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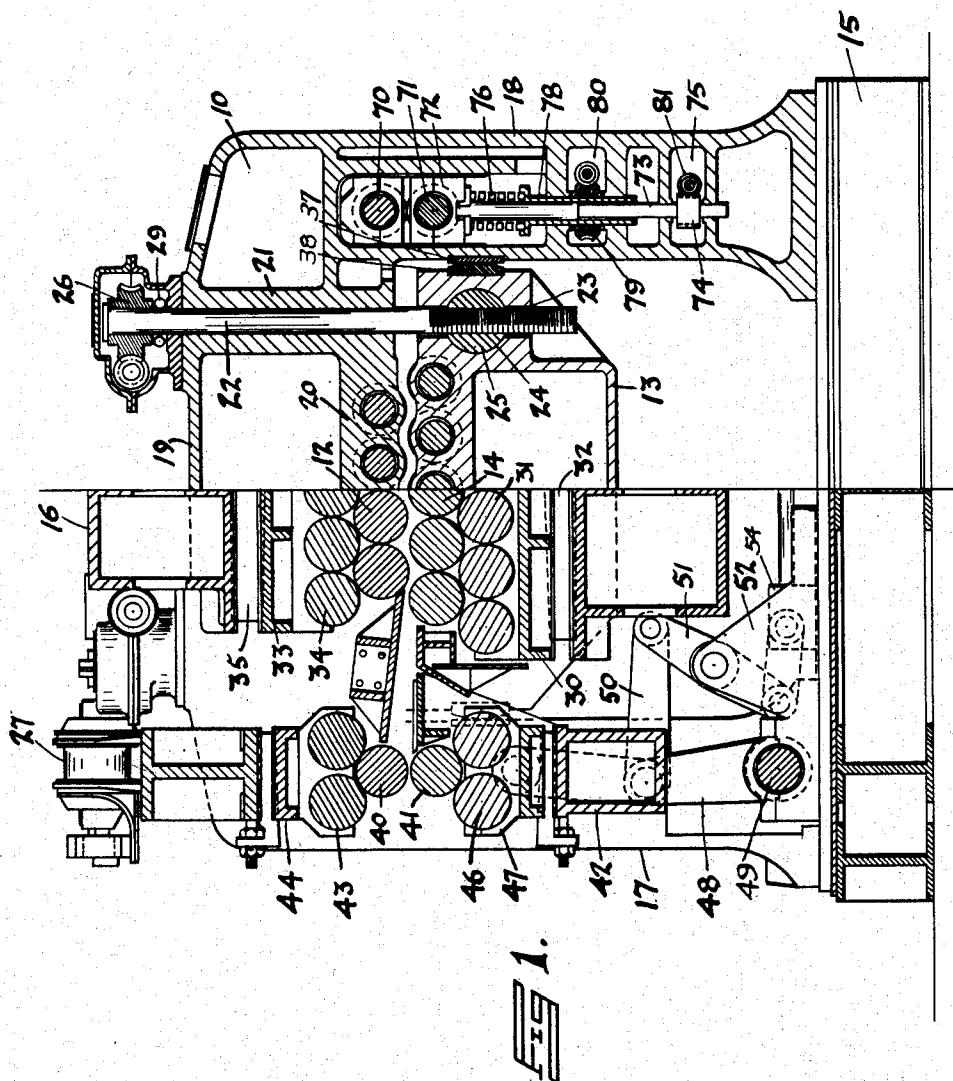
R. T. TODD

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ROLLER LEVELER

Filed March 13, 1941

3 Sheets-Sheet 1



Inventor

RUSSELL T. TODD

By

Francis J. Klemm

Attorney

July 11, 1944.

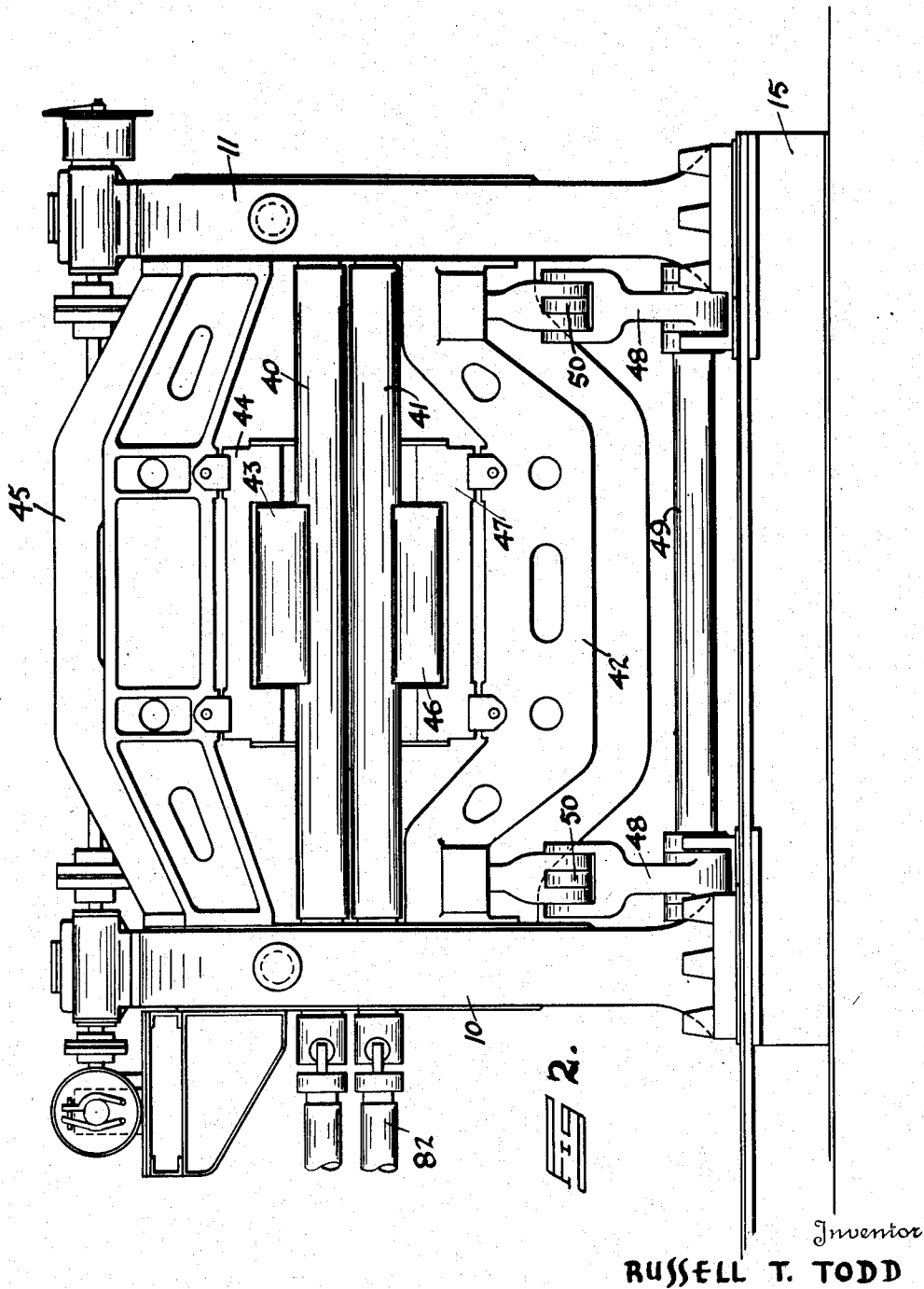
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3 Sheets-Sheet 2



By

Francis J. Klempfay

Attorney

July 11, 1944.

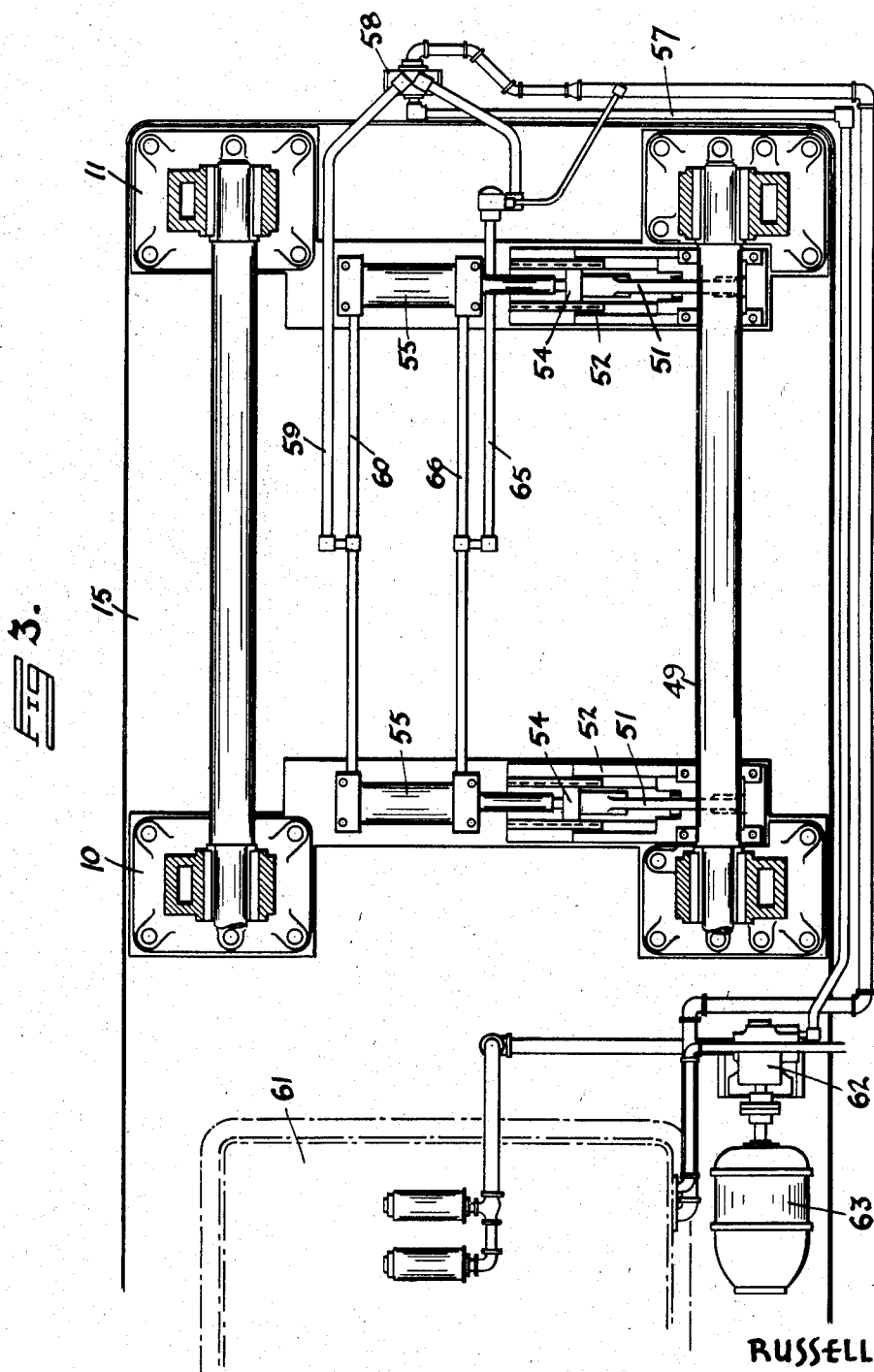
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3 Sheets-Sheet 3



Inventor
RUSSELL T. TODD

By *Francis J. Klempf*
Attorney

UNITED STATES PATENT OFFICE

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ROLLER LEVELER

Russell T. Todd, Youngstown, Ohio, assignor to
McKay Machine Company, Youngstown, Ohio,
a corporation of Ohio

Application March 13, 1941, Serial No. 383,134

12 Claims. (Cl. 153—54)

This invention relates to roller levelers for working and leveling metal sheets, strip and plate and is particularly adapted for but not necessarily limited to the working and leveling of such sections in the heavier gauges. Principal objects of the invention include the provision of a novel structural arrangement for resisting the heavy expansive forces exerted by the stock on the mechanism of the machine whereby the design and construction of the apparatus is substantially simplified and the probability of failure under prolonged and unusually severe conditions of service is substantially minimized.

Further, the invention seeks to provide an arrangement in an apparatus for roller leveling heavy gauge material whereby the resultant mechanism will possess ample strength and rigidity where required to oppose the large expansive forces exerted by the material while, nevertheless, enabling substantial reductions to be made in the weight and cost of the apparatus.

Another object of the invention is the incorporation in a roller leveler of an improved arrangement for reducing buckles in the stock to insure the ready entry of the stock into the working rolls of the machine without interrupting the operation of the production line in which the leveler might be positioned and without injury to the mechanism of the leveler.

Yet another object of the invention is the provision in a roller leveler of an improved pinch roll arrangement for engaging the leading end of the stock as it issues from the leveling pass and to draw the stock through the working rolls of the pass. Other objects of the invention include an improved arrangement and disposition of the operative parts of a roller leveler whereby the assembly, testing, and shipping of the completed machine may be facilitated. Further, the invention includes an improved arrangement for supporting and adjusting the adjustable bank of leveler rolls and improved means to restrain such rolls in their preselected position, the latter improvement contributing substantially to the longevity and low cost of maintenance of the apparatus.

These and other objects and advantages of the invention will become apparent from a consideration of the following detailed specification and the accompanying drawings wherein there is specifically disclosed a preferred embodiment of the invention.

In the drawings:

Figure 1 is a longitudinal section, along two

planes, of a roller leveler constructed in accordance with the principles of the invention;

Figure 2 is an end view of the apparatus of Figure 1; and

Figure 3 is a plan view of the base of the apparatus of Figure 1, illustrating the operating mechanism for the crushing roll which is operative to reduce buckles in the stock to allow the stock to enter the working rolls of the leveler.

Heretofore in constructing roller levelers the usual practice has been to journal the lower working rolls, whether or not provided with backing rolls, in a fixed housing or base and to journal the upper metal working rolls, whether or not provided with backing rolls in an upper frame or housing, the upper housing having adjustable connections with the lower housing by means of hold down screws whereby the interval and angularity between the housings may be adjusted.

The journals in the respective housings are so constructed that the rolls carried by one housing are offset with respect to the rolls carried by the other housing whereby the material passing through the leveler will be subjected to a sinuous path of travel with the extent of deformation progressing from a maximum to zero amplitude in the direction followed by the stock. Although an extra working roll is journaled in one of the housings for the purpose of neutralizing any longitudinal thrust which may appear between the housings, the action of the leveler is such by reason of the divergence of the upper and lower roll banks that the thrust is not entirely eliminated and must necessarily be taken up by the hold down screws or other connection between the housings. Also in these prior machines the very large expansive forces exerted by the stock during the leveling operation are transmitted through the working rolls and their backing rolls, if used, through the component parts of the respective housings, and through the hold down screws and their ancillary devices. This construction requires that substantially the whole of the housings and particularly their end standards or portions through which the hold down screws extend have sufficient strength and rigidity to transmit the heavy stresses without undue deflection. Therefore the housings must necessarily be large and heavy throughout substantially their whole extent and in the case of heavy plate levelers their massiveness and weight assume such proportions as to be almost impractical.

The above mentioned objectionable aspects of the prior devices are overcome by the present invention by journaling the adjustable bank of

working rolls in a separable block or support which is closely coupled to that portion of the fixed housing which journals the fixed bank of working rolls whereby but a portion of the housings need be of sufficient strength and rigidity to carry the stresses imparted by the stock. The remaining portions of the housings simply serve to support the mechanism of the leveler. This is accomplished in accordance with the invention and the preferred embodiment thereof as illustrated in Figures 1 through 3 by providing a pair of relatively fixed side housings 10 and 11 in which are journaled the ends of the upper working rolls 12 and a separable block or frame 13 (Figure 1) in which are journaled the ends of the lower metal working rolls 14. Housings 10 and 11 are supported on a suitable base 15 and are rigidly interconnected adjacent their upper ends by a heavy tie member 16 which is bolted or otherwise suitably secured to the housings 10 and 11.

As suggested in Figure 1, each of the housings 10 and 11 consists of end standards or portions 17 and 18 and a horizontally disposed upper portion 19. The latter is preferably cast hollow and its lower wall 20 receives the bushings in which the rolls 12 are journaled. Below wall 20 and in between end portions 17 and 18 the housings are open to provide, in effect, windows there-through for the reception of the ends of block 13. Upper housing portions 19 are each provided with two vertically extending webs 21 each provided with a vertically extending bore to receive a hold-down screw 22. Vertically aligned with each of said bores is a bore 23 in the block 13. Extending at right angles to each of the bores 23 and inwardly from the said ends of said block 13 is a bore 24 adapted to receive a shaft 25. Each of the shafts 25 is provided with a diametrically extending threaded aperture to receive the threaded portion of one of the hold-down screws 22 and it should be obvious that upon rotation of said screws without axial movement thereof the block 13 will be raised and lowered. Bores 23 are somewhat larger in diameter than the screws 22 and this, together with the cylindrical inner engagement between bores 24 and shafts 25, allows the block 13 to be adjusted about an axis extending transversely of the machine whereby the divergence between the upper and lower banks of working rolls may be varied.

To the upper end of each of the screws 22 is secured a worm wheel 26 adapted to be driven in pairs by motors 27. The screws at the entering end of the machine are coupled in pairs and driven by one motor while the screws at the material leaving end of the machine are coupled together and driven by a second motor in accordance with the usual practice. Below each of the worm wheels 26 there is a thrust bearing 29 which takes the axial thrust of the screws 22. It should be apparent that the stress path through the rolls housing portion 19, screws 22, and block 13 lies in a relatively confined area inwardly of the housing portions 17 and 18. Consequently such portions need not be constructed of particularly heavy sections and the overall weight and cost of the housings 10 and 11 may be substantially reduced.

Carried by the block 13 centrally thereof is a subhousing 30 which rotatably supports the lower backup rolls 31. In accordance with the usual practice, a wedge 32 is provided to move the subhousing 30 relative to the block 13 to vary the pressure between the working rolls 14 and the backup rolls 31. A similar subhousing 33 rotat-

ably supports upper backup rolls 34 and a similar wedge 35 may be employed to adjust the operative position of the subhousing 33 relative to the member 16 against which the subhousing 33 bears in operation. A wear plate 37 is secured to the inner wall of each of the portions 17 and 18 of each of the housings 10 and 11 and co-operating wear plates 38 are attached to the block 13. Plates 38 are provided with an outer convex surface to allow for the angular adjustment of the block 13. The wear plates are fitted rather closely and during the operation of the machine any longitudinal thrusts which may be imparted to the block 13 is taken up by the plates 37 and 38 without substantial impact or shattering between the parts. Also the provision of the plates 37 and 38 eliminate the possibility of any lateral thrusts appearing on the screws 22. This arrangement contributes to the ruggedness and durability of the machine and substantially eases the maintenance of the same. By suspending the adjustable bank of rolls there is eliminated the necessity of providing springs or other mechanisms to hold the fixed and adjustable banks of rolls in their proper spaced apart relation and thus the construction and maintenance of the apparatus is further simplified.

To reduce bulges and excessive deformation in the sheet, strip or plate to be leveled which would prevent the stock from readily entering between the working rolls of the leveler I provide a pair of crushing rolls 40 and 41 which are positioned in front of said working rolls and are operative to sufficiently reduce such bulges or other excessive deformations. Upper roll 40 is journaled in the housings 10 and 11 in a manner similar to the upper working rolls 12 while the lower crushing roll 41 is journaled in bearings, not shown, carried by the ends of a vertically slideable arbor 42 (Figures 1 and 2). Roll 40 is provided with backing rolls 43 journaled in a subhousing 44 bearing against a tie member 45 which interconnects the upper ends of the housings 10 and 11. Lower roll 41 is provided with a similar pair of backing rolls marked 46 which are journaled in a subhousing 47 resting on the arbor 42. The ends of the arbor 42 are slideably received in guideways, not shown, formed in the end portions 17 of the housings 10 and 11.

Since the stock to be handled may be deformed to such an extent that it will not enter either the crushing rolls or the leveler rolls if in their closed operative positions, means is provided to readily operate the crushing rolls to enable the end of the stock to be positioned therebetween, the means being operative to apply sufficient crushing force to the rolls when the rolls are moved toward each other. To this end, a pair of toggles 48 are connected to the arbor 42, one adjacent each end of the arbor, and the lower links of the toggles are rigidly keyed to a heavy common shaft 49. Pivotaly connected to each of the toggle pins is a link 50 which links are connected at their other ends with levers 51 pivoted on brackets 52. The opposite ends of levers 51 are connected by means of links 53 with slides 54 adapted to be operated by the hydraulic cylinders 55. Fluid pressure is admitted to the outer ends of cylinders 55 to bring the rolls 40 and 41 together through a conduit 57, a four-way valve 58, and conduits 59 and 60. Valve 58 is manually controlled, either electrically or mechanically. Fluid pressure is supplied to conduit 57 from a reservoir 61 by a pump 62 operated by a motor 63. Pump 62 has incorporated therein the usual

by-pass arrangement and in connection with the pump there is a pressure regulator, not shown, which is operative to control the pressure exerted by the cylinders 55 and consequently the pressure on the stock between the rolls 40 and 41. The rolls 40 and 41 are moved apart by operation of valve 58 which may divert fluid pressure through conduits 65 and 66 and to the opposite ends of cylinders 55.

A pair of pinch rolls 70 and 71 are provided at the stock leaving end of the leveler to assist the stock in its passage through the machine and heretofore such pinch rolls were normally spring pressed toward each other and into engagement with each other when no stock was between them. As the trailing end of a piece of stock passed through the pinch rolls, the rolls would come together under impact and this would tend to mar and scuff the rolls thus reducing their useful length of service. To obviate this difficulty and prevent impact between the rolls, I employ an improved arrangement now to be described. The upper pinch rolls 70 is journaled in fixed bearings mounted in housings 10 and 11 while the lower pinch roll 71 is journaled in bearing blocks 72 slideably mounted in windows provided in the housing sections 18. Blocks 72 are rigidly connected to a downwardly extending screw 73 which is in screw threaded engagement with a worm wheel 74 confined to limited axial movement in a pocket 75 formed in housing sections 18. Surrounding the upper portions of screw 73 is the coil spring 76 which bear against the lower surfaces of blocks 72 and have their lower ends received in a cup forming the tops of sleeves 78. Sleeves 78 extend downwardly along screw 73, surrounding the same and have screw threaded engagement with worm wheel 79 restrained against axial movement in pockets 80 also provided in housing sections 18. Means, not shown, is provided to prevent rotation of sleeve 78 and it should be apparent that upon rotation of worm wheel 79, the forces exerted by the springs 76 may be varied. In the operation of the apparatus the shaft, not shown, which rotates the worm wheel 74 through worms 81 is rotated in the proper direction to space apart the rolls 70 and 71, a distance just less than the thickness of the stock being handled so that as the stock comes between the rolls, the full adjusted value of the force exerted by the springs 76 will be brought to bear on the stock. As the stock passes out of the rolls, the springs 76 will move the lower rolls 71 but slightly toward the upper roll 70, such movement being limited by engagement of worm wheel 74 with the upper webs of the pocket 75. The axial play of worm wheels 74 is sufficient to enable the apparatus to operate in the manner described. Pinch rolls 70 and 71, crushing rolls 40 and 41, and the leveling rolls 12 and 14 are adapted to be driven by a suitable power source, not shown, and couplings 82.

It should now be apparent that I have provided improvements in the design and construction of roller levelers which accomplishes the objects initially set out. The design of the parts, particularly those which must bear large stresses, is substantially simplified thereby enabling definite economies to be effected in the construction, assembly and operation of the machine. The paths of stress resistance are materially shortened and in addition improved means is provided to support and guide the adjustable bank of rolls of the leveler. The above specifically described embodiments of the invention should be con-

sidered as illustrative only as obviously many changes may be made therein without departing from the spirit of the invention or the scope of the appended claims to which reference should be made in determining the scope of the invention.

What I claim is:

1. In a roller leveler, the combination of a pair of spaced parallel housings, each having a centrally disposed opening, an upper set of leveler rolls journaled in said housings, a rigid support suspended from the upper horizontal portions of said housings below said rolls, a lower set of leveler rolls journaled in said support, the ends of said support being positioned in said openings, the rolls of said second set being offset with respect to the rolls of said first mentioned set whereby a sinuous path of travel for stock is provided between the two sets of rolls.
2. Apparatus according to claim 1 in which said suspension means comprises a plurality of screws having pivotal connection with said support whereby the interval and angularity between said sets of rolls may be varied.
3. In a roller leveler, the combination of a pair of spaced parallel housings each having a centrally disposed opening therethrough, a set of leveler rolls journaled in said housings, a support having its ends received in said openings, a second set of leveler rolls journaled in said support, enlarged bores extending inwardly from the outer ends of said support, shafts received in said bores, vertically extending bores through said support and said shafts, vertically extending bores in portions of said housings aligned with said second mentioned bores, and elongated members extending through said second and third mentioned bores to oppose separation of said sets of rolls.
4. In a roller leveler, the combination of upper and lower sets of working rolls arranged in offset relation to define a sinuous path of travel for stock therebetween, a pair of pinch rolls at the stock leaving end of the pass through said working rolls, one of said pinch rolls being adapted to rotate about a fixed axis, the other of said pinch rolls being slidably mounted for movement toward and away from said fixed axis, means to urge the slidably mounted roll toward the fixed roll, means to vary the pressure exerted by said means to urge, and means to limit the extent of sliding movement of the movable pinch roll toward said fixed roll.
5. Apparatus according to claim 4 further including means to vary the position of the range of movement of said movable pinch roll relative to said fixed axis.
6. In a roller leveler, the combination of a base, a pair of housings supported on said base, leveler rolls supported by said housings, a crushing roll journaled in said housings, a cradle, a second crushing roll journaled in said cradle, means on said housings to slideably mount said cradle for movement toward and away from said first mentioned crushing roll, and means to move said cradle and to apply heavy pressure between said rolls comprising a motor mounted on said base, and a lever connecting said motor and cradle.
7. A roller leveler comprising in combination a pair of spaced housings each having a girder-like horizontal section and downwardly extending legs at either end of said horizontal section, an upper set of leveler rolls journaled in the lower portions of said horizontal sections, a rigid support having its respective ends positioned be-

tween the legs of the respective housings suspended from said horizontal sections, and a lower set of leveler rolls journaled in said support.

8. Apparatus according to claim 7 further including elongated vertically extending bores in said horizontal sections, the means to suspend said support comprising screws extending through said bores and having connection with said support, and a thrust bearing about each of said screws above said horizontal sections to oppose the downward force exerted on said screws by material passing between the upper and lower sets of rolls.

9. A roller leveler comprising in combination a pair of spaced housings each having a horizontally disposed portion and spaced vertically extending legs at either end of said horizontal portion, a bank of leveler rolls journaled in said horizontal portions, a support having its end portions positioned between the vertical legs of said housings, the arrangement being such that said legs oppose horizontal movement of said support in opposite directions extending substantially parallel with the path of travel of stock through said leveler, a cooperating bank of leveler rolls journaled in said support, and tension means extending from said horizontal portions to said support to oppose the separation of said banks of rolls by stock passing therebetween.

10. A roller leveler comprising in combination a pair of spaced housings each having a horizontal portion of box section and downwardly ex-

tending legs at either end of said horizontal section, an upper set of leveler rolls journaled in the lower parts of said horizontal portions, means journaling a lower set of leveler rolls at their ends, said means extending between said legs, and tension devices extending between said horizontal portions and said means to suspend the latter and oppose separation of said upper and lower roll sets by the stock passing between said sets.

11. Apparatus according to claim 10 further characterized in that said means comprises a rigid frame extending from within one of said housings to within the other of said housings, said rigid frame being box-like in section for at least a portion of its center extent, and back-up rolls rotatably supported by the center part of said frame.

12. A roller leveler comprising in combination a pair of spaced housings each having a horizontal portion and downwardly extending legs at either end of said horizontal portion, an upper set of leveler rolls journaled in the lower parts of said horizontal portions, a lower set of leveler rolls and means positioned between said legs to journal the ends of said lower rolls, tension devices extending between said horizontal portions and said means to suspend the lower set of rolls and to oppose separation of the two sets of rolls, and a pinch roll journaled in blocks slideably mounted in certain of the legs of said housings.

RUSSELL T. TODD.