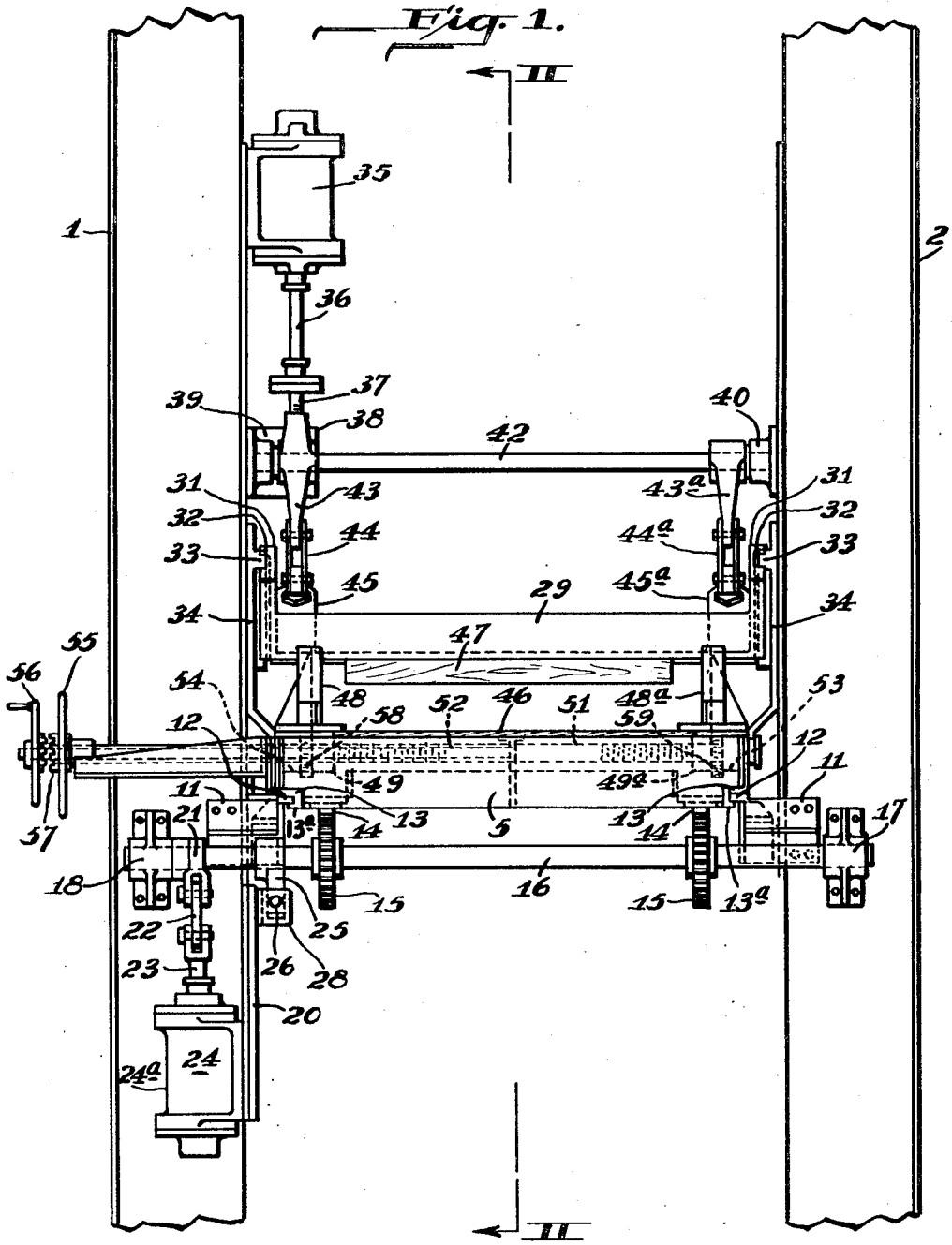
May 14, 1935. H. H. TALBOT 2,001,637

ROLLING MILL FEEDING APPARATUS

Filed Jan. 11, 1933 8 Sheets-Sheet 1

Fig. 1.



WITNESSES

A. B. Wallace.

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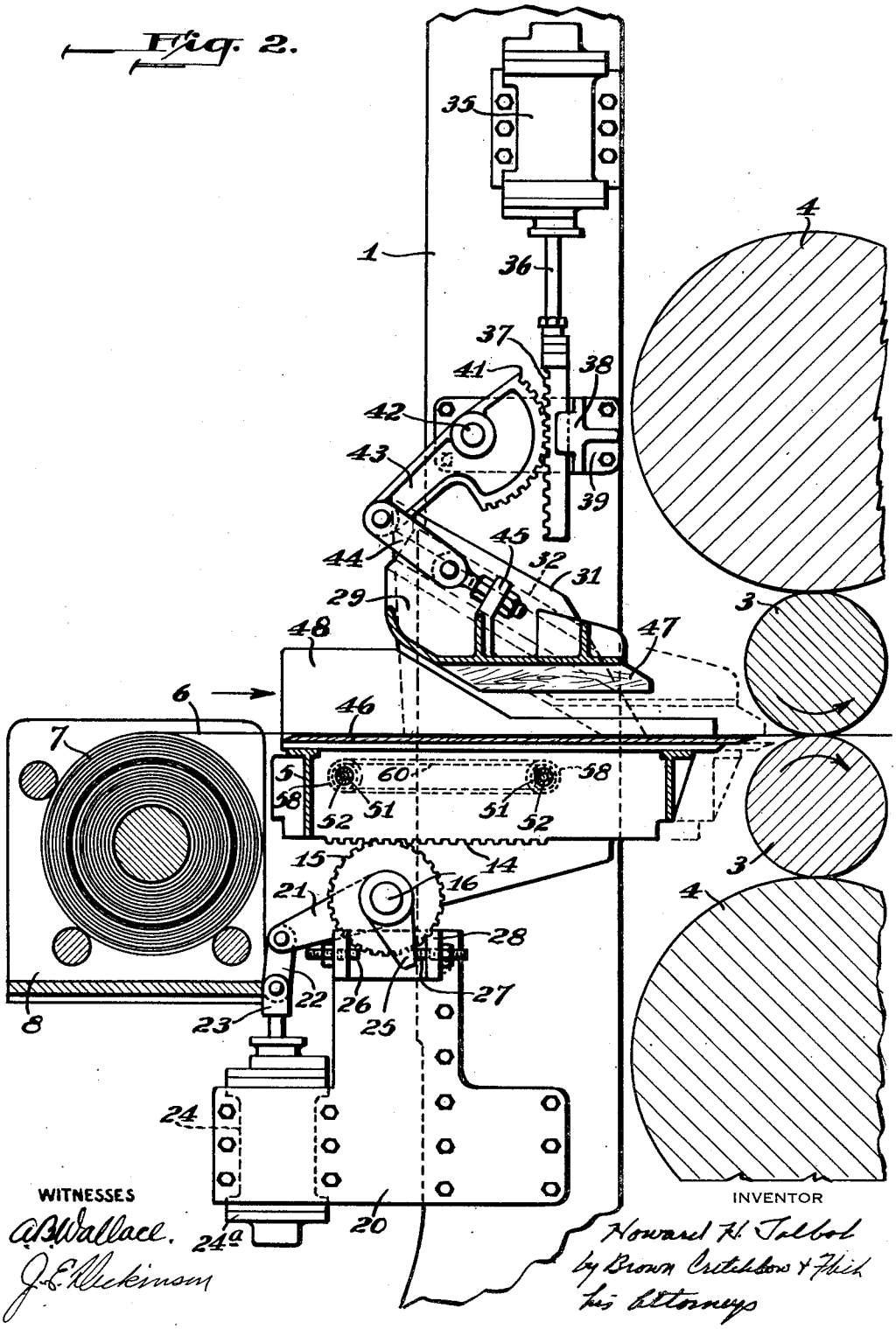
his attorneys

May 14, 1935. H. H. TALBOT 2,001,637

ROLLING MILL FEEDING APPARATUS

Filed Jan. 11, 1933 8 Sheets-Sheet 2

Fig. 2.



WITNESSES

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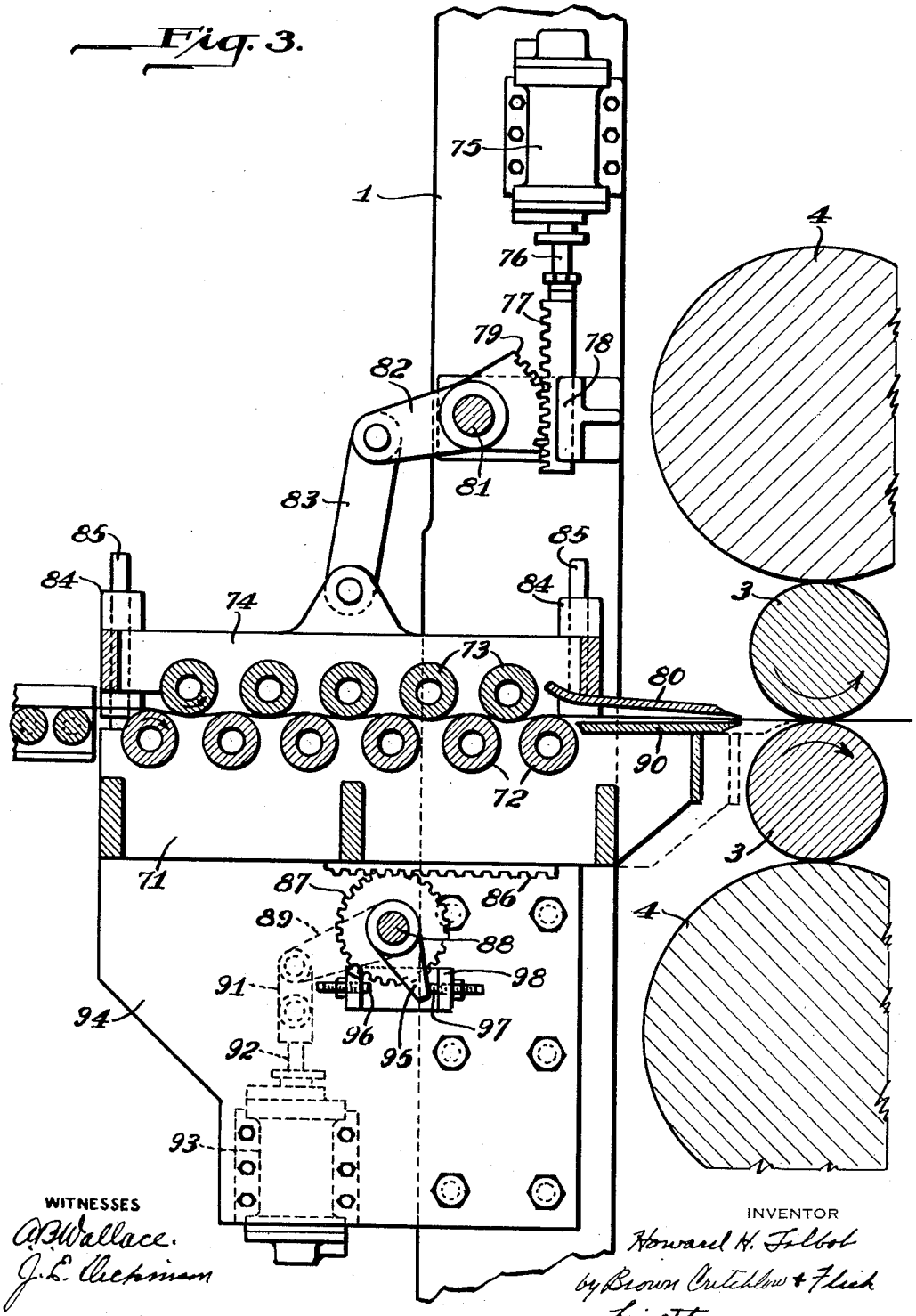
his Attorneys

May 14, 1935. H. H. TALBOT 2,001,637

ROLLING MILL FEEDING APPARATUS

Filed Jan. 11, 1933 8 Sheets-Sheet 3

Fig. 3.



WITNESSES

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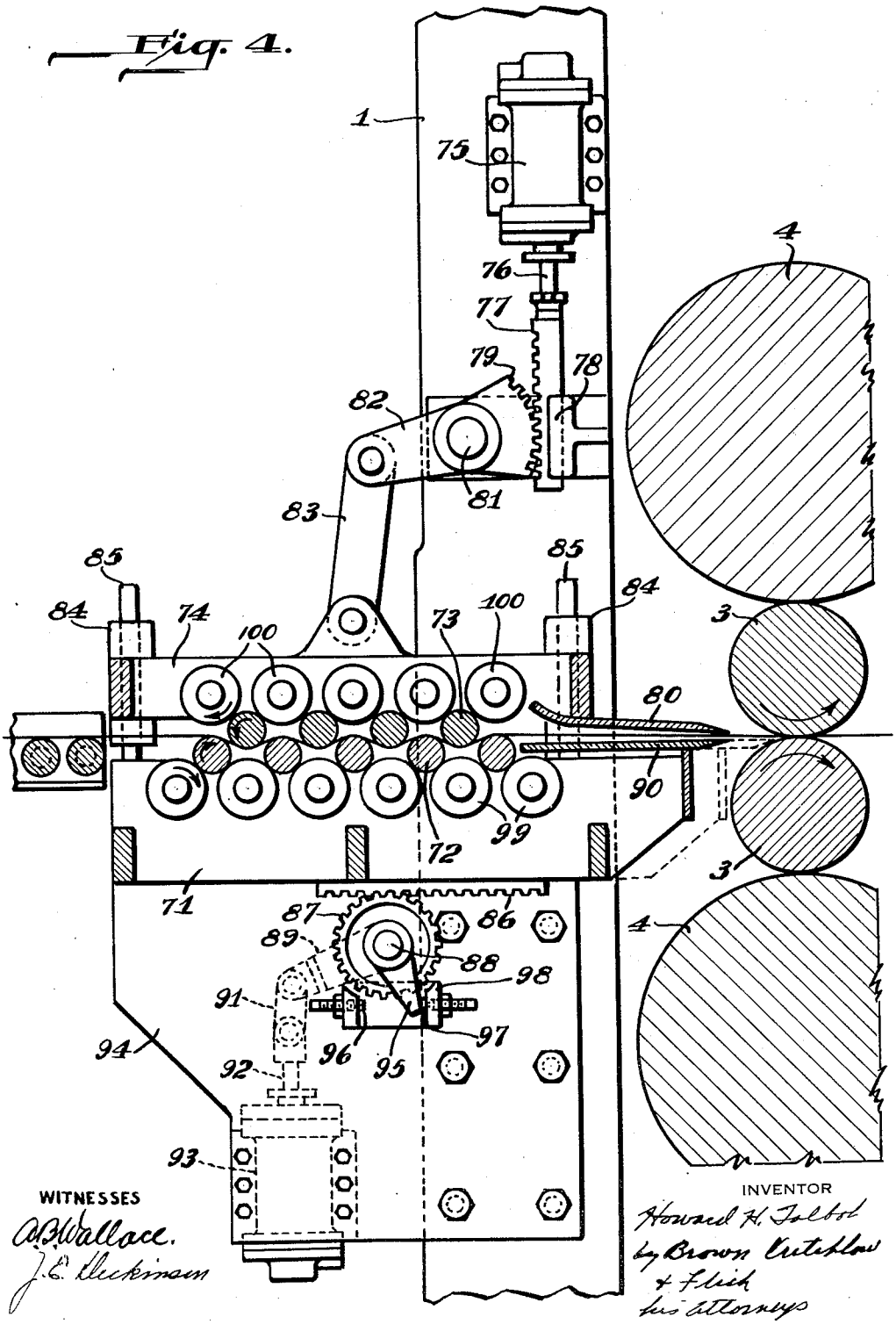
his attorneys

May 14, 1935. H. H. TALBOT 2,001,637

ROLLING MILL FEEDING APPARATUS

Filed Jan. 11, 1933 8 Sheets-Sheet 4

Fig. 4.



WITNESSES

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May 14, 1935. H. H. TALBOT 2,001,637

ROLLING MILL FEEDING APPARATUS

Filed Jan. 11, 1933 8 Sheets-Sheet 5

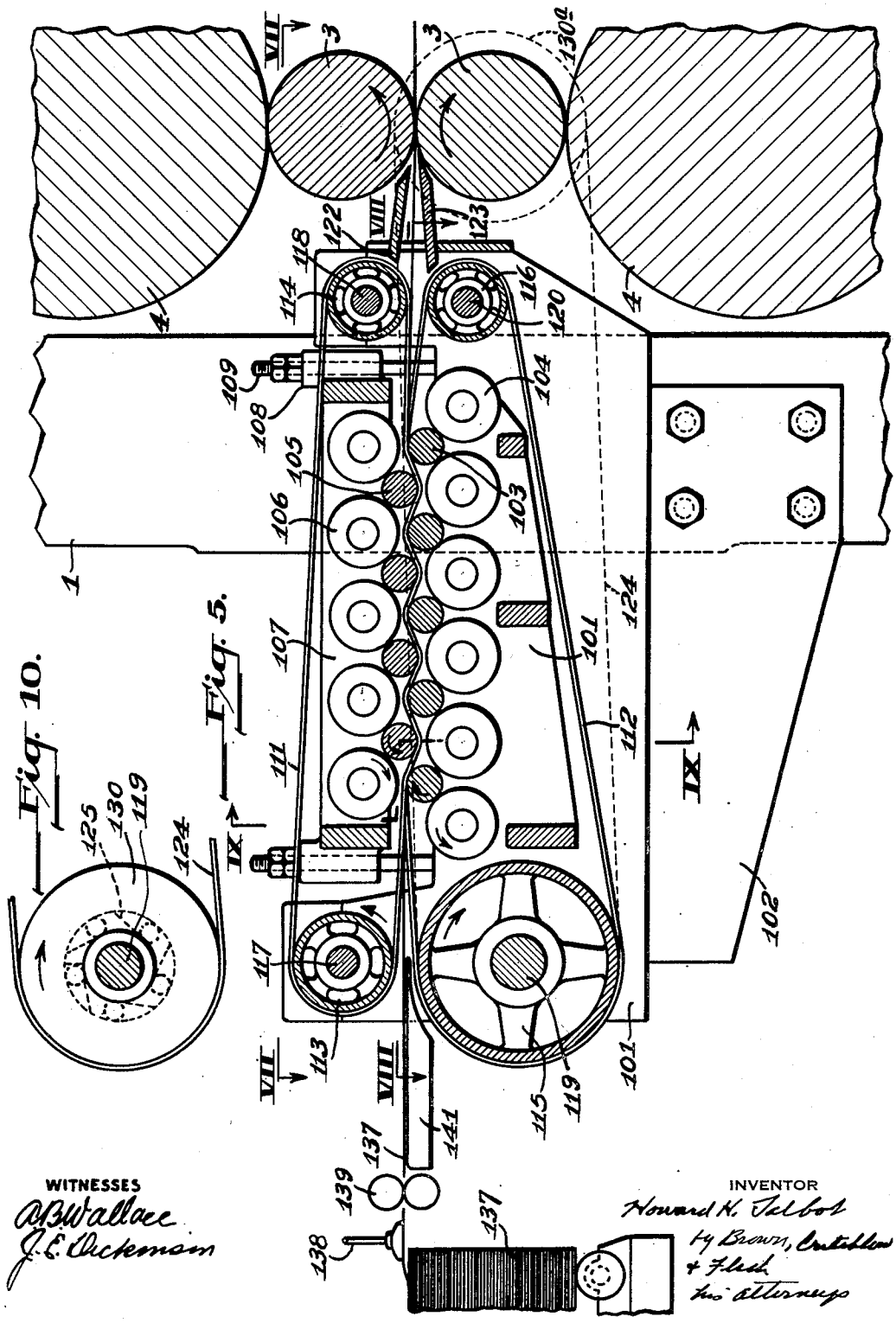


Fig. 10.

Fig. 5.

WITNESSES

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May 14, 1935. H. H. TALBOT 2,001,637

ROLLING MILL FEEDING APPARATUS

Filed Jan. 11, 1933 8 Sheets-Sheet 6

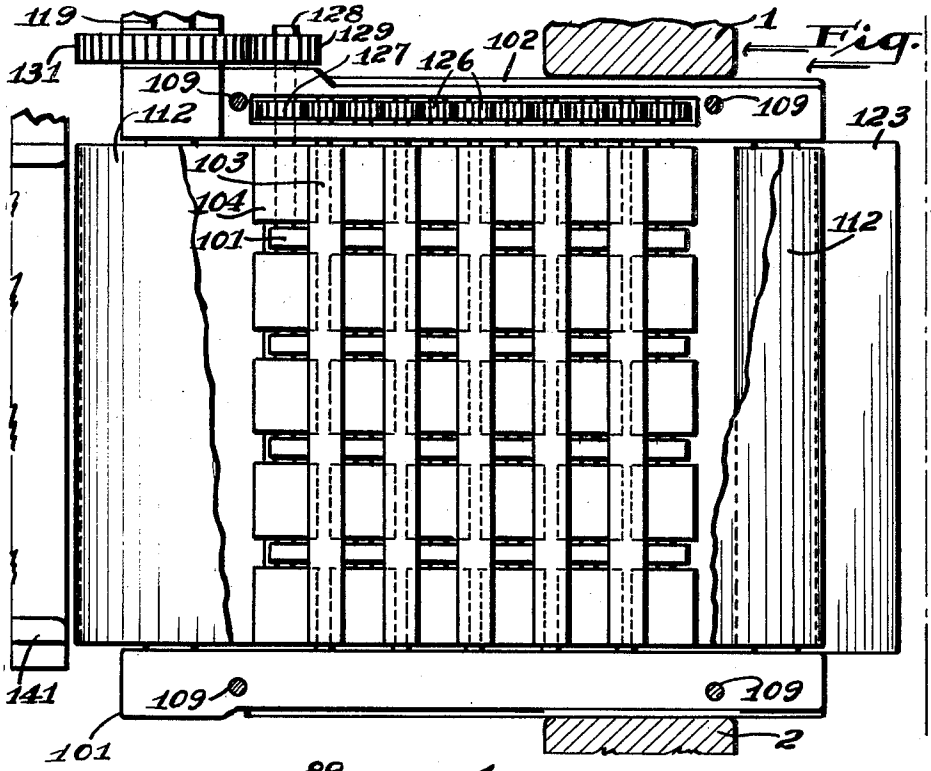


Fig. 8.

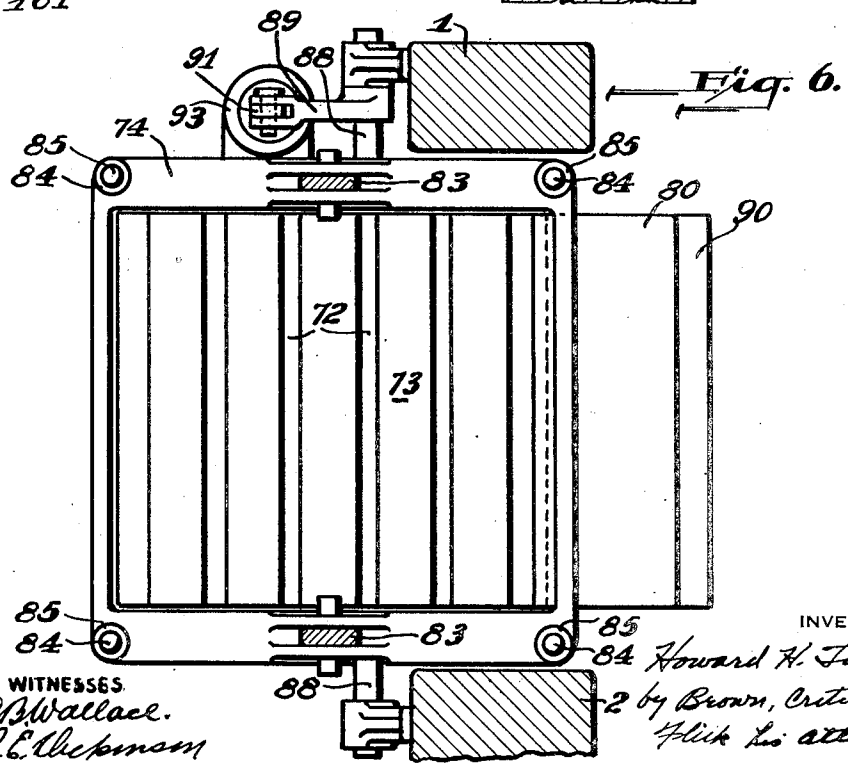


Fig. 6.

WITNESSES.
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May 14, 1935. H. H. TALBOT 2,001,637

ROLLING MILL FEEDING APPARATUS

Filed Jan. 11, 1933 8 Sheets-Sheet 7

Fig. 7.

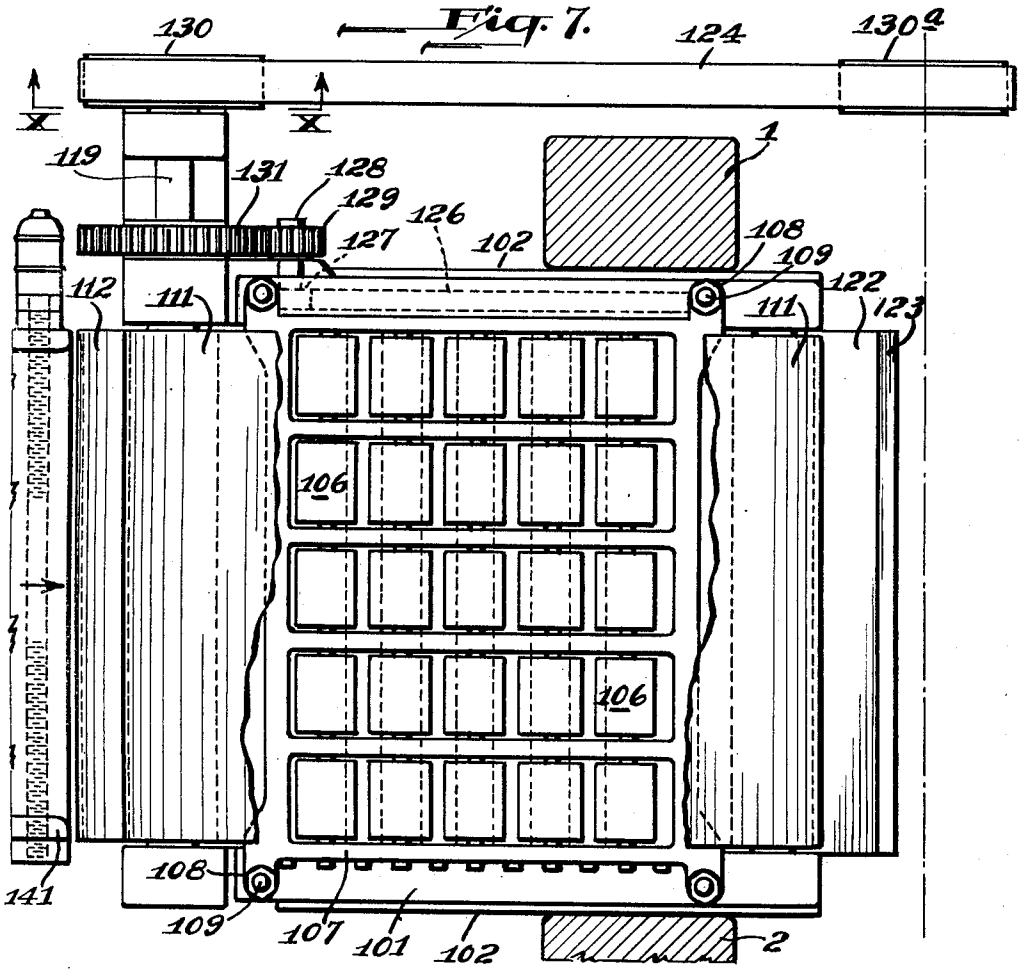
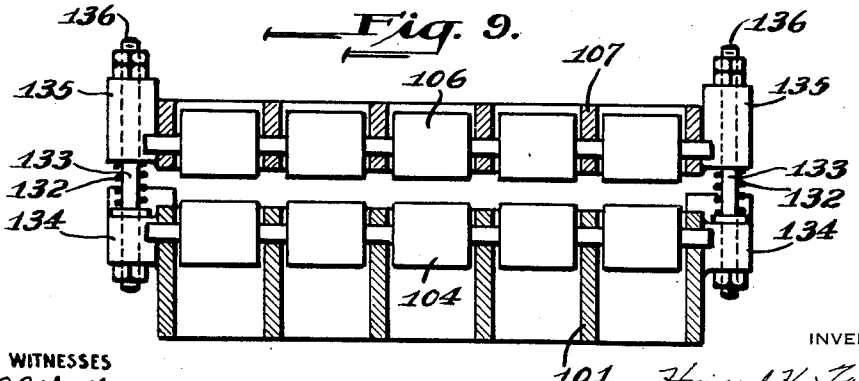


Fig. 9.



WITNESSES

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May 14, 1935. H. H. TALBOT 2,001,637

ROLLING MILL FEEDING APPARATUS

Filed Jan. 11, 1933 8 Sheets-Sheet 8

Fig. 12.

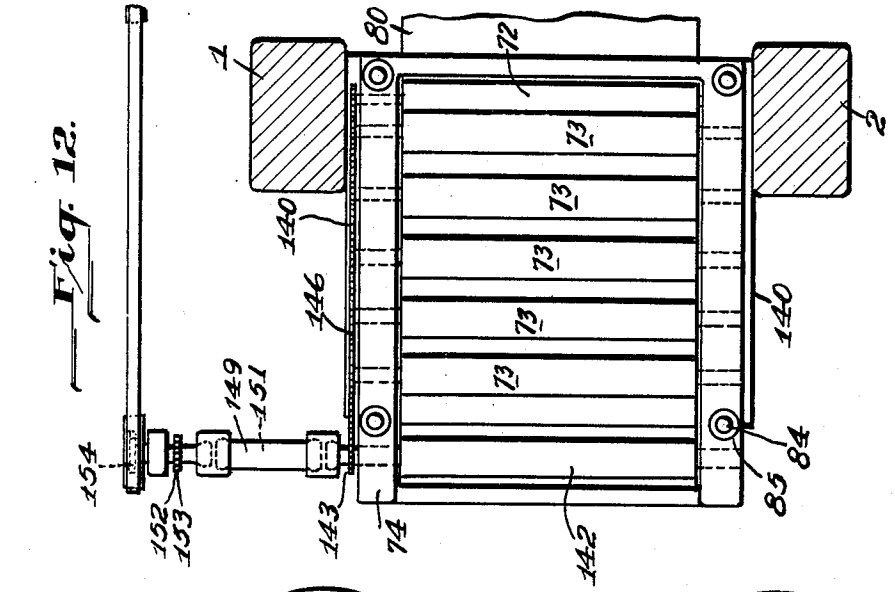
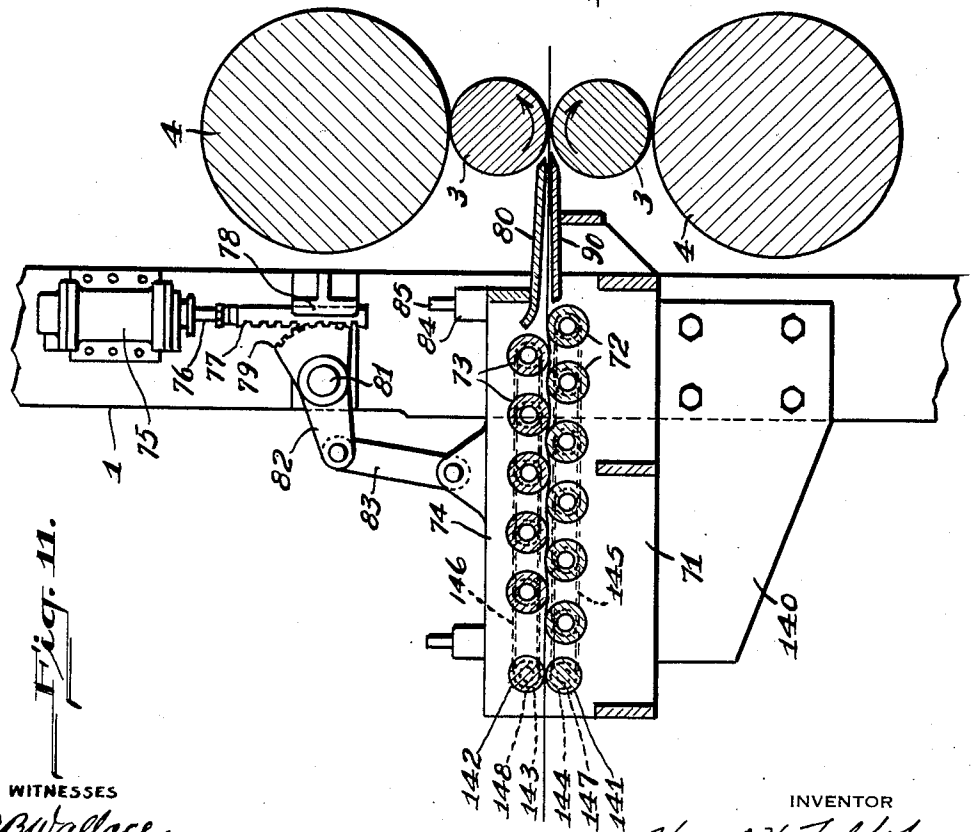


Fig. 11.



WITNESSES

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Patented May 14, 1935 2,001,637

UNITED STATES PATENT OFFICE

2,001,637

ROLLING MILL FEEDING APPARATUS

Howard H. Talbot, Pittsburgh, Pa., assignor to United Engineering & Foundry Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application January 11, 1933, Serial No. 651,153

27 Claims. (Cl. 80—43)

This invention relates to rolling-mill apparatus and more particularly to apparatus for feeding materials such as sheets, strips, and the like, into the working rolls of a rolling mill.

The primary object of the invention is to provide an apparatus for this purpose which is adapted to straighten the stock to be rolled before it is delivered to the mill, positively stick or feed it into the roll pass and tension it while it is being rolled.

A more particular object is to provide apparatus of this character which is simple and sturdy of construction, easy to operate and capable of materially increasing the speed of production of the mill with which it is used as compared with the prior practice.

Another object is to provide all of the aforementioned features in a single machine, and one which may be readily and easily applied to a rolling mill already in service as well as to one when it is being built.

These and numerous other objects, as well as the various other features and advantages of the invention, will be apparent when the following detailed description is read in conjunction with the accompanying drawings, of which, Fig. 1 is a front view of one embodiment of the invention; Fig. 2 a sectional view of the same taken on the line II—II of Fig. 1; Fig. 3 a view similar to Fig. 2 of a modification of the invention; Fig. 4 a view also similar to Fig. 2 of another modification of the invention; Fig. 5 another view similar to Fig. 2 of still another modification of the invention; Fig. 6 a plan view of the modification illustrated in Fig. 3; Fig. 7 a plan of the modification illustrated in Fig. 5, showing a section of the upper belt removed; Fig. 8 a broken horizontal section taken on the line VIII—VIII of Fig. 5; Fig. 9 a vertical section taken on the line IX—IX of Fig. 5; Fig. 10 a vertical section taken on the line X—X of Fig. 7; Fig. 11 a view similar to Fig. 1 of another modification of the invention; and Fig. 12 a plan view of the same.

Referring first to the embodiment of the invention illustrated in Figs. 1 and 2 of the drawings, the numerals 1 and 2 designate the roll housings or end uprights and the numerals 3 and 4 the working and backing-up rolls respectively of a rolling mill of a type used in the rolling of sheets, strips and the like, which is the form of material more particularly contemplated by the invention, although it may be used with other materials.

As shown in these figures, according to the invention, a table or platform 5 is provided for receiving the stock or the forward end of the stock to be rolled and delivering it to the working rolls 3 of the mill. In order to utilize the whole or as much of the roll width of the mill as is possible, the table is preferably made as wide as will conveniently fit between the mill housings 1 and 2, and mounted close to the working rolls with its top in the plane of the roll pass. To permit it being readily moved towards and from the mill it is slidably mounted at its lateral edges on supports 11 which are attached to the inner walls of the roll housings, and, to facilitate its movement, these supports are equipped with flat wear plates 12 which are made of hard wear-resisting material. Cooperating with these is a pair of L-shaped plates 13 made of similar material which are attached to the lateral lower edges of the table, the latter plates being provided with groove forming beads 13a on their lower edges which are arranged to engage the under sides of the plates 12 to thereby prevent the table from lifting away from its supports when it is reciprocated.

Beneath the table adjacent its lateral edges there is provided a pair of gear racks 14 which are arranged to mesh with a pair of gears 15 that are keyed to a shaft 16 supported in brackets 17 and 18 attached to the outer faces of the housing uprights 1 and 2. Adjacent the latter of these brackets 18, which is mounted on the left-hand housing 1 of the mill, there is secured to the gear shaft 16 a crank or lever 21 which has its outer end pivotally connected by a link 22 with the upper end of a piston rod 23. This piston rod in turn is connected to a piston disposed in the cylinder 24a of a reciprocatory engine 24 which is provided for moving the table to feed the stock into the mill, the engine being attached below the table 5 to the mill upright 1 by a plate 20. Any suitable power supply and control mechanism (not shown) may be provided for effecting and controlling the operation of this engine 24 to rotate the gear shaft 16 and reciprocate the table 5. To assist in determining the movement of the table, a dog 25 is keyed to the gear shaft 16 and arranged to engage a pair of adjustable stops 26 and 27 which are threadably mounted in a bifurcated bracket 28 attached to the plate 20 by which the engine is secured to the mill housing, the stops 26 and 27 being adjustable to vary the limit of the stroke of the platform.

In conformance with the invention, to positively or forcibly feed the stock into the work-

ing rolls when the table is moved toward the mill, a plane faced clamping shoe 29 is mounted for vertical adjustment above the top of the table. This shoe, as illustrated here, is made somewhat shorter than the table and is provided at its ends with vertically disposed guides 31 in which inclined grooves 32 are provided. These grooves are adapted to receive similarly inclined ribs 33 formed on a pair of plates 34 attached to the ends of the table or platform 5 and are inclined toward the mill end of the table so that when a piece of stock is clamped between the shoe and the table and an attempt is made to pull the stock toward the mill, as is done when the stock is engaged in the mill, the friction between the stock and shoe will tend to force the shoe more tightly against the stock. This insures a continual resistance to the passage of the stock between the shoe and table and tensions it as it is drawn into the mill. It also straightens the material, which, as well as the tensioning of the stock, is highly desirable in the rolling of materials of the character contemplated. In addition it assists in keeping the stock in line while it is being rolled, which is necessary to prevent edge crimping and faulty rolling. The slope of the ribs 33 and slots 32 is, of course, made insufficient to cause the shoe to wedge itself against the table tightly enough to rupture the stock due to the pull of the mill or to cause undue slipping between the mill rolls.

For moving the shoe into and out of engagement with the stock, an engine 35, similar to the one attached to the table, is attached to the inner face of one of the uprights 1 above the table. At the end of the piston rod 36, attached to the piston of this engine, a gear rack 37 is provided which is arranged to move in a bracket 38 attached to the housing 1 below the engine. This rack in turn is meshed with a gear sector 41 mounted on a shaft 42 supported at one end in the plate 39 on which the rack-supporting bracket 38 is formed and at the other end in a bearing 40 mounted on the other end upright 2. An arm 43 is secured to the back of this gear sector and pivotally connected by a connecting link 44 to a bracket 45 secured to the adjacent end of the shoe 29. At the opposite end of the shaft 42 an arm 43a is secured which, in turn, is pivotally connected by a link 44a to a bracket 45a secured to the opposite end of the shoe to thereby balance the movement of the shoe. Hence when the engine 35 is operated, which may be accomplished by any suitable power supply and control (not shown) the shoe 29 may be moved towards or away from the table 5 at the will of the operator.

In addition to positively sticking the stock placed upon the table 5 into the mill, as stated hereinbefore, it is also the duty of the shoe 29 and table 5 to function as a drag or braking device for tensioning the stock while it is being rolled, as well as for straightening it before it enters the mill. In order not to injure the surfaces of the stock as it is drawn between the two, their adjacent surfaces are lined with some suitable material which will not scratch or injure the stock. In the present instant, although brass or other material may be used, a series of wooden sections 46 and 47 respectively are mounted on the top of the table and on the lower side of the shoe, being provided in sections so that they may be readily replaced or removed to fit the width of stock being rolled.

To properly register or position the stock on the table, side guides 48 and 48a are provided and made adjustable to accommodate different widths of stock. For adjusting these guides 48 and 48a they are secured to threaded brackets 49 and 49a which are arranged to slide in transversely disposed slots formed in the top of the platform 5. Preferably two or more of these brackets are attached to each guide at spaced points along their length and these in turn threadably engaged on telescoping shafts 51 and 52 respectively which are mounted one within the other below the surface of the table and supported at their ends in suitable brackets 53 and 54, the outer of the two shafts not extending beyond the middle of the table. Where more than one bracket is attached to each guide, as shown here, the ends of one pair of shafts 51 and 52 are projected beyond the side of the table and equipped with turning wheels 55 and 56 by means of which they may be manually adjusted. To allow for their being adjusted both individually and collectively a clutch 57 is provided between the two wheels and, to turn all of the shafts 51 and 52 at the same time so that the guides will positively move in a straight line, sprockets 58 and 59 are mounted on them adjacent the brackets 53 and 54 on which they are supported and chains or belts 60 are mounted on these sprockets.

In operating this embodiment of the invention the stock guides 48 and 48a are first properly adjusted and the stock, which may be either in the form of a sheet or strip, such as the strip 6 shown being taken from a coil 7 mounted in a reel structure 8, is then fed onto the table while it is in its retrieved position until it hits the mill or until its forward end projects sufficiently beyond the end of the table to be fed to the mill by the table when it is moved forward. The upper engine 35 is then operated to move the shoe 29 to clamp the stock to the table. On the completion of this operation, the lower engine 24 is operated to move the table from its inoperative position, as shown by the full lines in Fig. 2, to its forward position shown by the dotted lines. This movement, due to the stock being clamped to the table by the shoe, positively forces the stock between the working rolls 3 of the mill and with sufficient force to permit the rolls being set to take a relatively heavy reduction. Furthermore, it does so in such a way that the end of the stock is started evenly in the roll-pass even though it may be cut irregularly or be beaded as it sometimes is. Once the stock is engaged between the rolls it is drawn between the shoe and table which also function as a drag to both tension and flatten the stock as well as hold it in proper alignment as it is drawn through the mill.

Referring now to Figs. 3 and 6 an embodiment of the invention is shown which comprises a feed table 71 that is mounted for reciprocating movement similar to the aforementioned table 5 but in place of a plane surface is provided with a plurality of spaced transverse rolls 72 which are mounted in suitable bearings in the side of the table. Above this table there is provided a vertically adjustable roll carrying frame 74 in which a plurality of rolls 73 is mounted being so arranged as to form a levelling pass with the table rolls 72, when the carrier 74 is lowered so that the upper rolls 73 project below the upper edge of the lower rolls 72. For lifting the carrier 74 so that a piece of stock

can be readily mounted on the top of the table 71 an engine 75 is employed being secured to the inner wall of the mill housing 1. The piston rod 76 of this engine is equipped with a gear rack 77 which is arranged to slide in a bracket 78 and is meshed with a gear sector 79 carried by a shaft 81 mounted between the two housings 1 and 2. The back of this gear sector is formed by an arm 82 which is connected by a link 83 to the side of the carrier 74. To guide the movement of the carrier it is equipped at its four corners with sleeves 84 through which pins 85 mounted on the table 71 are fitted.

For moving the table to and from the mill a gear rack 86 is mounted on its under side and with it a gear 87, mounted on a shaft 88 journaled to the mill housing, is meshed. A lever 89 in turn is keyed to this shaft and connected by a link 91 to the piston rod 92 of an engine 93 mounted on a plate 94 attached to the inner face of the mill housing. A dog 95 is also keyed to this shaft to engage a pair of stocks 96 and 97 screwed in a bifurcated bracket 98 attached to plate 94 for limiting the movement of the table.

To operate this embodiment of the invention, the table 71 is moved to its rearward position as shown in full lines in the drawings and the stock moved onto the rolls 72 until its forward end projects sufficiently beyond the ends of a pair of guides 80 and 90 provided on the mill end of the table to be forced into the rolls 3 of the mill when the table is moved to its forward or feeding position indicated by the dotted lines. When the stock is in place, the engine 75 is operated to lower the carrier 74, placing the rolls 73 between the rolls 72 and deflecting the stock so that it held firmly in place. The engine 93 is then operated to move the table forward and forcibly feed the end of the stock into the mill rolls. As soon as the stock is engaged in the rolls the mill pulls it through the rolls 72 and 73 which both tensions the stock and levels it as it is passing therethrough.

Referring to Fig. 4, there is shown another embodiment of the invention which differs from that shown in Figs. 3 and 6, only in that backing-up rolls 99 and 100 are employed for resisting the bending of the straightening rolls 72 and 73 respectively, and in which similar reference characters are used to designate its different parts. The advantage derived from the backing rolls used in this embodiment is that smaller work rolls can be used in the sticker to obtain increased straightening effect as well as adapt it to accommodate wider materials without the rolls bending.

Referring to Figs. 5, 7, 8, 9 and 10, an embodiment of the invention is shown which comprises a frame 101 that is permanently secured, by brackets or supporting plates 102, to the inner faces of the mill housings 1 and 2. In this frame there is mounted a series of straightening rolls 103 and sectional backing rolls 104, and above it, in a carrier 107, there is mounted a plurality of similar work rolls 105 and backing up rolls 106 which form with the rolls 103 a straightening pass similar to the one in the previously described reciprocating roll type machine. To hold the roll carrier 107 in place it is equipped at its corners with vertical sleeves 108 through which pins 109 provided on the corners of the frame 101 are fitted.

To provide for feeding the stock through this machine into the mill, a pair of belts 111 and 112 of the width of the straightening rolls are employed being arranged to encircle the upper and lower sets of straightening and backing rolls and to extend above pulleys 113 and 114 and 115 and 116 respectively mounted at the two ends of the frome 101 on shafts 117, 118, 119 and 120 journaled in the frame 101. To permit the ready entrance of the stock between the belts which carry it through the straightening rolls the pulleys 113 and 115 are separated sufficiently to provide a stock-receiving throat, and to guide the stock into the mill a pair of guide plates 122 and 123 are provided on the frame 101 just forward of the pulleys 114 and 116.

As a drive for the belts 111 and 112 the shaft 119 is projected to one side of frame 101 and equipped at its end with a pulley 130 on which a belt 124 is mounted that in turn is connected to the mill drive 130a. To adapt the machine to tension the stock, this drive is made in such manner that the speed of the belts 111 and 112 will be less than the peripheral speed of the working rolls 3 of the mill and to permit such operation without slipping of the belts when the stock is engaged in the mill and over-travel clutch 125 is provided in pulley 130. This clutch, although outlined in Fig. 10, is not shown and described in detail as any suitable clutch of this type may be used, many of which are well known in the art.

For driving the working rolls 103 to assist in the drive of the machine, they are geared together by gears 126 at one end and this train of gears is meshed with a gear 127 mounted on a shaft 128 which carries a gear 129, that in turn is meshed with a gear 131 keyed to the shaft 119. While this drive will aid in the functioning of the straightening rolls for many installations of the invention they may be omitted.

Another feature of this embodiment of the invention which may be omitted in certain installations is the use of springs 132 for varying the position of the roll carrier 107 with respect to the frame 101. As shown in Fig. 9 such springs are mounted on pins 133 anchored in brackets 134 which are attached to the sides of the table and extended through sleeves 135 secured to the sides of the carrier, the springs being arranged between the brackets and sleeves and the pins equipped with nuts 136 for varying the spring pressure.

In the operation of this latter embodiment of the invention the stock, which is shown as comprising a pile of sheets 137 at the left-hand end of Fig. 5, is either manually or mechanically, as indicated, taken therefrom by a vacuum transfer device 138 or other suitable mechanism and fed into a set of pinch rolls 139. These in turn feed the sheets over a support 141 where they are picked up by the belts 111 and 112. These then draw them between the rolls 103 and 105 and in turn force them positively into the rolls 3 by way of the guides 122 and 123. The running of the stock through the machine in this fashion, as will be appreciated, causes it to be straightened and as the belts are run at a slower speed than the mill, the straightening rolls automatically become a drag as soon as the mill starts to pull the stock.

In Figs. 11 and 12 there is illustrated still another modification of the invention which is in a sense a combination of the embodiments shown in Figs. 3 and 5 in that it incorporates the levelling rolls, together with means for driving these rolls, for feeding the stock into the mill, in-

stead of means for reciprocating the levelling roll support. In this embodiment the same reference characters have been applied to the parts which correspond to those shown in Figs. 3 and 6. As illustrated in the embodiment the table 71 is rigidly secured by plates 140 to the mill uprights 1 and 2, and rolls 141 and 142 are mounted in the entrance ends of the frame 71 and carrier 74 and arranged to function as pinch rolls for feeding the stock into the leveller. On the ends of the pinch rolls and the levelling rolls sprocket wheels 143 and 144 are provided, and over these chains 145 and 146 are extended to drive such rolls. For driving these chains the axes 147 and 148 of the rolls 141 and 142 are projected beyond the sides of the frame 71 and carrier 74 and connected by flexible couplings, which permit relative movement of the carrier with drive shafts 149 and 151 which are in turn tied together by a pair of gears 152 and 153 and coupled to the mill drive through an over-travel clutch 154 whereby they are adapted to drive the rolls at a peripheral speed which is slower than that of the mill.

As will be readily appreciated by those skilled in the art, the advantages of the invention are that it insures positive and accurate feeding of the stock to the mill, makes for increased speed, reduces the labor required and maintains the stock in alignment as well as straightens and tensions it while it is being rolled, thereby improving the product and reducing the cost of production.

According to the provisions of the patent statutes, I have explained the principle and mode of operation of my invention, and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A combined sticker, drag and leveling apparatus for use with a rolling mill, comprising a table adapted to be reciprocably mounted in horizontal alignment with the roll pass of the mill, a plurality of transversely extending rolls mounted in spaced parallel relation in the top of said table, a roll-supporting frame mounted above said table, a plurality of transversely extending rolls mounted in parallel spaced relation in said frame with their axes lying between the axes of the rolls mounted in said table, forming a wave-like stock working pass between said two sets of rolls means for moving said frame toward and away from said table whereby adapting it to clamp a piece of stock when disposed between said rolls and resist the movement therethrough, and means for moving said table and frame toward the mill to forcibly feed stock so clamped and held by said sets of rolls to the mill, the mill after biting the material, pulling the same through said sets of rolls which then act as a drag and leveling apparatus.

2. A combined sticker, drag and leveling apparatus for use with a rolling mill, comprising a table mounted for reciprocable movement in horizontal alignment with the roll pass of the mill, a plurality of transversely extending rolls mounted in spaced parallel relation in the top of said table, a roll-supporting frame mounted above said table, a plurality of transversely extending rolls mounted in parallel spaced relation in said frame with their axes lying between the axes of the rolls mounted in said table forming a wave-like stock-working pass between said two sets of rolls, means for moving said frame toward and away from said table whereby adapting it to clamp a piece of stock when disposed between said rolls and resist its movement therethrough, means for guiding the movement of said frame toward and away from the table, and means for moving said table and frame in the plane of the mill pass to forcibly feed stock so clamped and held by said sets of rolls into the mill, the mill after biting said material pulling the same through said sets of rolls which then act as a drag and leveling apparatus.

3. A combined feeding, tensioning and leveling apparatus for use with a rolling mill, comprising a table mounted for reciprocable movement in the plane of the roll pass of a rolling mill, a plurality of transversely extending work rolls mounted in spaced parallel relation in the top of said table, a plurality of backing rolls mounted in said table to resist bending of said work rolls, a roll-supporting frame mounted above said table, a plurality of transversely extending work rolls mounted in parallel spaced relation in said frame with their axes lying between the axes of the work rolls mounted in said table, backing rolls mounted in said frame to resist bending of the frame work rolls, means for moving said frame toward and away from said table whereby adapting it to form a straightening and stock-engaging as well as tensioning pass for a piece of stock disposed between the work rolls of the frame and table, and means for moving said table and frame toward the mill to forcibly feed stock engaged by said frame and table work rolls to the working rolls of a rolling mill.

4. A combined feeding, tensioning and leveling apparatus for use with a rolling mill, comprising a table adapted to be mounted for reciprocable movement in horizontal alignment with the roll pass of a rolling mill, a plurality of transversely extending rolls mounted in spaced parallel relation in the top of said table, a roll-supporting frame mounted above said table, a plurality of transversely extending rolls mounted in parallel spaced relation in said frame with their axes lying between the axes of the rolls mounted in said table forming a wave-like stock-working pass between said two sets of rolls, means for moving said frame toward and away from said table whereby adapting it to clamp a piece of stock when disposed between said rolls and resist its movement therethrough, pins disposed at the corners of said table slidably extended through sleeves attached to said frame to guide the movement of said frame with respect to the table, and means for moving said table and frame in the plane of the mill pass to forcibly feed stock so clamped and held by said sets of rolls into the mill, the mill after biting said material pulling the same through said sets of rolls which then act as a drag and leveling apparatus.

5. A combined sticker, drag and leveling apparatus for use with a rolling mill, comprising a table adapted to be arranged for reciprocable movement in horizontal alignment with the roll pass of a rolling mill, a plurality of transversely extending rolls mounted in spaced parallel relation in the top of said table, a roll-supporting frame mounted above said table, a plurality of rolls mounted in parallel spaced relation in said frame and arranged to form a wave shaped

stock engaging pass between the two sets of rolls mounted in said table, means for moving said frame toward and away from said table to clamp a piece of stock when disposed between the two sets of rolls and resist its movement therethrough, means for moving said table and frame toward the mill to thereby forcibly feed stock so clamped and held by said sets of rolls into the mill, the mill after biting said material pulling the same through said sets of rolls which then act as a drag and leveling apparatus, and guiding means mounted on the front end of the table for preventing the stock from buckling between the leveling apparatus and the mill as it is forced thereby into the roll pass of a mill.

6. A combined stock feeding, tensioning and straightening apparatus for use with a rolling mill, comprising a frame adapted to be mounted in front of a mill in the plane of the roll pass of the mill, a plurality of transversely disposed rolls mounted in spaced parallel relation in said frame, a roll carrier mounted on said frame above said rolls and arranged to rest thereon, a plurality of rolls mounted in said carrier in spaced parallel relation and arranged to form a straightening pass with the rolls of said frame, a pair of pulleys mounted at each end of said frame one above the other, a belt extended about the two upper pulleys and the rolls mounted in said roll carrier, another belt extended about said lower pair of pulleys and the rolls mounted in said frame, and means for driving one of said belts.

7. A combined stock feeding, tensioning and straightening apparatus for use with a rolling mill, comprising a frame adapted to be mounted in front of a mill in the plane of the roll pass of the mill, a plurality of transversely disposed rolls mounted in spaced parallel relation in said frame, a roll carrier mounted on said frame above said rolls and arranged to rest thereon, a plurality of rolls mounted in said carrier in spaced parallel relation and arranged to form a straightening pass with the rolls mounted in said frame, means for varying the relative position of said carrier on said table, a pair of pulleys mounted at each end of said frame one above the other on opposite sides of the pass provided by said rolls, a belt extended about the two upper pulleys at the opposite ends of the frame and the rolls mounted in said carrier, another belt extended about the lower pulleys and the rolls mounted in said frame, and means for driving one of said pulleys.

8. A combined stock feeding, tensioning and straightening apparatus for use with a rolling mill, comprising a frame adapted to be mounted in front of a mill in the plane of the roll pass of the mill, a plurality of transversely disposed rolls mounted in spaced parallel relation in said frame, a roll carrier mounted for vertical adjustment on said frame above said rolls, a plurality of rolls mounted in spaced parallel relation in said carrier and arranged to form a straightening pass with the rolls mounted in said frame, a pair of pulleys mounted at each end of said frame one above the other on opposite sides of the straightening pass formed by said rolls, a belt extended about the two upper pulleys at the opposite ends of the frame and the rolls mounted in said roll carrier, another belt extended about the lower two of said pulleys and the rolls mounted in said frame, and means for driving one of said pulleys from the mill.

9. In combination with a rolling mill, a combined stock feeding, tensioning and straightening apparatus comprising a frame adapted to be mounted at the front of the mill, a plurality of transversely disposed rolls mounted in spaced parallel relation in said frame with their upper sides lying substantially in the plane of the roll pass, a roll carrier mounted on said frame above said rolls, a plurality of rolls mounted in said carrier in spaced parallel relation and arranged to form a straightening pass with the rolls mounted in said frame, a pair of pulleys mounted at each end of said frame one above the other, a belt extended about the two upper pulleys and the rolls mounted in said roll carrier, another belt extended about the two lower pulleys and the rolls mounted in said frame, and means for driving one of said pulleys from the mill at a peripheral speed less than the peripheral speed of the mill rolls.

10. A combined feeding, tensioning and leveling apparatus for use with a rolling mill, comprising a table mounted for reciprocable movement in the plane of the roll pass of a rolling mill, a plurality of transversely extending work rolls mounted in spaced parallel relation in the top of said table, a plurality of backing rolls mounted in said table in such a manner as to resist bending of said work rolls in both the horizontal and vertical planes, a roll-supporting frame mounted above said table, a plurality of transversely extending work rolls mounted in parallel spaced relation in said frame with their axes lying between the axes of the work rolls mounted in said table, backing rolls mounted in said frame in such a manner as to resist bending of the frame work rolls in both the horizontal and vertical planes, means for moving said frame toward and away from said table whereby adapting it to form a straightening and stock-engaging as well as tensioning pass for a piece of stock disposed between the work rolls of the frame and table, and means for moving said table and frame toward the mill to forcibly feed stock engaged by said frame and table work rolls to the working rolls of a rolling mill.

11. A combined feeding, tensioning and leveling apparatus for use in feeding thin flat material into the working rolls of a rolling mill of the backed-up working roll type, comprising a table adapted to be mounted between the roll housings of a mill in front of the working rolls thereof, a plurality of transverse rolls mounted in spaced parallel relation in the top of said table, a plurality of backing rolls mounted in said table to engage said working rolls at opposite sides of their axes and below their centers, a vertically adjustable frame mounted above said table, a plurality of transverse work rolls mounted in spaced parallel relation in said frame with their axes lying between the axes of the working rolls mounted in said table, backing rolls mounted in spaced parallel relation in said frame to engage the work rolls in said frame at opposite sides of their axes and above their centers, means for moving said frame towards and away from said table to form a stock-engaging and stock-straightening pass between as well as adapt said work rolls to resist the passage of a piece of stock between them, and means for moving said table and frame integrally towards and away from the mill to forcibly feed stock engaged between said frame and table rolls to the working rolls of a rolling mill.

12. A combined apparatus according to claim 3 in which the backing rolls are divided into

sections and so supported in said table and frame as to engage said table and frame working rolls at spaced points along their lengths.

13. The combination with a rolling mill provided with relatively small working rolls, means for forcibly feeding into the roll pass formed by said rolls flat stock which is too thick to be entered therein without the application of a positive pressure and too thin to permit the feeding force to be applied to it at an appreciable distance from the rolls on account of buckling, said feeding means being arranged adjacent the entrance to said roll pass and adapted to engage the upper and lower surface of the stock sufficiently close to the rolls to prevent it from buckling sufficiently to interfere with its entrance in the roll pass as the force is applied to it.

14. The combination with a rolling mill provided with relatively small working rolls, means for forcibly feeding into the roll pass formed by said rolls flat stock which is too thick to be entered therein without the application of a positive pressure and too thin to permit the feeding force to be applied to it at an appreciable distance from the rolls on account of buckling, said feeding means being arranged adjacent the entrance to said roll pass and adapted to engage the upper and lower surface of the stock across the entire width thereof and sufficiently close to the rolls to maintain the front end of the stock in accurate alignment for entrance into the roll pass and also sufficiently close to the rolls to prevent it from buckling when it is forced into the mill.

15. The combination with a rolling mill provided with relatively small working rolls, means for forcibly feeding into the roll pass formed by said rolls flat stock which is too thick to be entered therein without the application of a positive pressure and too thin to permit the feeding force to be applied to it at an appreciable distance from the rolls on account of buckling, said feeding means comprising means for gripping the stock sufficiently close to said rolls to prevent it from buckling as it is forced into the roll pass, means for rapidly releasing said gripping means to facilitate the entrance of the stock into it, and means for rapidly moving it to feed the stock into the mill.

16. In combination with a rolling mill, a combined sticker and drag comprising a stock supporting platform mounted for movement in front of the roll pass of the mill, means for supporting said platform, a gear rack attached thereto, a drive shaft equipped with a pinion disposed to engage said rack, an engine mounted on said mill and operably connected to said shaft, a clamping shoe reciprocably mounted above said platform, an engine mounted in said mill, and means connecting said latter engine to said shoe for clamping it to said platform, said connecting means being adapted to permit movement of the platform after the shoe is clamped onto it.

17. In combination with a rolling mill, a combined sticker and drag comprising a stock supporting platform mounted for movement in front of and in the plane of the roll pass adjacent the entrance thereto, guiding means on said platform for aligning the stock thereon, means for adjusting said guides to accommodate stocks of different widths, an engine mounted on said mill, means connecting said engine to said platform to move it to and from the mill, a shoe for clamping the stock to said platform movably mounted thereabove, means for positively moving said shoe into and out of engagement with said platform, and means connecting said latter means to said shoe in a manner to permit movement of the shoe with the platform after it is clamped thereto.

18. The combination with a rolling mill of a roller leveler mounted adjacent the roll pass thereof for movement in the plane of said pass, means for positively moving said leveler to feed a piece of stock engaged in it into the mill, and means interposed between the leveler and the mill for preventing the stock buckling between the outlet of the leveler and the entrance of the mill.

19. The combination with a rolling mill of a roller leveler for feeding flat stock into the roll pass thereof and tensioning it after it is in the mill, said leveler comprising a main supporting frame mounted for movement, to and from the mill, a series of spaced transversely disposed rolls mounted in said frame in the plane of the roll pass, an upper roll frame mounted for guided vertical movement above said main frame, a series of spaced transversely disposed rolls mounted in said latter frame in staggered relation with said first-mentioned rolls, means for moving said upper frame to a position above said lower rolls and to a position placing the lower surface of the upper rolls below the upper surface of the lower rolls to thereby flex a piece of stock disposed between them, means for positively moving said main supporting frame towards and from the mill and means carried by said main frame for preventing the stock from buckling between the leveler and the mill.

20. The combination with a rolling mill of a roller leveler for feeding flat stock into the roll pass thereof and tensioning it after it is in the mill, said leveler comprising a main supporting frame mounted for movement, to and from the mill, a series of spaced transversely disposed rolls mounted in said frame in the plane of the roll pass, an upper roll supporting frame mounted for guided vertical movement above said main frame, a series of spaced transversely disposed rolls mounted in said latter frame in staggered relation with said first-mentioned rolls and forming a wave-like stock-working pass between said two sets of rolls, means for moving said upper frame to a position above said lower rolls and to a position placing the lower surface of the upper rolls below the upper surface of the lower rolls to clamp a piece of stock between said rolls and resist its movement therethrough, means for modifying the operation of said latter means to vary the position of the upper rolls when in their lowered positions, means for positively moving said main supporting frame toward and from the mill to thereby forcibly feed stock so clamped and held by said sets of rolls into the mill, the mill after biting said material pulling the same through said sets of rolls which then act as a drag and leveling apparatus.

21. The combination with a rolling mill of a roller leveler for feeding flat stock into the roll pass thereof and tensioning it after it is in the mill, said leveler comprising a main supporting frame mounted for movement, to and from the mill, a series of spaced transversely disposed rolls mounted in said frame in the plane of the roll pass, an upper roll frame mounted for guided vertical movement above said main fur-

nace, a series of spaced transversely disposed rolls mounted in said latter frame in staggered relation with said first-mentioned rolls, power means for rapidly moving said upper frame to carry said upper rolls clear of said lower rolls and also lower them to a position placing their lower surfaces below the upper surfaces of said lower rolls to thereby flex a piece of stock disposed between them, means for adjusting the position of said upper rolls, means for positively moving said main supporting frame towards and from the mill, and means carried by said main frame for preventing the stock buckling between the leveler and mill as it is forced into the mill by the leveler.

22. In combination with a rolling mill provided with working rolls, a feeding device for feeding thin metallic stock into the bite of the mill rolls, said feeding device comprising means for engaging and gripping the leading end of the stock, means for positively moving said gripping means to force the end of the stock into the bite of the mill rolls and disposed to operate sufficiently close to the rolls to prevent deleterious buckling of the stock end as it is forced into the mill.

23. In combination with a rolling mill provided with working rolls, a feeding device for feeding thin metallic stock into the bite of the mill rolls, said feeding device comprising means for engaging and gripping the leading end of the stock, means for positively moving said gripping means to force the end of the stock into the bite of the mill rolls and disposed to operate sufficiently close to the rolls to prevent deleterious buckling of the stock end as it is forced into the mill and adapted to exert a tension on the stock after it is engaged in the rolls.

24. The method of rolling thin metallic stock comprising setting the mill rolls to effect a reduction in excess of that permitted without the stock being forcibly fed into the bite of the rolls, clamping the stock adjacent its leading end, then forcing it between the mill rolls by said clamping means, the clamping means being disposed to engage the stock sufficiently close to its end to prevent it from deleteriously buckling as the feeding force is applied.

25. The method of rolling thin metal stock which comprises setting the mill to take a reduction in excess of that which will permit the stock being entered between the mill rolls without the application of a positive force, and applying a positive force to the stock sufficient to force it into the rolls and at a point sufficiently close to the leading end of the stock to prevent the stock from deleteriously buckling.

26. The method of rolling thin metallic stock comprising setting the mill rolls to take a reduction in excess of that permitted without the stock being forcibly fed into the bite of the rolls, clamping the stock adjacent its leading end, forcing such end by said clamping means into the mill rolls, and thereafter tensioning the stock by said clamping means as it is drawn through the mill, the clamping means being operative sufficiently close to the end of the stock and the mill to prevent the stock from deleteriously buckling as the feeding force is applied.

27. An apparatus according to claim 22 characterized by the means for engaging and gripping the leading end of the stock being adapted to engage the stock across its entire width.

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