Nov. 25, 1924. 1,516,627

G. A. WISE

LEVELING APPARATUS FOR METALLIC SHEETS AND THE LIKE

Filed June 15, 1922 7 Sheets-Sheet 1

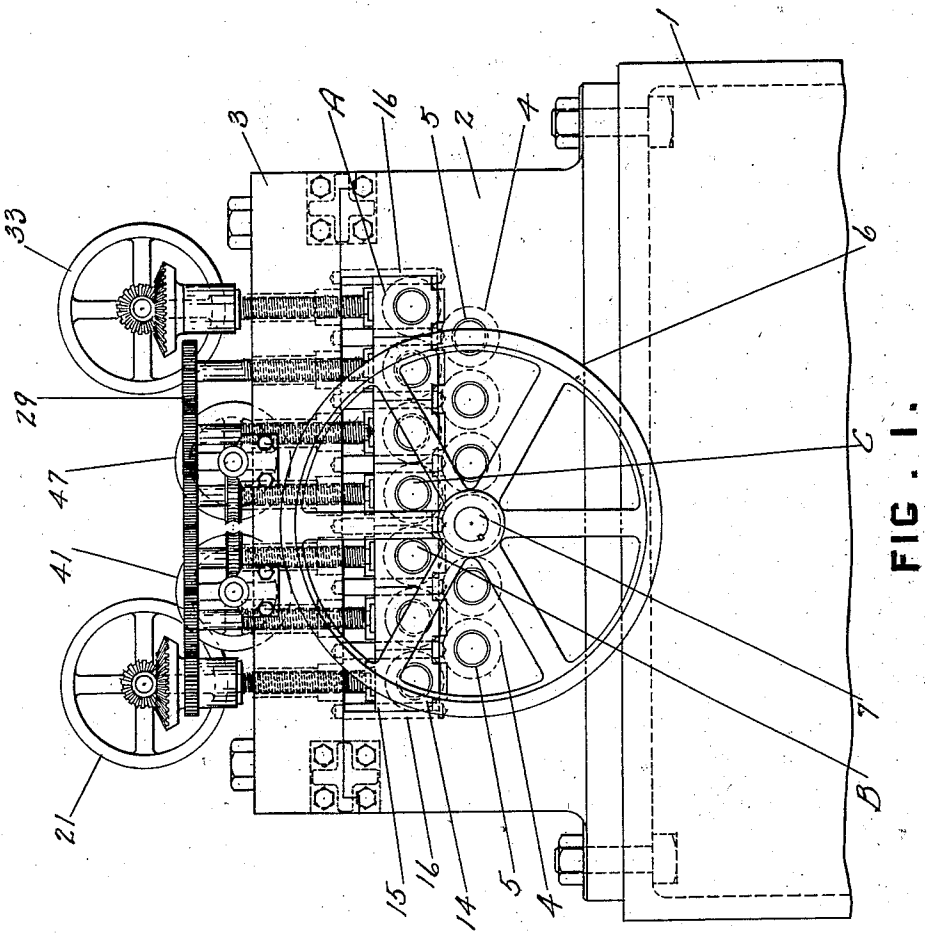


FIG. 1.

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LEVELING APPARATUS FOR METALLIC SHEETS AND THE LIKE

Filed June 15, 1922 7 Sheets-Sheet 2

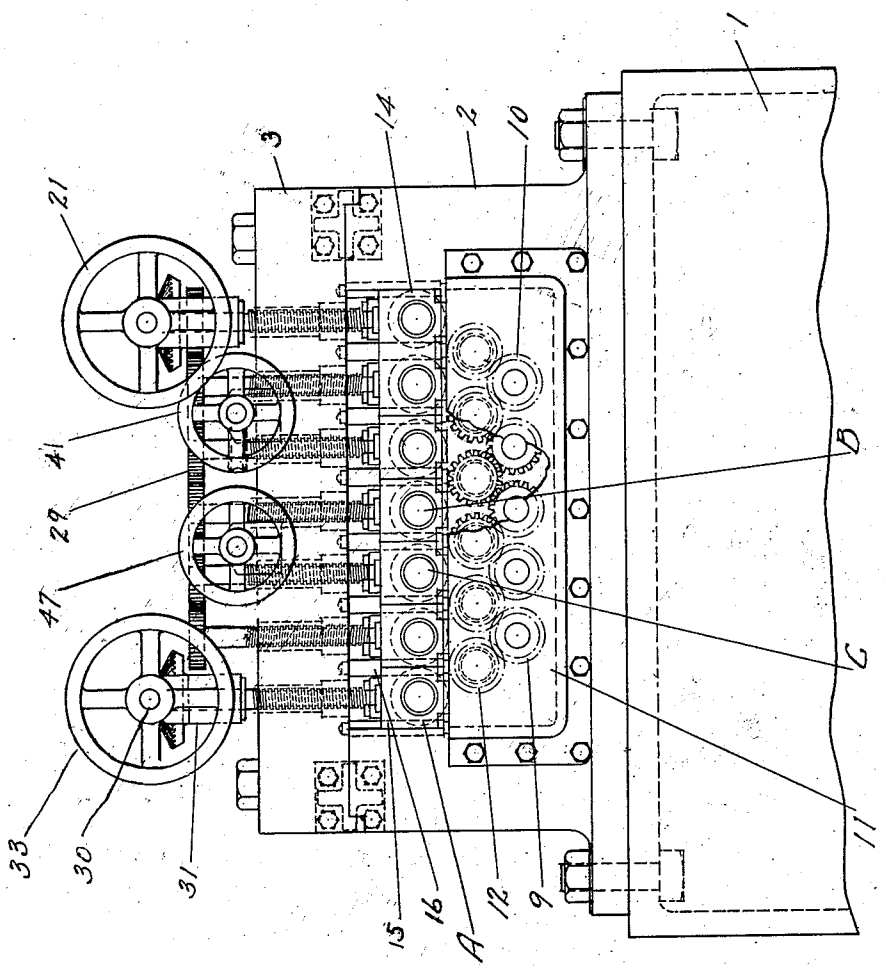


FIG. 2

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LEVELING APPARATUS FOR METALLIC SHEETS AND THE LIKE

Filed June 15, 1922 7 Sheets-Sheet 3

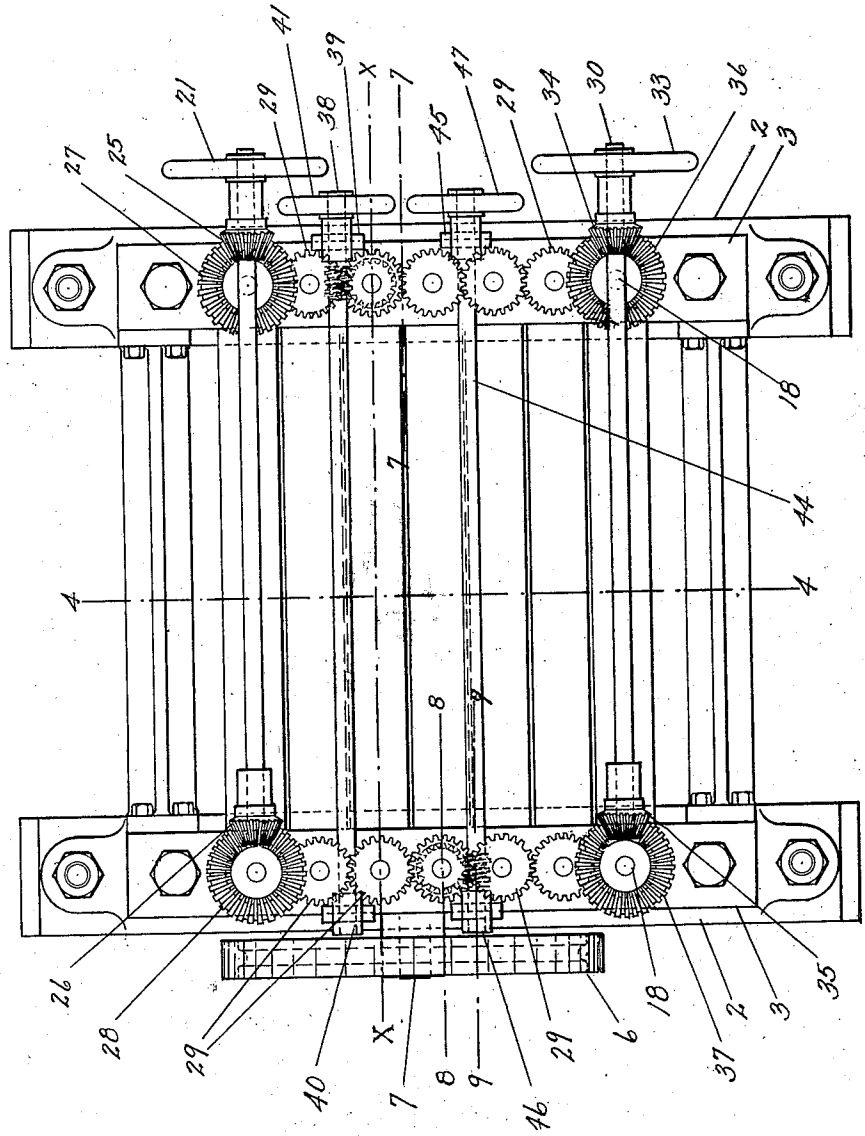


FIG. 3

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LEVELING APPARATUS FOR METALLIC SHEETS AND THE LIKE

Filed June 15, 1922 7 Sheets-Sheet 4

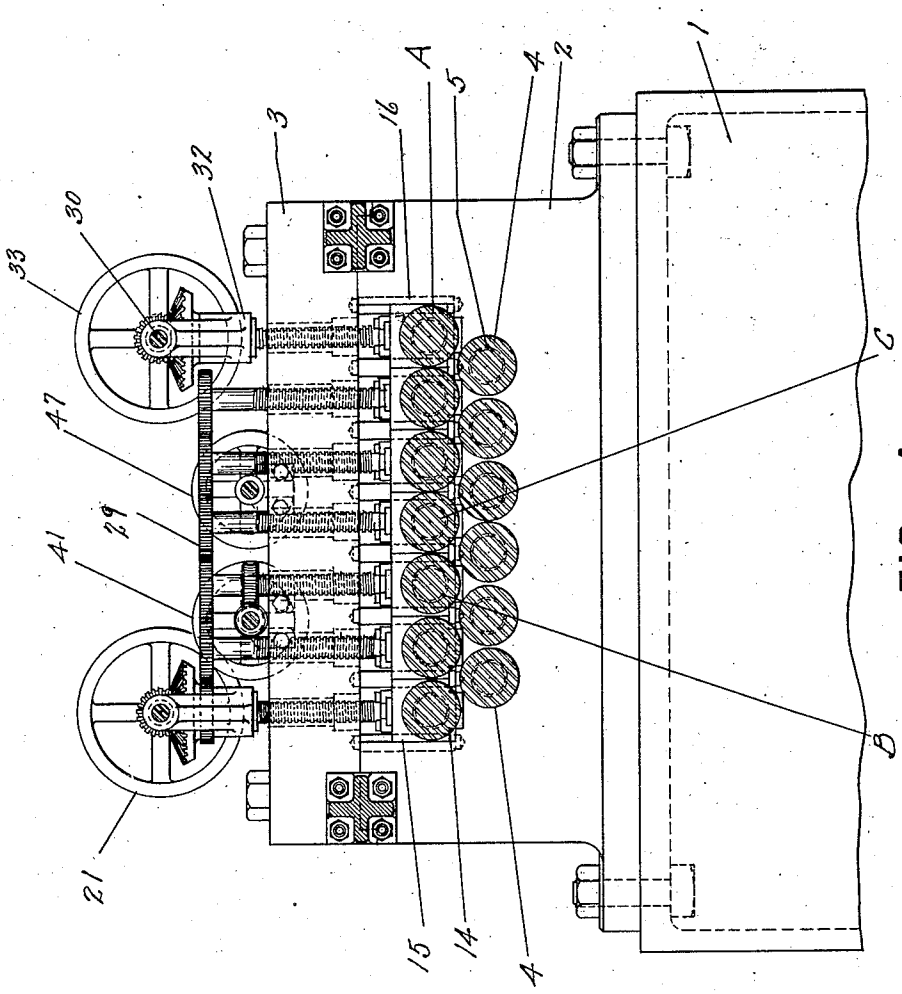


FIG. 4.

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LEVELING APPARATUS FOR METALLIC SHEETS AND THE LIKE

Filed June 15, 1922 7 Sheets-Sheet 5

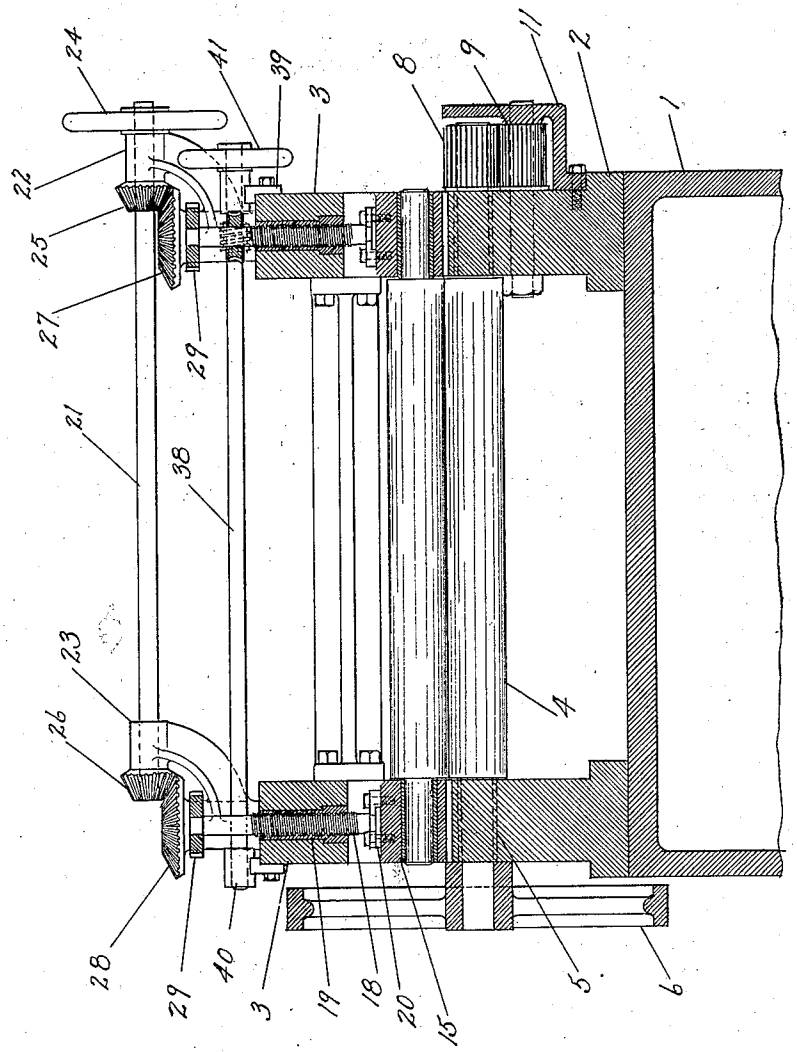


FIG. 5.

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LEVELING APPARATUS FOR METALLIC SHEETS AND THE LIKE

Filed June 15, 1922 7 Sheets-Sheet 6

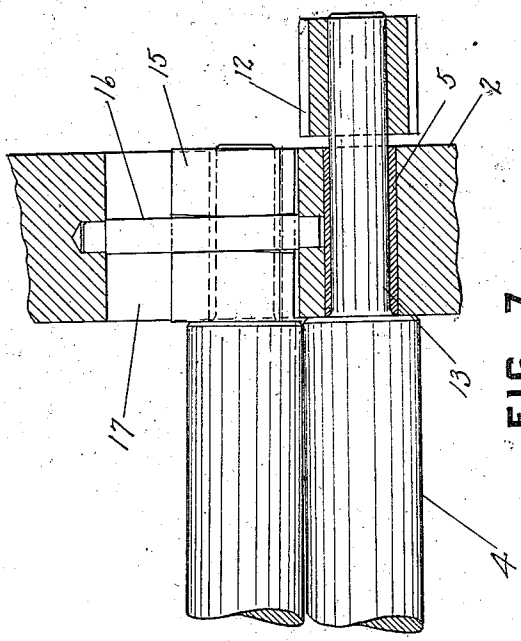


FIG. 7.

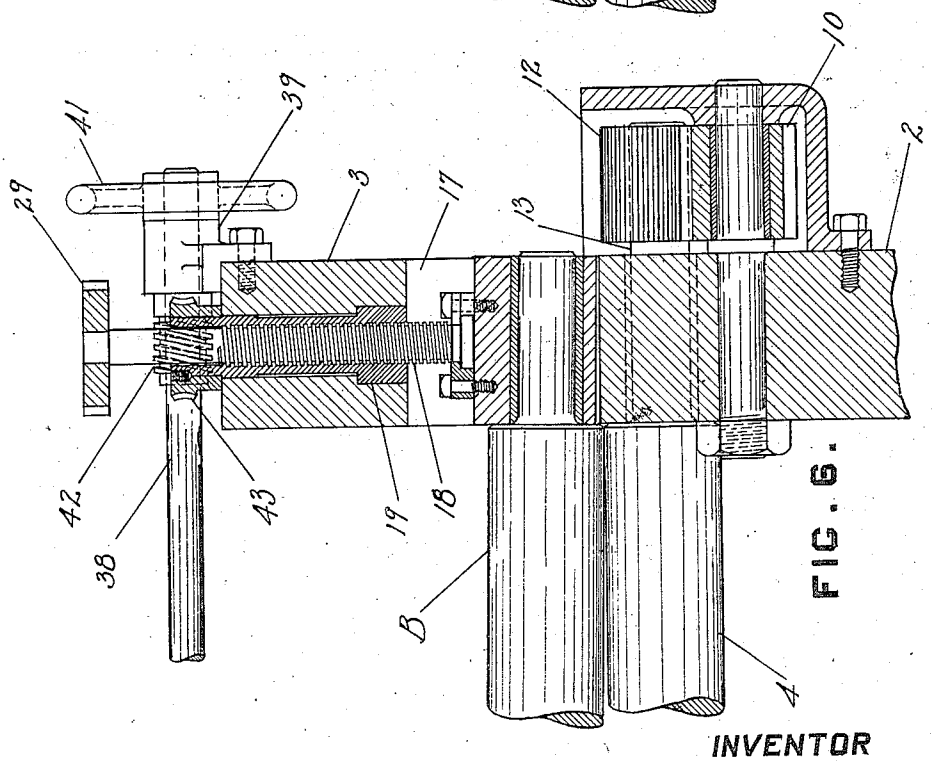


FIG. 6.

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by William B. Wharton

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Nov. 25, 1924. 1,516,627

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LEVELING APPARATUS FOR METALLIC SHEETS AND THE LIKE

Filed June 15, 1922 7 Sheets-Sheet 7

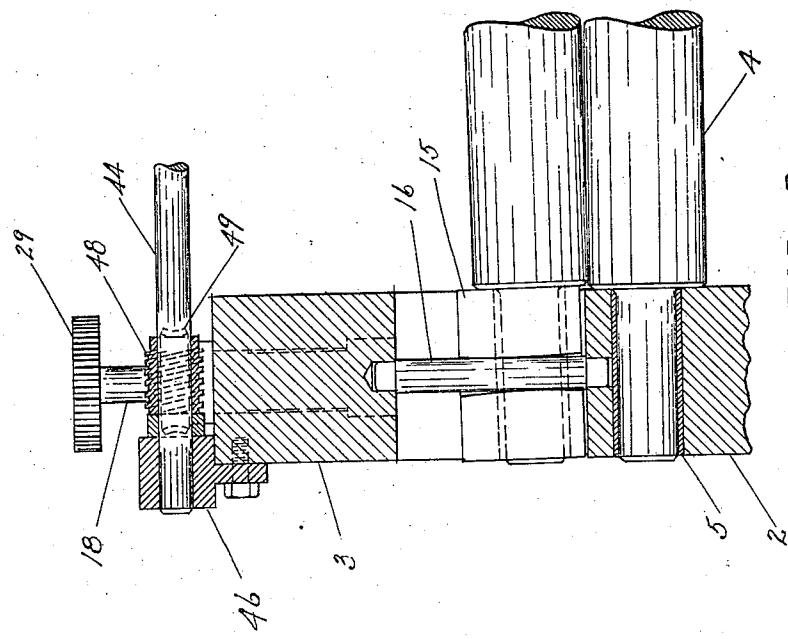


FIG. 9.

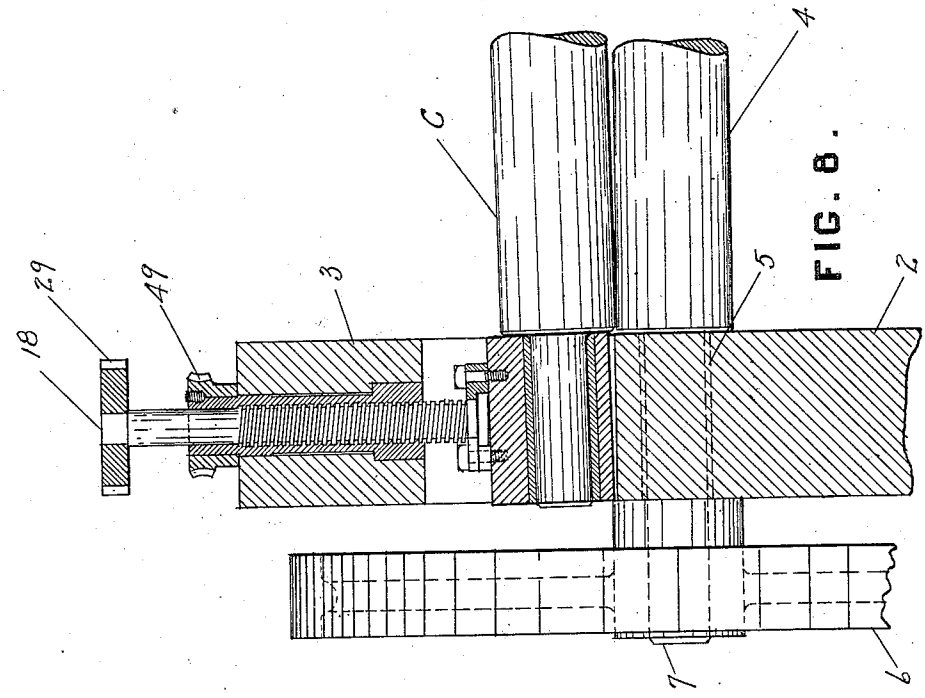


FIG. 8.

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Patented Nov. 25, 1924. 1,516,627

UNITED STATES PATENT OFFICE.

GEORGE A. WISE, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO SUTTON-ABRAMSEN ENGINEERING COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

LEVELING APPARATUS FOR METALLIC SHEETS AND THE LIKE.

Application filed June 15, 1922. Serial No. 568,508.

To all whom it may concern:

Be it known that I, GEORGE A. WISE, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in a Leveling Apparatus for Metallic Sheets and the like, of which the following is a specification.

This invention relates to leveling apparatus for flattening hot or cold metallic sheets or plates.

Finished sheets or plates, particularly sheets, generally present a dished contour, that is they vary from a true plane in having a slow or gradual inclination from points adjacent the central longitudinal line of the sheet outwardly to the edges thereof. The finished sheets or plates also frequently have a definite bow or ridge extending longitudinally thereof, and in some cases show a wavy surface. This distorted condition causes serious manufacturing troubles to all users of metallic sheets or plates.

The object of the present invention is to provide apparatus capable of removing these objectionable features, and producing a perfectly flat or level sheet or plate.

Further objects of the invention are to provide apparatus having the advantages noted above which is further susceptible of adjustment for differences in the degree to which the sheets or plates of different runs or lots are distorted, and in which the adjustment may be effected so readily that an exact adjustment may be made almost instantly should the degree of distortion of the sheets or plates alter during the continuance of a single run through a hot mill due to any cause, as for instance a change in the temperature of the sheets or plates, or a change in the temperature of the mill rolls.

Another object of the invention is to provide apparatus which may be adjusted to such a fine point that it will act upon and correct the slightest distortion in the sheets or plates.

Another object of the invention is to provide means for checking any tendency for the sheets or plates to sweep upwardly or downwardly as they pass from the apparatus.

In the accompanying drawings Figure 1 is a side elevation of the machine; Figure 2 is an elevation of the opposite side thereof; Figure 3 is a plan view thereof; Figure 4 is a vertical longitudinal section through the machine on the line 4—4 Figure 3; Figure 5 is a section on the line X—X Figure 3; Figure 6 is a section on the line X—X Figure 3, showing on an enlarged scale a portion of the apparatus as shown in Figure 5; Figure 7 is a sectional detail in enlarged scale on the line 7—7 Figure 3; Figure 8 is a cross sectional view on the line 8—8 Figure 3; and Figure 9 is a sectional detail on an enlarged scale taken on the line 9—9 Figure 3.

The machine comprises primarily a base 1, a main frame 2 secured thereon, a cap frame 3 on the main frame, rolls, means for actuating the same, means for the independent vertical adjustment of one of the rolls, means for the simultaneous vertical adjustment of other of the rolls, and means for adjustably tilting certain of the rolls, independently of the general vertical adjustment.

The train of lower rolls 4 are trunnioned in stationary bearings 5 in the main frame 2 of the machine. These rolls are positively actuated by means of a pulley or the like mounted on a shaft 7 and adapted to receive power from any suitable source; a pinion 8 mounted on the shaft 7 at the side of the machine opposite to the pulley 6, a train of pinions 9 and 10 mounted in the frame 2 and in the housing 11 thereon, and pinions 12 on the trunnions 13 of the rolls 4 and meshing with the pinions 10.

The upper train or tier of rolls 14 are trunnioned in vertically adjustable bearing blocks 15, which engage with vertical guide pins or posts 16 extending into both the main frame 2 and the cap frame 3 of the machine. As shown with particular clearness in Figures 7 to 9 inclusive of the drawings, clearance spaces 17 for the vertical movement of the bearing blocks are provided within the main frame 2 and cap frame 3, and the guide pins 16 pass through these spaces.

For the sake of convenience, the separately adjustable unit of the upper rolls 14 will be given the special identifying character "A", and the skew or tiltable rolls the identifying characters "B" and "C".

The means which operate directly on the

bearing blocks 15 of the upper rolls 14 for raising and lowering the same are identical for all of the upper rolls. Such means, as shown in detail in Figure 5 of the drawings, comprise a screw 18 threaded into a nut 19, which is immovably secured in the cap frame 3 as by being forced thereinto. The lower extremity of the screw 18 is secured to a foot 20 which is bolted to the upper extremity of the bearing block 15. Rotation of the screw 18 in one direction therefore lowers the block to which it is secured while rotation in the opposite direction raises the block.

All the upper rolls, with the exception of the roll A, are adjustable simultaneously and equally by common means provided for that purpose. Such means comprise a shaft 21; which extends completely across the machine, and which is mounted in bracket bearings 22 and 23 secured to the opposite sides of the cap frame 3. The shaft 21 is operated by a wheel 24, and is provided with bevel pinions 25 and 26 meshing with bevel gears 27 and 28 on the adjusting screws 18 which it immediately overlies on both sides of the machine. The operation of wheel 24 in one direction or the other thus serves to raise or lower the particular one of the rolls 14 which it overlies.

In order to transmit motion for adjusting all the upper rolls of the set simultaneously, a pinion 29 is mounted on each of the screws 18, and these pinions intermesh along both sides of the machine. As the direction of rotation of adjacent pinions 29 and their screws 18 is thus opposite, adjacent screws 18 are oppositely threaded in their nuts 19, so that the effect is uniform throughout the machine. The end roll A of the rolls 14 of the upper train or tier is provided with an independent shaft 30; having bearings 31 and 32, and arranged to be actuated by the wheel 33. The shaft 30 has thereon the bevel pinions 34 and 35 meshing respectively with the bevel gears 36 and 37 on the adjusting screws 18 of this independently adjustable roll A.

The roll A is rendered capable of an independent adjustment so that, as stated above, it may be adjusted to cause the sheets or plates to be passed straight from the machine. Thus if there is a tendency during a run for the sheets to sweep upwardly, this tendency may be corrected for by lowering the roll A; and if with the roll A in such position a tendency for the sheets or plates to sweep downwardly should develop, this tendency may be corrected by raising the roll the necessary distance.

It is in the arrangement of the rolls B and C that the chief novelty of the present invention resides.

These rolls B and C are mounted in a manner exactly similar to the other rolls 14 of the upper tier. Means are provided, however, for independently raising or lowering one end of each of these rolls. For the purpose of raising and lowering the roll B, the shaft 38 is mounted transversely of the machine in bearings 39 and 40, and is arranged to be rotated by means of the wheel 41. On the side of the machine adjacent the wheel 41 shaft 38 is provided with a worm 42 meshing with a worm gear 43 carried by the portion of nut 19 which extends above the cap frame 3.

When, therefore, wheel 41 is operated, shaft 38 is rotated and the motion is transmitted to the screw 18 by means of the meshing of worm 42 and worm gear 43. The rotation of screw 18 in its nut 19 causes vertical movement of the screw to raise or lower the end of the roll thus acted upon. This action tilts the roll as shown in Figures 6 and 7. In order to permit this tilting a slight amount of play is permitted between the bearing blocks 15 and guide pin 16, as shown particularly in Figure 7 of the drawings. As the required tilting of the roll is extremely slight, this amount of play need not be great.

The means for tilting the other skew roll C comprises a shaft 44 extending transversely of the machine, and mounted in bearings 45 and 46. This shaft 44 is rotated by means of a wheel 47 disposed adjacent the wheel 41 for operating shaft 38. At the side of the machine opposite the wheels 41 and 47 the shaft 44 is provided with a worm 48 meshing with the worm gear 49 on the screw 18 of the roll C. As shown in Figures 8 and 9 of the drawings, the structure operating directly on one end of the roll C is identical with that operating directly upon the opposite end of the roll B.

As the opposite ends of the two rolls B and C are independently adjustable, they may be set to operate upon deviations of different degree on the two sides of the sheets.

The operation of the machine will be readily understood. It should be noted that the lower rolls 4 and the upper rolls 14 are relatively staggered, so that the sheet or plates is subjected to a repeated flexing during its passage through the rolls. This action flattens out longitudinal bows in the sheet or plate and also corrects a wavy contour thereof. Simultaneously the skew rolls B and C serve to flex the sheets or plates longitudinally beyond their plane in a direction opposite to that in which they are naturally dished, so as to give the sheets or plates a permanent set in a true plane.

The roll A operates as previously described to direct the sheets as they pass from the machine.

It will also be seen that the ready and independent adjustment of the rolls B and C permits the machine to be accommodated

to deviations of varying degree in the progress of a run through a hot mill without shutting out the hot rolls for that purpose. If, it should be observed during use of the apparatus in any connection that the sheets passing from the machine have either had their dished contour insufficiently corrected, or that there has been an overcorrection producing a dish in the opposite direction, the proper adjustment may be instantly made.

Leveling machines previously in use have embodied the general principle of using tiers of relatively staggered rolls for leveling or flattening sheets or plates, all the rolls of one such tier being simultaneously adjustable vertically of the machine. Such machines, however, have failed to completely fulfill their purpose because the dished contour of finished sheets or plates is not readily corrected permanently, the resiliency of the metal tending to cause the sheet or plate to return to dished form after leaving the leveling machine.

The leveling machine of the present invention possesses a marked advantage in that it presents practical means for breaking down the dished contour of sheets and plates in such manner that the metal of the sheet or plate is permanently established in a true plane, without any tendency toward returning to a dished contour.

The machine further permits an increased production of sheets in the use of any sheet producing equipment, because of the ability of the machine to correct any amount of distortion that may occur in a sheet or plate mill.

It will be understood that the machine may be modified in a number of particulars without departing from the spirit of the invention. Thus the number of skew rolls may be varied in number.

As the machine is susceptible of a number of other modifications without departing from the spirit of the present invention, the scope of the invention is to be restricted only by the limitations contained in the appended claims.

What I claim is:

1. In a machine for leveling sheet and plate metal the combination of a machine frame, a tier of lower rolls having bearings in said frame, a tier of upper rolls mounted in vertically adjustable bearings, adjusting screws arranged to adjust the rolls of said tier vertically, means for acting upon all of said adjusting screws simultaneously to adjust the upper tier of rolls as a unit, a roll in said upper tier adjustable in bearings tiltable in the frame, and means arranged to act upon the adjusting screw at one end of said roll independently of the other rolls of the tier for tilting said roll in the machine.

2. In a machine for leveling sheet and plate metal the combination of a machine frame, a tier of lower rolls having bearings in said frame, a tier of upper rolls mounted in vertically adjustable bearings, adjusting screws arranged to adjust the rolls of said upper tier vertically, means for acting upon all of said adjusting screws simultaneously to adjust the upper tier of rolls as a unit, two rolls in said upper tier being trunnioned in bearings tiltable in said frame, and means arranged to act upon the adjusting screws at opposite ends of the two rolls independently of the other rolls of the tier for tilting the rolls in opposite directions in the machine.

3. In a machine for leveling sheet and plate metal the combination of a machine frame, a tier of lower rolls having bearings in said frame, a tier of upper rolls mounted in vertically adjustable bearings, means for adjusting vertically both ends of each roll of the upper tier, a plurality of the rolls of the upper tier being susceptible of vertical adjustment at one end thereof independently of the other rolls to produce tilting of such rolls, actuating means arranged to act upon said adjusting means to simultaneously raise or lower both ends of all rolls of the tier as a unit, and independent actuating means arranged to act upon said adjusting means to raise or lower one end of each of said tiltable rolls independently to tilt the roll.

4. In a machine for leveling sheet and plate metal the combination of a machine frame, a tier of lower rolls having bearings in said frame, a tier of upper rolls mounted in vertically adjustable bearings, means for adjusting vertically both ends of each roll of the upper tier, a plurality of the rolls of the upper tier being susceptible of vertical adjustment at one end thereof independently of the other rolls to produce tilting of such rolls, actuating means arranged to act upon said adjusting means to simultaneously raise or lower both ends of all rolls of the tier as a unit, independent actuating means arranged to act upon said adjusting means to raise or lower one end of each of said tiltable rolls independently to tilt the roll, an upper roll mounted at the discharge end of the machine independently of the tier of rolls, and means for the independent vertical adjustment of said roll to direct sheets or plates as they issue from the machine.

In testimony whereof, I hereunto set my hand.

GEORGE A. WISE.

Witnesses:
R. M. GAUGHAN,
E. B. WALTERS.