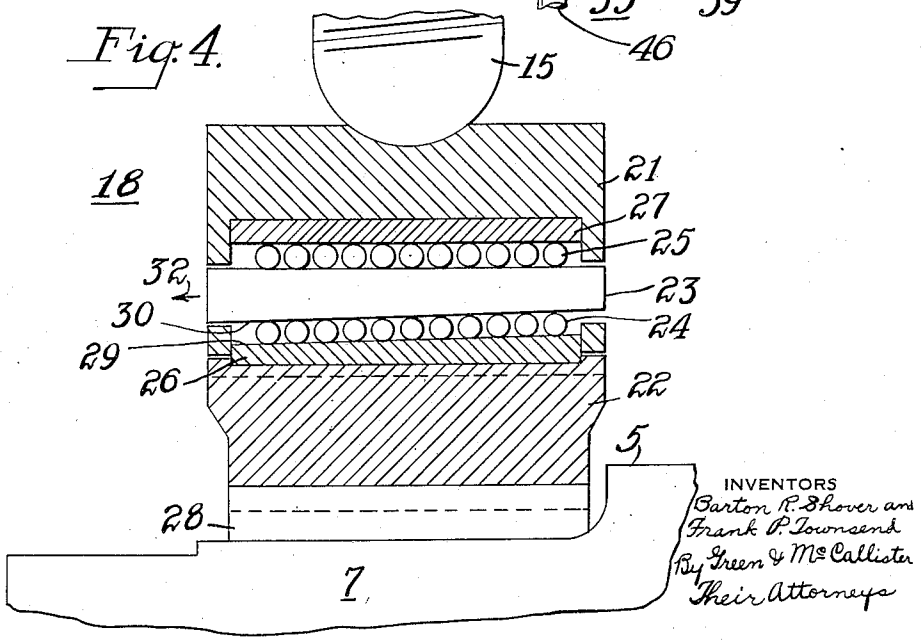


Fig. 4.



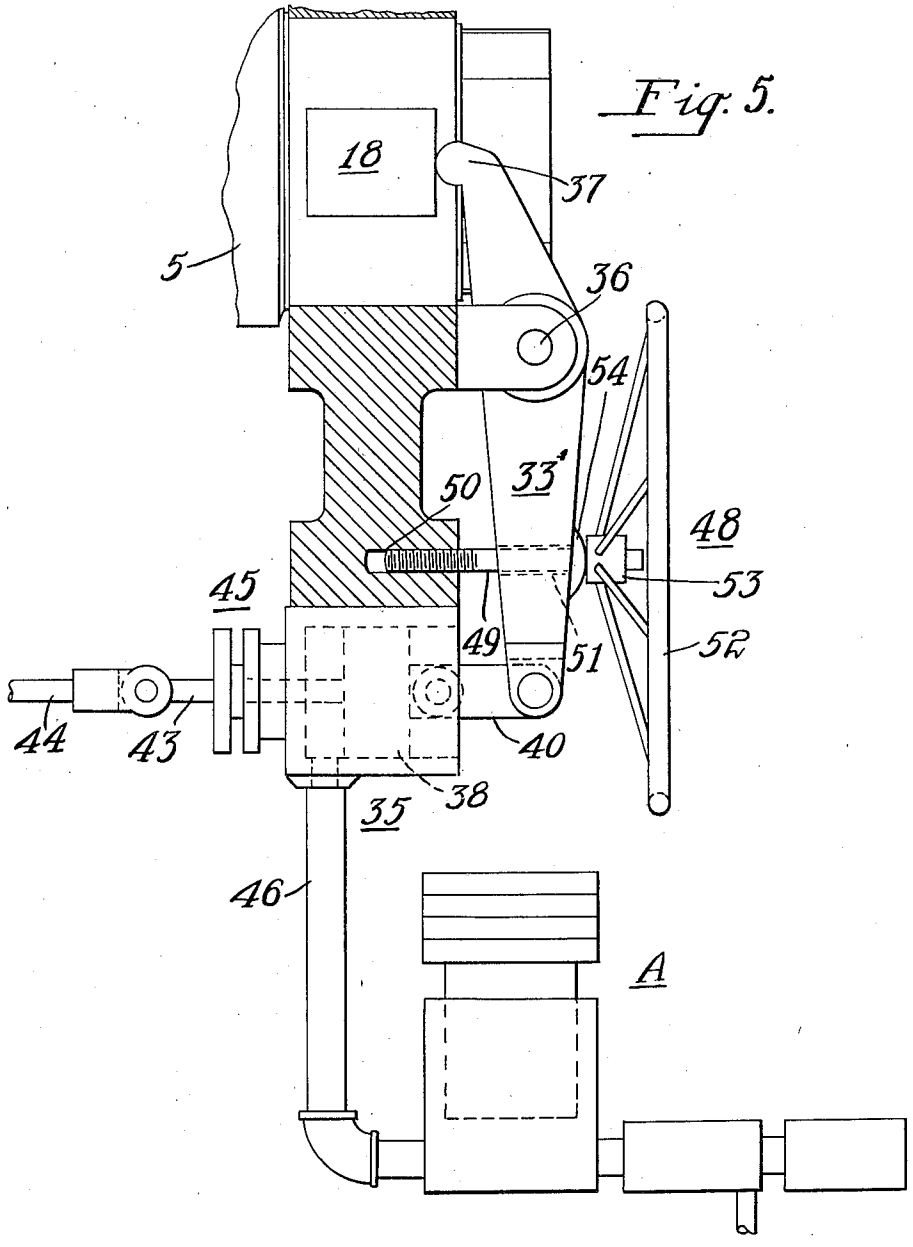
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Fig. 5.



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UNITED STATES PATENT OFFICE

BARTON R. SHOVER AND FRANK P. TOWNSEND, OF PITTSBURGH, PENNSYLVANIA

ROLLING MILL

Application filed November 25, 1929. Serial No. 409,514.

This invention relates to rolling mills and particularly to mills for rolling metal sheets, strips, plates and the like.

An object of this invention is to control the rolling pressures to which sheets, strips, plates and the like are subjected during the rolling operations.

Another object of the invention is to provide a rolling mill that shall be particularly adapted to the method, disclosed in the United States Letters Patent No. 1,367,015 granted to V. B. Browne, of controlling the grain growth in magnetic alloy sheets.

A still further object of the invention is to provide an improved rolling mill of the type shown in the patent to Browne No. 1,367,015 employed for carrying out the method disclosed in said patent.

As stated in the aforesaid patent to Browne No. 1,367,015, the pressures to which the alloy sheets are subjected during the rolling operations, are controlled in accordance with the degree of heat used in obtaining a certain grain structure so that the strain produced in the sheets is such that the grain in the finished sheets after annealing is of a size predetermined to be the proper size to give to such sheets the desired permeability with permissible hysteresis and eddy current losses.

The invention as disclosed herein comprises the novel arrangement and combination of parts and is particularly adapted for controlling the pressures to which magnetic alloy sheets are subjected during the rolling operations.

For a better understanding of the invention reference may be had to the following description taken in conjunction with the accompanying drawings in which:

Figure 1 is a front view in elevation, partly in section, of a rolling mill arranged and constructed in accordance with the invention;

Fig. 2 is an end view in elevation of the mill shown in Fig. 1;

Fig. 3 is a view in section taken on lines III—III of Figs. 1 and 2;

Fig. 4 is an enlarged partial view showing the pressure controlling device in vertical section; and

Fig. 5 is a partial enlarged view, partly in section, showing a modified form of the roller pressure controlling means.

Throughout the drawings and the specification like characters of reference indicate like parts.

In the drawings a rolling mill 1 is shown that comprises housings 2 and 3 having windows 4 therein and upper and lower rolls 5 and 6.

The rolls 5 and 6 are provided with the usual necks 7—8 and 9—10, respectively, that extend through the windows 4 of the housings 2 and 3.

In accordance with usual practice, the necks 9 and 10 of the lower roll 6 are mounted on bearing blocks 11, only one of which is shown (see Fig. 2); also the rolls 5 and 6 are yieldingly held apart by means of upper and lower bearing blocks 12 and 13 and a coil spring 14 located between the blocks (see Figs. 1 and 2).

In order that the roll 5 may be adjusted to any predetermined position with respect to the lower roll 6, the usual screw-downs 15 and 16 are provided, the screw-downs being employed to overcome the tendency of the springs 14 to separate the rolls 5 and 6 and to maintain the rolls in predetermined adjusted relation one to the other.

In rolling magnetic alloy sheets, the sheets are heat treated prior to the rolling operations in order to obtain a predetermined grain structure characteristic as set forth in the patent to Browne No. 1,367,015. As set forth in this Patent No. 1,367,015, it is necessary to control the pressure imposed on the sheets by the rolls 5 and 6 at a substantially constant value during the rolling operation for the reason that if the sheets are heated to a predetermined temperature prior to the rolling operations and if during the rolling operations the pressure imposed on the sheets by the rolls 5 and 6 is maintained at a substantially constant value, the finished sheets will be of the proper grain structure conducive to high permeability with permissible hysteresis and eddy current losses.

As pointed out in the patent to Browne No. 1,367,015, the alloy sheets are heat

treated and rolled at a predetermined temperature. However, it often happens that the sheets may not be of uniform temperature throughout and as a consequence of which certain sections of the sheets will be relatively soft and others will be relatively hard. Because of the variations in hardness of the sheets, the rolling pressures will vary. Also, it frequently happens that the temperature of the entire sheets drops below the predetermined value at which they should be rolled thereby causing the sheets to be harder than they would be if rolled at the proper temperature. This increased hardness would cause the rolling pressures to be increased above the value which will give the proper grain growth characteristic. The grain structure characteristic of the sheets will be uniform if the rolling pressures are maintained constant throughout.

In the applicant's terminology "rolling pressure", as applied to this application, means the pressure resultant found by dividing the ratio of the value of the pressure exerted by the rolls upon a given piece by the value of the pressure resistance of a given sheet to a change of shape or grain structure. The last value, of course, depends to a great extent upon the hardness of a given sheet at the time of rolling. For, when the sheet has a portion of greater hardness than another portion, there will be an excess resisting pressure when the rolls pass over the harder portion, and these rolls will be yieldingly pressed away from the sheet, thereby automatically increasing the value of the pressure exerted by the rolls. The result is that the ratio before mentioned is maintained constant.

Therefore, in order that the finished sheets shall acquire the proper grain structure during the rolling operations, means 18 are provided and disposed between the screw-downs 15 and 16 and the necks 7—8 of the upper roll 5 for controlling the rolling pressures and maintaining it at a pre-determined constant or uniform value. The means 18 operate in such a manner that the roll 5 will rise and lower in accordance with the variations in the rolling pressure imposed on the sheets, strips, plates and the like being rolled.

One of the means 18 is shown more particularly in detail in Fig. 4 of the drawings and comprises upper and lower thrust block members 21 and 22, a wedge 23 and two groups of anti-friction rollers 24 and 25. The group of rollers 24 is disposed between the wedge 23 and a backing plate 26 of hardened steel which is securely mounted in place on the lower thrust block 22.

The group of rollers 25 is positioned between the top face of the wedge 23 and a backing plate 27 preferably of hardened steel which is securely mounted in place in the upper thrust block member 21.

As shown the lower thrust block member 22 is provided with a bearing member 28 that rides on the neck 7 of the upper roll 5. It is to be noted that the face 29 of the backing member 26 upon which the group of rollers 24 rests is tapered at such an angle that it is substantially parallel to the tapered lower face 30 of the wedge 23. The screw-downs 15 and 16 press downwardly on the top of the upper thrust block member 21 as is clearly shown in Figs. 2 and 4 of the drawings.

While as shown in Fig. 4 of the drawings only the lower face 30 of the wedge block 23 and the adjacent face 29 of the backing plate 26 are tapered, however, if desirable, both upper and lower faces of the wedge block 23 may be tapered as well as the adjacent faces of the backing plates 26 and 27. The preferred construction, however, it that shown in Fig. 4 wherein the upper face of the wedge block 23 and the adjacent face of the backing plate 27 are horizontal and not tapered because by this construction side thrust on the screw-downs is eliminated. Side thrust would arise if the upper face of the wedge block 23 and the adjacent face of the backing plate 27 were tapered.

In the rolling of steel sheets of the character set forth in the patent to Browne No. 1,367,015 it frequently happens that the sheets are not uniform as to hardness, that is, certain sections of the sheets will be relatively softer than other sections. Therefore, as the sheets pass between the rolls 5 and 6, an upward thrust will be imposed upon the upper roll 5 when the hard sections of the sheets are between the roll and also if the entire sheets become harder as the result of cooling below the predetermined value. When the hard sections of the sheets pass between the roll the upward thrust on the roll 5 causes the wedges 23 to move outwardly in the direction of the arrow as indicated at 32 thereby causing the roll 5 to move upwardly and to maintain the pressure on the hard sections on the sheets at the desired value. In this manner the soft and the hard sections of the sheets are rolled at substantially the same pressure. Since the sheets are rolled at a predetermined temperature and the sections throughout the sheets are rolled at substantially the same pressure, the strain imposed on the sheets throughout their lengths will be uniform; therefore, the grain structure of the sheets will be uniform and of the desired value. Since the grain structure is of the desired value, the permeability of the sheets will be relatively high and still maintain the hysteresis and eddy current losses at a permissible value.

The outward movement of the wedge blocks 23 is controlled or limited by levers 33 and 34 which are yieldingly held against movement by a pressure device 35.

As shown the lever 33 is pivotally mounted on the housing 3 medially of its ends as indicated at 36 and is so arranged that the end 37 thereof presses against the outer end of the wedge block 23. The opposite end of the lever 33 is pivotally connected to a piston 38 mounted in a cylinder 39 of the pressure device 35 through a link 40.

The lever 34 is pivotally mounted at its outer end on the housing 2 as indicated at 41 and is provided with a lug 42 medially of its ends which is arranged to press against the outer end of the wedge block 23. The inner end of the lever 34 is connected to the piston 38 through a piston rod 43 and a connecting rod 44. The cylinder 39 is provided with the usual stuffing box and gland construction 45 through which the piston rod 43 enters the cylinder 39. Fluid pressure enters the cylinder 39 through a pipe connection 46 and the pressure of the fluid which enters the cylinder may be adjusted to any predetermined value by means of an accumulator A shown in Fig. 5. The accumulator A is shown and described in the patent to Browne No. 1,367,015.

When the roll 5 is moved upwardly in response to variations in pressure between the rolls, a force is imposed on the wedges 23 causing them to move outwardly which outward movement is opposed by the levers 33 and 34 acting against the pressure in the cylinder 39. Since the lever 33 is pivotally mounted medially of its ends and the lever 34 is pivotally mounted at its outer end, the wedge blocks 23 will move simultaneously in the same direction depending upon whether the levers 33 and 34 are turning in clockwise or in a counter-clockwise direction. When the wedge blocks 23 move outwardly, the levers 33 and 34 turn in a clockwise direction against the pressure in the cylinder 39.

When the rolling pressure between the rolls 5 and 6 has been relieved, the roll 5 will lower. Therefore, since the levers 33 and 34 are opposed by the pressure in the cylinder 33, the levers will move in a counter-clockwise direction to thereby force the wedge blocks 23 inwardly to their normal position as indicated in Fig. 4.

Since the wedge blocks 23 move outwardly in response to the upward movement of the roll 5 and are moved inwardly by the levers 33 and 34 against the pressure in the cylinder 39 a uniform pressure will be maintained upon the sheets during the rolling operation.

In some applications of the rolling mill it may be desirable to adjustably limit the movement of the levers 33 and 34 in a counter-clockwise direction. For this purpose a regulating device 48 is provided that comprises a rod 49 that has screw-thread engagement in a tapped hole 50 in the housing 3 and extends outwardly therefrom through an aperture 51 in the lever 33'. A hand wheel 52 is mounted or keyed to the outer end of the rod 49 and is provided with a hub 53 disposed to contact with a boss 54 on the lever 33'. By turning the hand wheel 52 in the desired direction the hub 53 may be moved away from or towards the ledge or boss 54 on the lever 33' thereby controlling the limits of movement of the levers 33' and 34, which in turn control the minimum and maximum separation of the rolls.

While various modifications and changes may be made in the mill herein shown and described without departing from the spirit and the scope of the invention, it is to be understood that only such limitations shall be placed on the invention as are imposed by the prior art and the appended claims.

What we claim as new and desire to secure by Letters Patent is:

1. In a rolling mill having upper and lower rolls and a screw-down for the upper roll, upper and lower thrust block members disposed between the screw-down and the upper roll, and a wedge between said thrust block members for permitting upward movement of the lower thrust block members in response to an upward thrust on said upper roll, and pressure responsive mechanism for yieldingly opposing outward movement of said wedge.

2. In a rolling mill having upper and lower rolls and a screw-down for the upper roll, upper and lower thrust block members disposed between the screw-down and the upper roll, and a wedge between said thrust block members disposed for movement at right angles to the screw-down for permitting upward movement of the lower thrust block members in response to an upward thrust on said upper roll and pressure responsive mechanism for yieldingly limiting the movement of said wedge.

3. In a rolling mill having upper and lower rolls and a screw-down for the upper roll, upper and lower thrust block members disposed between the screw-down and the upper roll, a wedge between said thrust block members, and anti-friction rollers between the wedge and said blocks, and pressure responsive mechanism for yieldingly opposing outward movement of said wedge.

4. In a rolling mill having upper and lower rolls and a screw-down for the upper roll, upper and lower thrust block members disposed between the screw-down and the upper roll, a wedge between said thrust block members, anti-friction means between the wedge and said blocks, and pressure responsive mechanism for yieldingly opposing the movement of said wedge.

5. In a rolling mill having upper and lower rolls, in combination wedges disposed one adjacent to each end of the upper roll, said wedges being adapted to permit sepa-

ration of said rolls in response to increases of pressure exerted by metal to be rolled between the rolls, and pressure responsive means disposed to return said wedges in response to downward movement of said roll.

6. In a rolling mill having upper and lower rolls and a screw-down for the upper roll, the combination of upper and lower thrust block members disposed between the screw-down and the upper roll, a backing plate disposed between said thrust block members and a wedge, and anti-friction rollers disposed between the wedge and said blocks.

7. In a rolling mill having upper and lower rolls and a screw-down for the upper roll, the combination of upper and lower thrust block members disposed between the screw-down and the upper roll, and a wedge disposed between said thrust block members for permitting upward movement of the lower thrust block members in response to an upward thrust on said upper roll, a yielding pressure lever cooperatively associated with an end of said wedge for yieldingly opposing outward movement of said wedge when said upper roll is subjected to an excess pressure and for yieldingly returning said wedge to its original position when said roll is relieved of said excess pressure.

8. In a rolling mill having upper and lower rolls and a screw-down for the upper roll, the combination of upper and lower thrust block members disposed between the screw-down and the upper roll, a wedge disposed between said thrust block members for permitting upward movement thereof in response to an upward thrust on said upper roll, a pressure resisting mechanism having an operating lever pivoted thereto at one end thereof, said lever being cooperatively associated at the other end thereof with an end of said wedge, so that said wedge will be yieldably held in position thereby.

9. In a rolling mill having upper and lower rolls and a screw-down for the upper roll, the combination of upper and lower thrust block members disposed between the screw-down and the upper roll, a wedge between said thrust block members for permitting upward movement thereof in response to an upward thrust upon said upper roll, a pressure cylinder for yieldingly resisting an outward movement of said wedge, said cylinder having an operating lever pivotally connecting thereto, said lever being disposed for cooperation with an end of said wedge.

10. In a rolling mill having upper and lower rolls and a screw-down for each neck of the upper roll, the combination of upper and lower thrust block members disposed between said screw-downs and the necks of the upper roll, wedges disposed between said thrust block members for permitting upward movement thereof in response to an upward thrust on said upper roll, a pressure responsive means for yieldingly resisting any outward movement of either or both of said wedges, said pressure responsive means having a lever system which includes a portion cooperating with each wedge, so that an outer movement of one or both of said wedges will be yieldingly resisted.

11. In a rolling mill having upper and lower rolls and a screw-down for the upper roll, the combination of upper and lower thrust block members disposed between the screw-down and the upper roll, a wedge between said thrust block members for permitting upward movement thereof in response to an upward thrust upon said upper roll, a pressure cylinder for yieldingly resisting in outward movement of said wedge, said cylinder having an operating lever pivotally connecting thereto, said lever being disposed for cooperation with an end of said wedge, and means cooperating with said lever for adjusting the maximum separation of the rolls.

In testimony whereof, we have hereunto set our names this 22nd day of November, 1929.

BARTON R. SHOVER.
FRANK P. TOWNSEND.