Aug. 23, 1932. W. SYKES 1,873,361

APPARATUS FOR MANUFACTURING PLATES

Filed Jan. 11, 1928 4 Sheets-Sheet 1

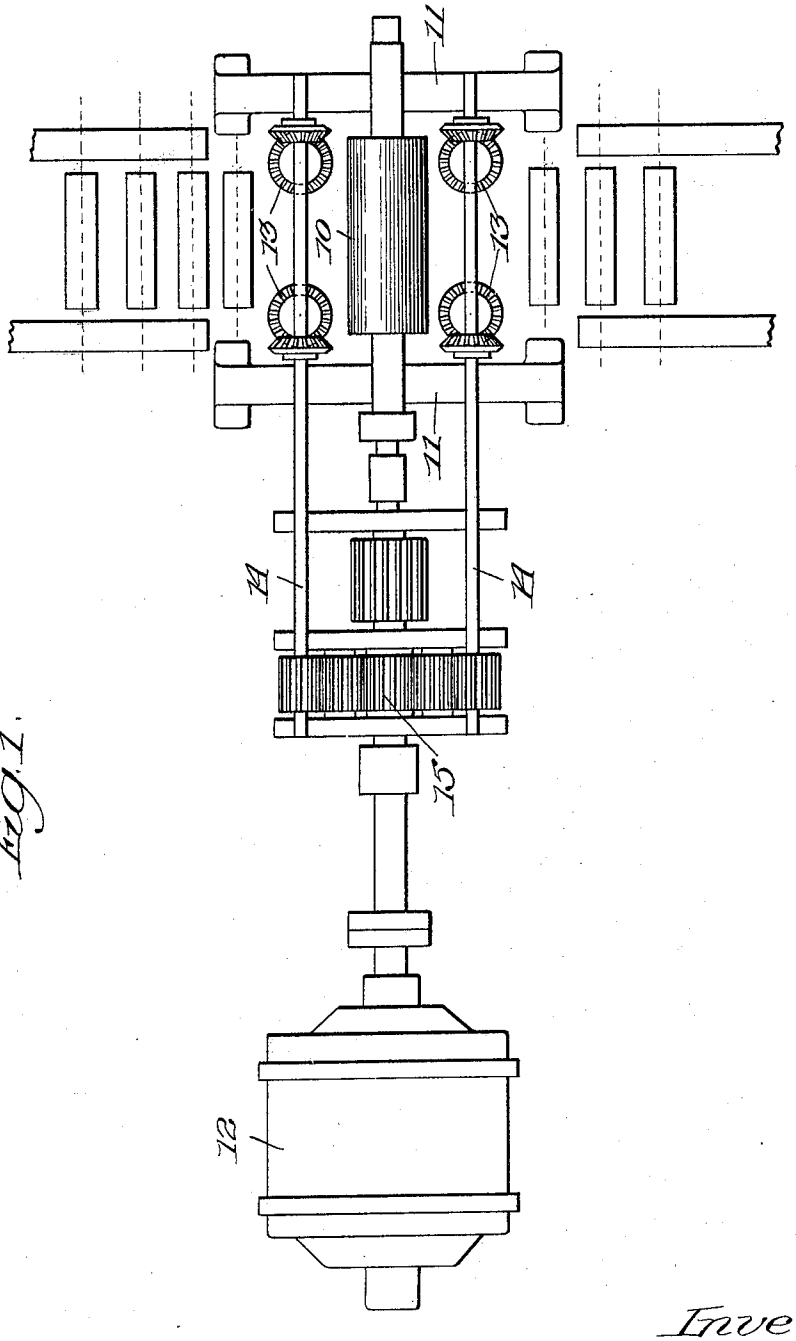


Fig. 1.

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APPARATUS FOR MANUFACTURING PLATES

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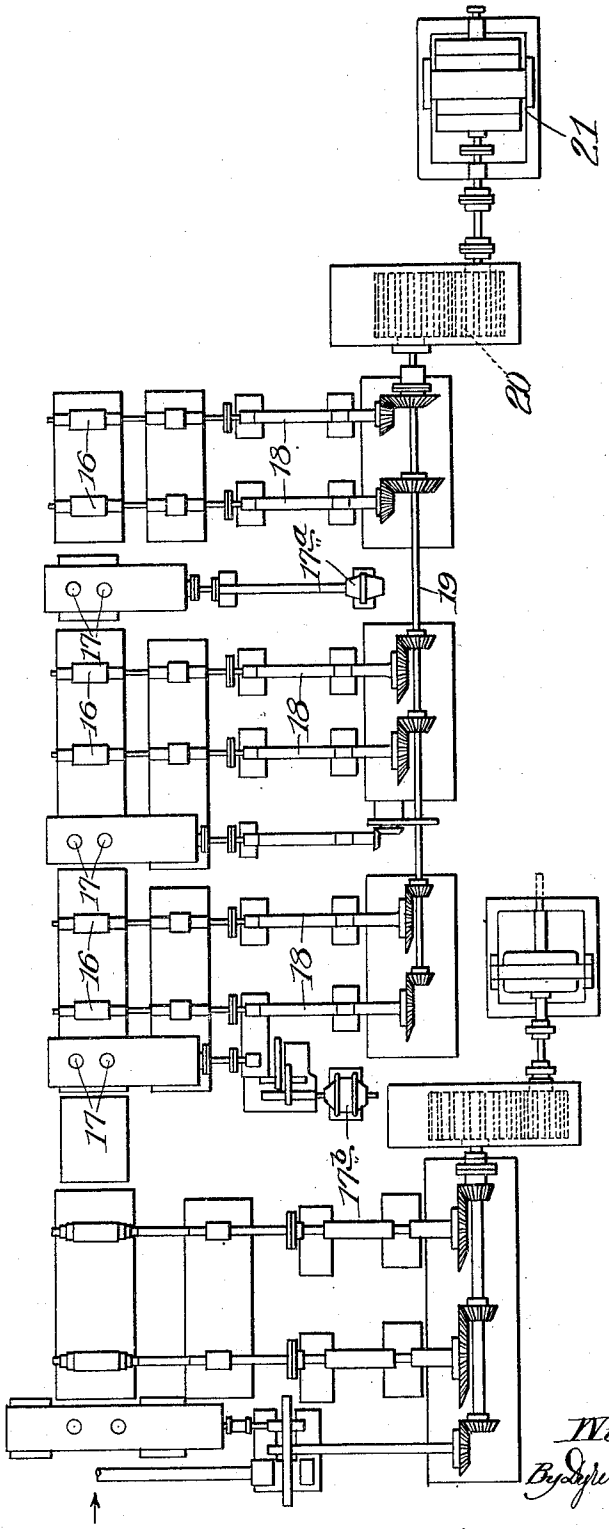


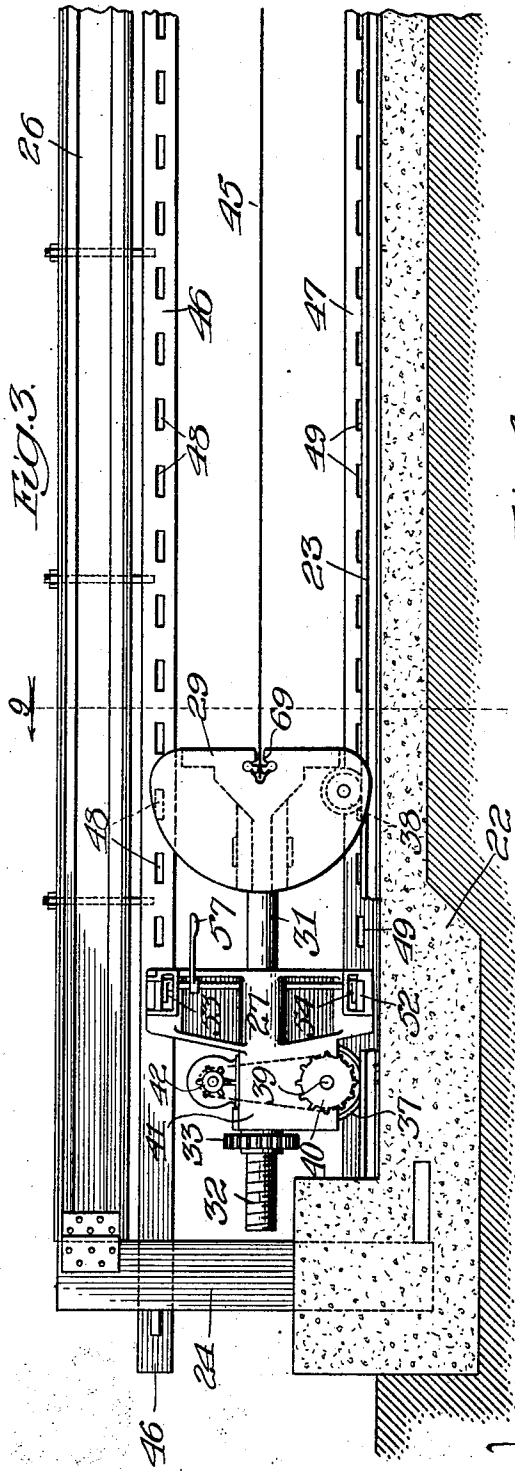
Fig. 2.

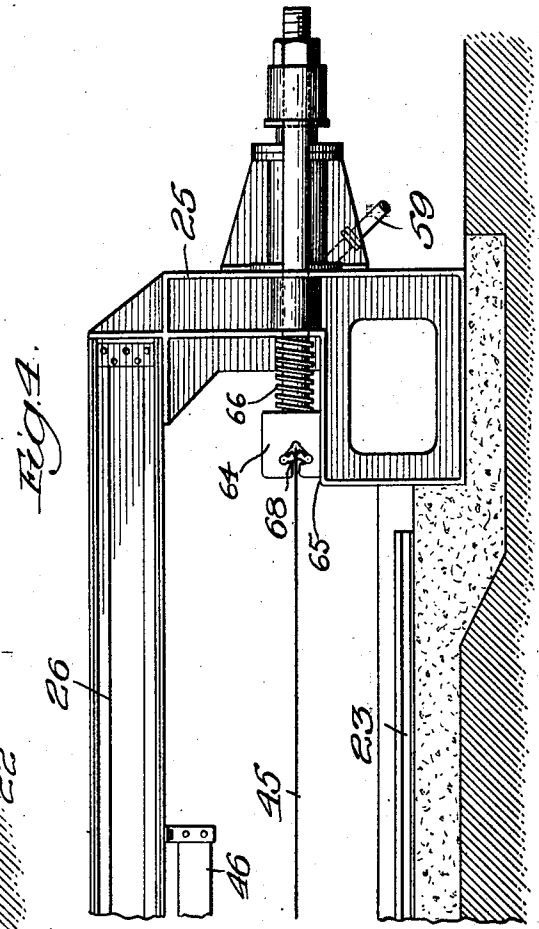
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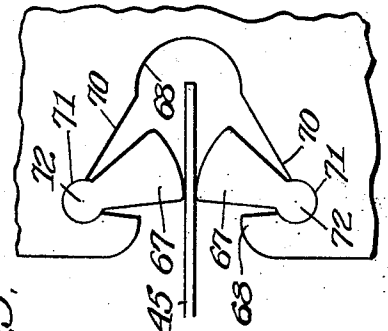
Aug. 23, 1932. W. SYKES 1,873,361

APPARATUS FOR MANUFACTURING PLATES

Filed Jan. 11, 1928 4 Sheets-Sheet 3







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APPARATUS FOR MANUFACTURING PLATES

Filed Jan. 11, 1928 4 Sheets-Sheet 4

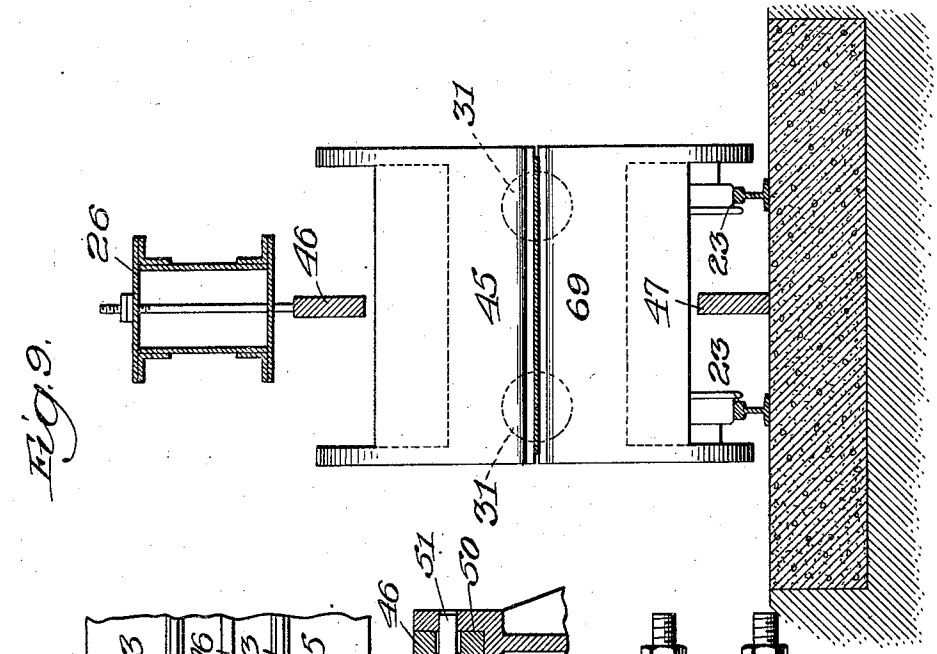


Fig. 9.

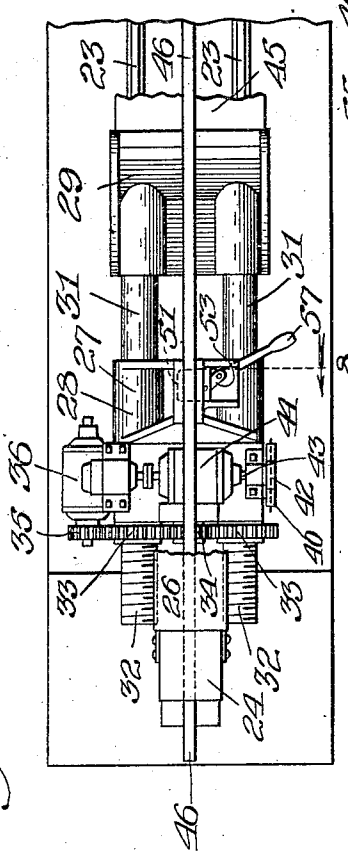


Fig. 6.

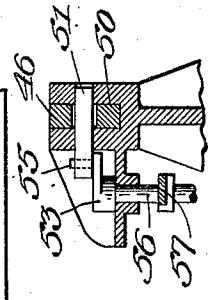


Fig. 8.

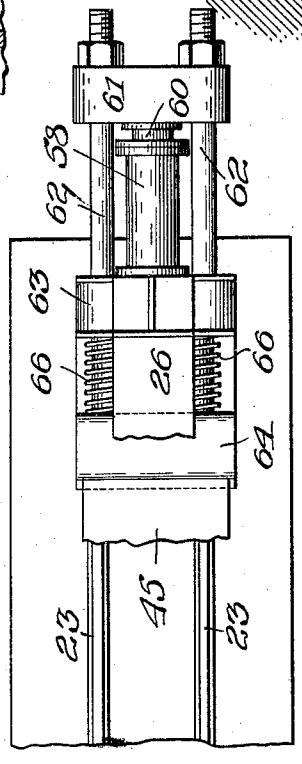


Fig. 7.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR MANUFACTURING PLATES

Application filed January 11, 1928. Serial No. 245,940.

My invention relates, more particularly, to the manufacture of so-called universal mill plates (as distinguished from "sheets"), namely, plates, the lateral edges of which are rolled to cause the plates to be of the desired thickness and width, such kind of plates being commonly produced either on reversing universal mills or mills of the so-called continuous type in which the material from which the plates are formed moves unidirectionally through the mill.

While the lateral edges of such plates so rolled on mills as commonly provided are equidistant throughout their length by reason of the provision of vertical rolls between which the material passes in the rolling operation, it often happens that the plates issue from the mill curved in the horizontal plane beyond the permissible commercial tolerances, due to one or more of many causes as recognized in the art; and in some cases, while issuing from the mill in such form as to cause them to be within such permissible tolerances become curved in the horizontal plane, in cooling, beyond such tolerances.

As further descriptive of the conditions presented by prior practice, it may be stated that in the use of the reversing type of mill fairly satisfactory results in the production of plates, have been produced by providing a so-called straight edge against which one edge of the plate, after passing through the mill, is forced by pressure applied to the opposite edge thereof, but such an arrangement is wholly unsuited for the production of relatively thin plates inasmuch as the action of the straightening means buckles, instead of straightens, the plate. Furthermore, it often occurs that plates which issue from these mills of such form as to be within the permissible tolerance, become curved in a horizontal plane beyond such tolerance in the cooling thereof on the cooling bed due to unequal cooling of the various portions of the plate.

In the case of the so-called continuous mill the plates are usually rolled in very long lengths and sheared to the desired lengths, as they leave the mill, by means of a flying shear and thereafter piled on top of each other and then removed to a cooling bed. In this type of mill the straight edge device which has sometimes been used with the reversible mill as above stated cannot be used and it often happens that the plates issuing from these mills present the objectionable curvature referred to or that such objectionable curvature is produced in the cooling of the plates. Such curved plates have been straightened cold, as for example by subjecting them individually to a bulldozing operation or to a peening operation. The principal objection to the bulldozing operation is that it is commercially impracticable to straighten a plate by this operation, due to the tendency of the plate to buckle, unless the width of the plate is less than thirty times its thickness and in any event the plate is subjected to objectional local stresses. The peening operation referred to consists in peening the concave edge portion of the plate to elongate this edge but which operation is not commercially satisfactory and sets up the objectionable stresses referred to.

The deficiencies in the methods and apparatus hitherto employed, present great objections in the commercial production of plates of the character above stated particularly because of the necessity for scrapping certain of the plates because they fail to meet the permissible tolerances as to flatness of faces and rectilinear parallelism of lateral rolled edges.

While it is possible to roll plates within the permissible tolerances, at least so that the plates as they issue from the mill in heated condition will be within such tolerances, such operation of a mill requires that the mill be operated very slowly and the plate as it is rolled carefully observed and as the rolling progresses comparatively fine adjustments made of the parts of the mill for correction, this slowing down of the operation of the mill obviously greatly adding to the cost of production. It is furthermore to be noted that in the case of the continuous mill, where long lengths are usually rolled and cut to desired lengths as they leave the mill it is usually impossible to correct for curvature by adjustments of the parts of the mill while the steel is in the mill, so that a considerable amount of steel may be rolled before an op-

portunity occurs to correct such curvature with consequent loss of material.

My primary object is to provide a novel apparatus for straightening rolled edge plates which shall be applicable to the straightening of such plates of widely varying thicknesses ranging from a relatively thick plate to a relatively thin plate, without danger of buckling the plates and by an operation which is performed upon the plate after it has passed through the mill and the plate is in relatively cool condition and in the use of which the mill may be operated rapidly and without the careful adjustment of its parts necessary to ensure the rolling of the plates within the permissible tolerances; another object is to perform the straightening operation economically and by apparatus of comparatively inexpensive construction; and other objects as will be manifest from the following description.

Referring to the accompanying drawings:—

Figure 1 is a plan view, partly diagrammatic, of a well known construction of so-called reversible universal mill for rolling plates. Figure 2 is a similar view of a well known universal mill of the continuous type. Figure 3 is a view in side elevation of one end of plate-stretching mechanism embodying my invention and by the use of which my new method may be practiced, and Figure 4, a similar view of the other end of this mechanism, these two views showing a plate, to be stretched, positioned therein. Figure 5 is a broken, enlarged, view of the jaw portion of the part of the mechanism shown in Fig. 4. Figure 6 is a plan view of the part of the mechanism shown in Fig. 3, with a portion of the upper girder member broken away. Figure 7 is a similar view of the part of the mechanism shown in Fig. 4, also with a portion of the upper girder member broken away. Figure 8 is a broken, enlarged, sectional view taken at the line 8 on Fig. 6 and viewed in the direction of the arrow; and Figure 9, an enlarged, sectional, view taken at the line 9 on Fig. 3 and viewed in the direction of the arrow.

The plates to be produced in accordance with my invention are first rolled to the desired thickness with their opposed lateral edges rolled to cause the plates to be of the desired width, these lateral edges being equidistantly spaced throughout the length of the plate, by any suitable mechanism as for example on a reversing universal mill or on a continuous universal mill, mills of both of these types being illustrated.

Referring to the reversing mill structure of Fig. 1, it comprises a pair of horizontal rolls arranged in a vertical series, one only of these rolls being shown at 10 and between which the material from which the plate is to be formed, is rolled to cause the plate to be of the desired thickness, the rolls 10 being mounted in housings 11 and driven in opposite directions from a power device represented at 12, in a well known manner.

The machine also comprises vertically disposed rolls represented at 13, shown as 4 in number, and located adjacent opposite ends of said horizontal rolls 10 and provided for the purpose of rolling the edges of the plate to cause the plate to be of the desired width, these rolls being illustrated as driven, in a manner well known in the art, through the medium of shafts 14 connected with the drive shaft of the power device 12 through the medium of the gear train 15. In the use of this mill a slab from which the plate is to be formed and of slightly greater width than the desired width of the plate is passed back and forth through the horizontal and vertical rolls the rotation of which is reversed at the end of each pass to cause these rolls to rotate in the direction of the movement of the plate being formed, the vertical rolls being gradually moved toward each other and likewise the horizontal rolls to gradually reduce the distance between these rolls with each pass to produce in the final pass a plate of the desired thickness and width.

Referring to the continuous universal mill of Fig. 2 it comprises a horizontal series of pairs of horizontal rolls 16 the rolls of each pair being disposed one above the other, and a horizontal series of pairs of vertical rolls 17 the rolls of each pair being spaced apart horizontally adjacent opposite ends of the horizontal rolls 16. These several rolls are suitably journalled in the frame of the machine, the rolls of each pair of horizontal rolls 16 being driven in opposite directions from jack shafts 18 geared to a cross shaft 19 and driven, through the medium of a gear train 20, by a motor represented at 21. The rolls 17 of each pair thereof are driven in opposite directions and in the arrangement shown by three separate means, one pair being driven, by suitable driving connections, from a motor 17^a; another pair by the motor 21 by suitable connections between this pair and the shaft 19; and the third pair by a motor 17^b through suitable driving connections.

In the use of the mill just described the material from which the plate is to be formed, passes successively between the horizontal rolls 16 and between the vertical rolls 17. The material in passing between the rolls referred to is reduced in thickness and in width, the vertical rolls operating to roll the opposite lateral edges of the plate as it is being formed, and the plate issuing from the end of the machine of the desired thickness and width with its lateral edges, rolled as stated, spaced apart an equal distance throughout the length of the plate.

Where the plates produced by the rolling operation, as for example on either of the

mill structures described, are curved laterally, namely, in the horizontal plane beyond the permissible commercial tolerances the plates are subjected to a straightening action which, in accordance with my invention comprises, generally stated, the pulling of the plate, by engaging it at its opposite ends, and with such force as to cause the plate to be stressed beyond its elastic limit, into a form in which its lateral rolled edges extend so nearly straight and parallel as to be within the permissible commercial tolerances.

In Figs. 3 to 9, inclusive, of the drawings I have disclosed an apparatus of a construction suitable for operating on the plate to straighten it and constituting the preferred embodiment of my invention.

The apparatus referred to comprises a relatively heavy base member 22 equipped with parallel tracks 23 and provided at its ends with heavy uprights 24 and 25, rigidly connected together at their upper ends by a girder 26, the base member 22, uprights 24 and 25, and grider 26 forming a heavy rigid frame.

Located in the space within this frame at one end thereof, is a carriage 27 formed of two sections 28 and 29 relatively adjustable lengthwise of the machine, the section 29 being in the form of a clamp head provided with parallel bars 31 extending longitudinally from one end thereof and guidingly through horizontal openings in the carriage-section 28, the rear ends of these bars being threaded as represented at 32 and equipped with gears 33 internally threaded and screwing upon the threaded ends 32 of the bars and abutting an end of the carriage-section 28. The gears 33 mesh with a pinion 34 journalled on the frame, one of the gears 33 meshing with another pinion 35 driven by a motor 36 mounted on the carriage-section 28 the arrangement just described permitting of the adjustment of the clamping head 29 on the section 28 in a direction lengthwise of the machine.

The carriage 27 is equipped with pairs of wheels 37 and 38 provided on the carriage sections 28 and 29, respectively, and at which wheels the carriage rests on, and is movable along, the rails 23. The wheels 37 are rigidly connected together through the medium of an axle 39 journalled in the carriage-section 28 and equipped with a sprocket 40. The sprocket 40 is engaged by a sprocket chain 41 passing over a sprocket 42 rigidly secured to one end of a shaft 43 journalled on the carriage-section 28 and driven by a motor 44 on this section. The means just described afford means by which the carriage may be moved along the rails 23 for the purpose hereinafter described.

The apparatus also comprises bars 46 and 47 which extend lengthwise of the apparatus and are securely anchored against displacement, these bars, which are arranged adjacent the top and bottom, respectively, of the stationary frame of the apparatus, containing a series of vertically aligned openings 48 and 49, respectively. The carriage-section 28 contains an upwardly-opening groove 50 and a similar downwardly-opening groove at which this frame section slidingly embraces the upper and lower bars 46 and 47.

Means are provided for firmly anchoring the carriage in its different positions of adjustment along the stationary frame these means comprising blocks 51 and 52 slidably mounted in the grooved portions of the carriage-sections 28 and adapted to be projected through the openings 48 and 49. The blocks 51 and 52 are pivotally connected with the pins of cranks 53 and 54, respectively, the pin of crank 53 being represented at 55. The cranks 53 and 54 are rigidly connected with the upper and lower ends of a vertical shaft 56 journalled in the carriage-section 28 and equipped with an actuating handle 57 rigid therewith, the cranks 53 and 54 being so arranged on this shaft that the crank pins are in vertical alignment with each other, it being understood from the foregoing description that by actuating the shaft 56 the blocks 51 and 52 may be moved into and out of those of the slots 48 and 49 with which they register.

The apparatus at the opposite end of the stationary frame is provided with means operable to exert on the end of the plate opposite that gripped by the carriage 27, sufficient pulling force to stretch the plate into the desired form above referred to, these means comprising hydraulic mechanism shown as formed of a cylinder 58 secured to the upright 25 the inlet of the cylinder being in communication with a pipe 59 which, in practice, would lead to any suitable source of actuating pressure. The mechanism also comprises a ram 60 operating in the cylinder 58 and connected with a cross-head 61 provided with a pair of parallel rods 62 sliding in guide-portions 63 provided on the upright 25, the forward ends of these rods being rigidly connected with a clamp head 64 slidable on an extension 65 of the upright 25, coil springs 66 surrounding the rod 62 being confined between the upright 25 and the head 64 and tending to move this head to the left in Figs. 4 and 7.

Any suitable means for clamping the ends of the plate to be straightened to the heads 28 and 64 may be provided. In the particular construction shown such clamping means comprise grippers 67 which are mounted in the heads at opposite sides of horizontal slots therein and represented at 68 and 69, respectively. As shown of the head 64, the heads are transversely recessed, as represented at 70, at opposite sides of the slots therein, to form socket portions 71 in which the partially

cylindrical portions 72 of the grippers are rotatably confined, these grippers being entered into the portions 71 of the recesses through either end of these portions. The grippers 67 are so constructed and arranged, as shown, that they converge in a direction toward the end of the machine at which they are located whereby the end of a plate may be readily introduced between these grippers and when force is applied tending to move the head 64 to the right in Figs. 4 and 7 the grippers on each head will automatically grip the ends of the plate to provide the resistance necessary to prevent movement of the plates in the heads.

In the operation of the machine the plate to be straightened is positioned, in relatively cold condition, at its opposite ends between the grippers on the heads 29 and 64, and assuming the carriage 27 to be anchored against movement lengthwise of the machine by the positioning of the blocks 51 and 52 in registering ones of the openings 48 and 49, the operator admits actuating fluid through the pipe 59 to the hydraulic cylinder 58 thereby forcing the head 64 to the right in Figs. 4 and 7 which subjects the plate to the straightening action referred to, the power exerted by the hydraulic mechanism being sufficient to stretch the plate beyond its elastic limit into a condition in which its lateral rolled edges extend straight and parallel, or at least sufficiently so to be within the permissible commercial tolerances.

The purpose of providing for the adjustment of the carriage 27 along the apparatus into different positions in which it may be anchored as described, is to adapt the apparatus for stretching of plates of different lengths. As a carriage of the construction shown is rather cumbersome, and involves considerable time for its adjustment and anchoring, it is preferably constructed in sections as shown and described with means for adjusting the clamp head 29 relative to the carriage-section 28 whereby relatively fine adjustments of the head 29 may be effected when necessary following the adjustment of the other section of the carriage and by which adjustments for plates varying slightly in length, may be made without necessitating the adjustment of such other carriage-section.

While I have illustrated and described a particular form of apparatus suitable for practicing my improved method, I do not wish to be understood as intending to limit my invention thereto, as the same may be practiced by other constructions of apparatus; and while I have illustrated by the apparatus shown, a particular embodiment of my invention, I do not wish to be understood as intending to limit it thereto as the same may be variously modified and altered without departing from the spirit of my invention.

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

1. A machine of the character set forth, comprising spaced-apart members for engaging the ends of the work, one of said members being formed of sections both of which are adjustable, as a unit, lengthwise of the machine and one of which is a work-engaging section and is bodily adjustable relative to the other section thereof in a direction lengthwise of the machine, means for rigidly holding said other section against movement lengthwise of the machine, and means for effecting relative movement of said members in a direction away from each other to stretch the work.

2. A machine of the character set forth, comprising spaced-apart members for engaging the ends of the work, one of said members being formed of sections both of which are adjustable, as a unit, lengthwise of the machine and one of which is a work-engaging section and is bodily adjustable relative to the other section thereof in a direction lengthwise of the machine, and means for moving the work engaging portion of the other of said members in a direction away from said work engaging section.

3. A machine of the character set forth, comprising spaced-apart members for engaging the ends of the work, one of said members being formed of sections both of which are adjustable, as a unit, lengthwise of the machine and one of which is a work-engaging section and is bodily adjustable relative to the other section thereof in a direction lengthwise of the machine, and hydraulic means for moving the work engaging portion of the other of said members in a direction away from said work engaging section.

4. A machine of the character set forth, comprising spaced apart members for engaging the ends of the work, one of said members being formed of sections both of which are adjustable, as a unit, lengthwise of the machine and one of which is a work-engaging section having parallel rods extending therefrom and guidingly engaging the other of said sections, and means engaging said rods for adjusting said sections relative to each other.

5. A machine of the character set forth, comprising spaced apart members for engaging the ends of the work, one of said members being formed of sections both of which are adjustable, as a unit, lengthwise of the machine and one of which is a work-engaging section having parallel rods extending therefrom and guidingly engaging the other of said sections, and means engaging said rods for adjusting said sections relative to each other, and means for effecting relative movement lengthwise of the machine of the portions of said members at which the work is engaged.

6. A stretching machine comprising spaced-apart members for engaging the ends of the work, one of said members being formed of sections both of which are adjustable, as a unit, lengthwise of the machine, and one of which is a work-engaging section bodily adjustable relative to the other section thereof in a direction lengthwise of the machine and supported at least partly otherwise than on such other section, and means for effecting relative movement of said members in a direction away from each other to stretch the work.

7. A machine of the character set forth, comprising spaced apart members for engaging the ends of the work, one of said members being formed of sections both of which are adjustable, as a unit, lengthwise of the machine and one of which is a work-engaging section and is adjustable relative to the other section thereof, means for rigidly holding such other section against movement lengthwise of the machine, and a motor on said last-referred-to section and operative to adjust said work-engaging section relative to said other section.

WILFRED SYKES.