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3,621,693

STRAIGHTENING MACHINE FOR STRUCTURAL WORKPIECES

Filed Aug. 8, 1969

3 Sheets-Sheet 1

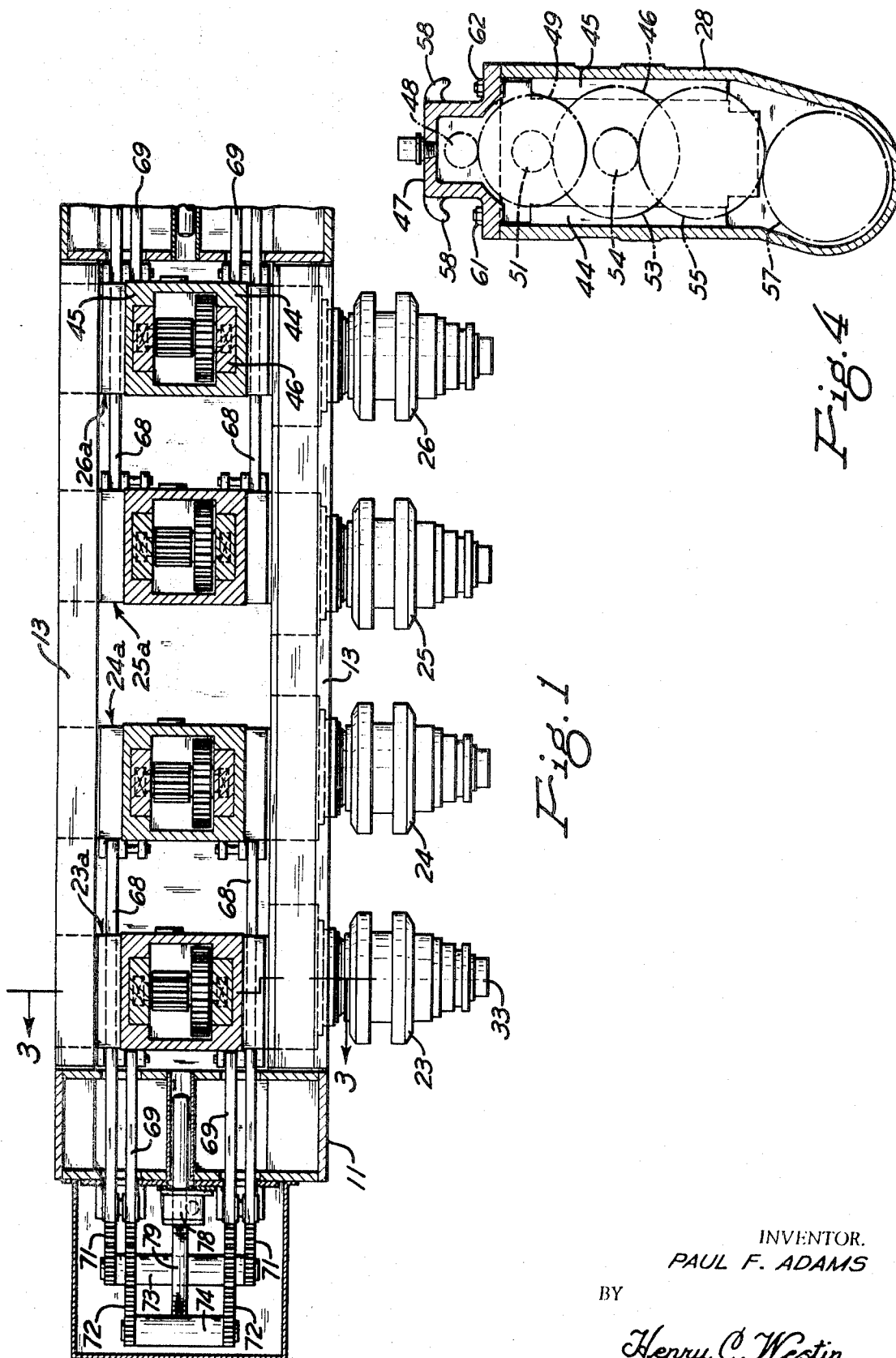


Fig. 4

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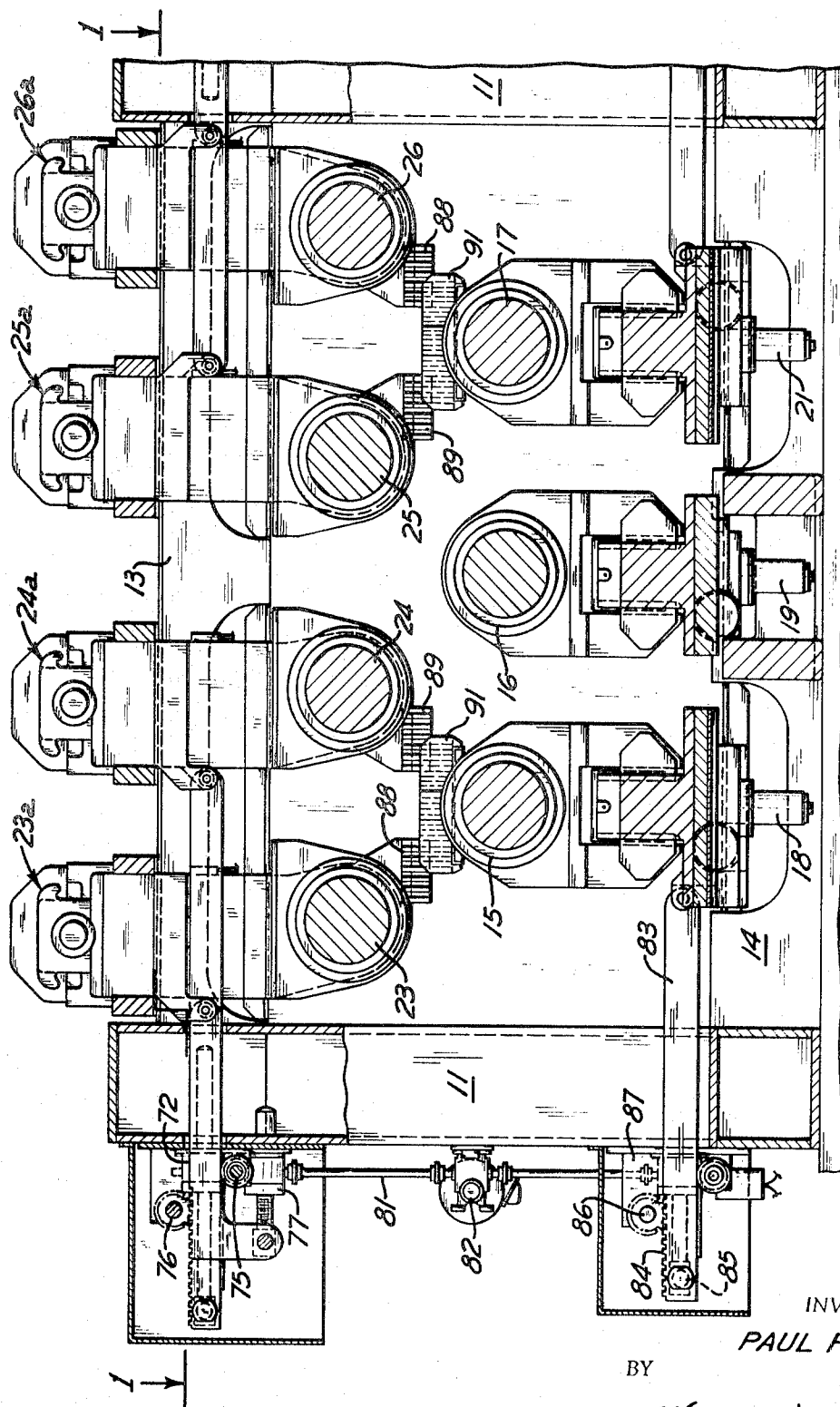


Fig. 2

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3 Sheets-Sheet 3

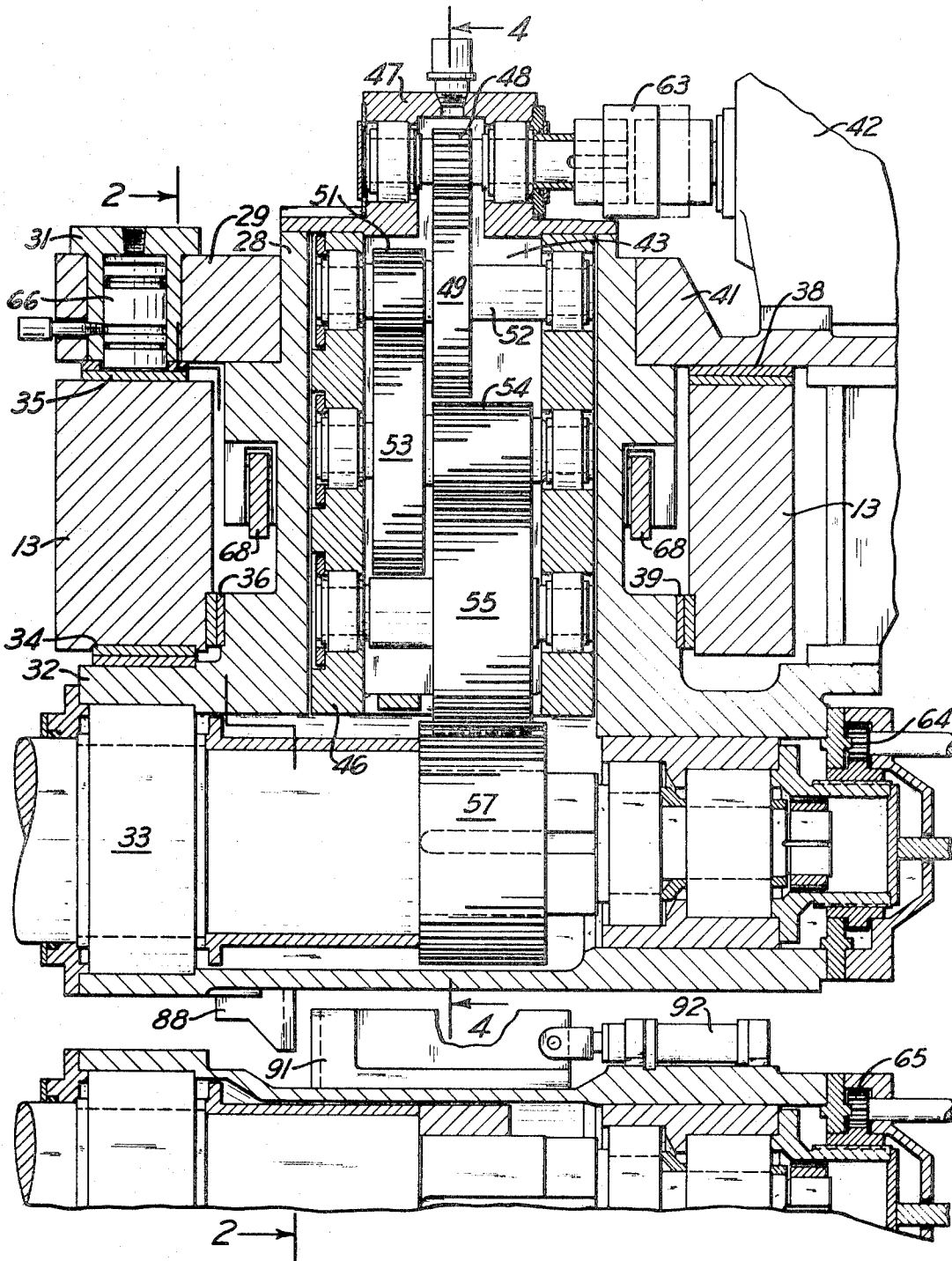


Fig. 3

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STRAIGHTENING MACHINE FOR STRUCTURAL WORKPIECES

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5 Claims

ABSTRACT OF THE DISCLOSURE

The disclosure relates to a straightening machine wherein there is provided a number of independent roller assemblies so arranged that they form sets of three rollers between which the product to be straightened is fed. Each roller assembly is provided with a frame and with reference to the upper assemblies, there is provided a gear driving arrangement for the rollers thereof. Each gear driving arrangement is constructed as a unitary assembly adapted to be quickly removed from and inserted into the frames as a unit. Positioning means are provided for the individual roller assemblies, which means allow the assemblies to be moved parallel to the pass line without disturbing their predetermined spaced relationship. Also disclosed is a locking means for maintaining the roller assemblies in their predetermined spaced relationship after it has been established. There is disclosed, in addition, a pressure take-up mechanism associated with each frame of the upper roller assemblies for eliminating any clearance between the frames and the housing.

Present-day straighteners of the type employed for straightening heavy sections, such as, large channels and wide flange beams, take the form of very large, cumbersome machines employing very integral adjusting mechanisms for the rollers. In view of the much larger sections being rolled, there is a need for an improved machine which will not only be much more economical to manufacture, but also to operate. Because of the need for various adjustments of the rollers relative to each other and relative to the pass line, very elaborate adjusting mechanisms were heretofore found necessary.

It is the object of the present invention to provide a simplified straightening machine of a caliber that will efficiently and effectively straighten the larger sections now being rolled by modern structural mills.

More specifically, the present invention provides employment of individual roller assemblies, each of which is adapted to be adjustable relative to a housing and to each other by a mechanism synchronized so as to maintain a predetermined relationship between the rollers.

A further object of the present invention is to provide in connection with the roller assembly a unitary driving assembly designed to be quickly removable and replaceable as a unit to and from the housing.

It is a further object of the present invention to provide an economical and quickly operating locking means for maintaining the roller assembly in a predetermined spaced relationship.

It is a still further object of the present invention to provide a force exerting means for taking up the clearances between the individual frames that carried the roller assemblies and the main housing.

These objects, as well as various other novel features and advantages of the present invention, will be more clearly understood when the following description is read along with the accompanying drawings of which:

FIG. 1 is a sectional view taken on lines 1—1 of FIG. 2;

FIG. 2 is a sectional view taken on lines 2—2 of FIG. 3;

FIG. 3 is a sectional view taken on lines 3—3 of FIG. 1; and

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FIG. 4 is a sectional view taken on lines 4—4 of FIG. 3.

With reference to the drawings, it will be noted in FIG. 2 that the straightener comprises two spaced pairs of upright end members 11 forming the posts of a rectangular box-like structure. Between each upright member there are provided upper and lower longitudinal separators 13 and 14. As shown in FIG. 1, the upright members 11 extend the full width of the straightener between which the separators 13 and 14 extend.

Referring now to the lower separators 14, it will be noted in FIG. 2 that there are provided three roller assemblies 15, 16 and 17 which are carried by the lower separators 14 and in which construction the outer assemblies 15 and 17 are adapted to move longitudinally relative to the separators 14. The three lower roller assemblies 15, 16 and 17 are adjustable vertically by a worm and wheel assembly 18, 19 and 21 of a well-known construction. The mechanism for moving the outer lower roller 15 and 17 longitudinally will be discussed later after the top roller assemblies have been described. The lower roller assemblies in the straightener machine illustrated are non-driven.

With reference to the top roller assemblies and in again referring to FIG. 2, there are provided four independent roller assemblies 23, 24, 25 and 26, each of which is mounted on the upper separators 13 in a manner that allows them to slide longitudinally relative to the separators. As actually shown in FIG. 1, the roller assemblies 23—26 are arranged to straddle the upper separators 13 wherein the lower ends of the roller assemblies extend downwardly towards the pass line of the straightener and assure a cooperative relationship with the lower straightener roller assemblies 15, 16 and 17. In looking at FIG. 2 it will be noted that the roller assemblies are equally spaced with reference to the other roller assemblies of its set and only the lower center roller 16 is not adjustable longitudinally.

As noted previously, it is one of the features of the present invention to provide a replaceable drive unit for each of the upper roller assemblies which are the only rollers driven in the disclosed straightener. In this connection reference is made to FIG. 3 where it will be observed that the separators 13 are adapted to carry outer frames 28 provided for each roller assembly. Since each of the upper roller assemblies is identical, it is deemed necessary to describe only one of them.

The weight of the frame 28 is actually taken at the front of the machine through a block 29 formed as an integral part of the frame 28 and to which is secured a housing of a piston cylinder assembly 31, the lower end of which is mounted and engages with the front separator 13.

In still referring to FIG. 3, it will be observed that the front lower portion of the frame 28 is provided with a bore 32 which receives an arbor 33 of the straightener roller assembly and that between the outer portion of the bore 32 there are provided two bushings 34. A similar bushing 35 is provided at the top in addition to two vertical bushings 36 adjacent the cylinder housings 31 which bushings allow the frame 28 to move relative to the front separator 13.

At the drive side of the straightener the frame is allowed to move relative to the back separator 13 which supports its weight by virtue of two horizontal bushings 38 and two vertical bushings 39. It should be noted here that the portion 41 of the frame shown at the top of FIG. 3 is formed as an integral part of the frame 28 and moves with the frame relative to the back separator 13. This portion, as noted, serves to support the electrical motor 42, the function of which will be explained later.

Still referring to FIG. 3, it will be observed that the frame 28 is provided with an opening 43 for receiving a

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triple reduction gear train employed to drive the arbor 33 and, hence, one of the straightening rollers. Before describing the gearing itself and with reference to FIG. 4, it will be noted that the frame 28 is provided with vertical blocks 44 and 45 which extends a substantial distance between the opposite ends of the frame. These blocks appear also in FIG. 1 where it will be noted that a gear frame 46 employed to form a unitary gear assembly slidably fits into the slots formed by the blocks 44 and 45. At the top, the gear frame overhangs the blocks; thereby, the blocks take the weight of the entire gear assembly. As FIGS. 3 and 4 show, the gear frame 46 comprises an upper cap 47 which rotatably receives a motor pinion 48 which meshes with and drives a first spur gear 49 mounted on a common shaft with a pinion 51, the shaft being identified as 52 and rotatably received in the gear frame. Below the gears 49 and 51 there is a second set of gears 53 and 54 similarly rotatably mounted in the gear frame 46, the pinion 54 driving a gear 55 arranged beneath it and rotatably mounted in the gear frame. The gear 55 drives a gear 57 mounted on the arbor 33 and by virtue of which the straightening roller secured to the arbor is driven.

Referring again to FIG. 4, it will be noted that the cap 47 is provided with hooks 58 and that the cap 47 is secured to the blocks 44 and 45 by virtue of bolt and nut assemblies 61 and 62; the bolts, of course being secured to the blocks so that upon removal of the nuts a crane or other suitable means connected to the hooks 58 may lift the entire gear assembly as a unit from the frame 28. Before this is done, of course, the coupling 63 shown in FIG. 3 must be moved to the phantom position so as to free the drive shaft of the pinion 48 and disconnect the shaft from the motor 42 which is provided to furnish the driving force for the arbor 33 through the reduction gearing already described.

Before passing on to the other features of the present invention and in still referring to FIG. 3, attention is directed to a gear assembly 64 provided for adjusting longitudinally the arbors 33. It will be noted also that a similar gear assembly 65 is provided for the same purpose as the lower roller of the set illustrated in FIG. 3.

In conjunction with the aforesaid description of the upper roller assembly of the straightener and in referring to FIG. 3, it will be observed that a piston assembly 66 is provided in the cylinder 31 already described, the cylinder being a single acting cylinder adapted to receive fluid under pressure and exert a force sufficient to take up any clearances between the front separator 13 and the frame 28. As previously noted, the function of the piston cylinder assembly is to place the individual rollers in a condition so that they can be quickly moved relative to the separators 13, but just as quickly brought into a rigid construction so as to eliminate any clearance between the supports and frames during the straightening operation and when the machine is under the full working load.

In referring again to FIGS. 1 and 2, there is provided a means for adjusting the straightening rollers in a manner that the equal distance relationship of the rollers of each set of the rollers is always maintained. In this regard, it will be appreciated that the rollers of the two outer sets of rollers as viewed in FIG. 2, have an equality of spacing relative to each other, which spacing is desired to be maintained even though the rollers may be moved longitudinally to more effectively straighten different size workpieces. In referring first to the innermost upper rollers 24 and 25, it will be noted from FIG. 1 that there is provided for each such roller assembly parallel bars 68, and for the outermost roller assemblies 23 and 26, bars 69. These numbers are applied to both the left and right-hand roll assemblies as one views FIG. 1. The ends of the bars are associated with a rack assembly, which, in referring to the set of bars 68, are connected to a rack assembly 71, whereas, the bars 69 are

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connected to a rack assembly 72. The rack assemblies are joined by equalizing shafts 73 and 74, respectively, and they are each guided by a pair of guide rolls, one roll being shown more clearly in FIG. 2 as 75. The pinions for the rack assemblies 71 and 72 are mounted in the same longitudinal plane, one of which is noted in FIG. 2 at 76. Each pinion of the rack assemblies is driven by a worm-wheel jack unit, i.e., pinion of the rack 71 by a unit 77 and the rack 72 by a unit 78. FIG. 1 shows the jack set for the rack 72 in which it will be noted that it consists of a threaded shaft 79 connected to the equalized bar 74, a portion of which is seen at the left side of the jack 78. Both jacks are driven by a common shaft 81 which is driven, in turn, by a motor 82 mounted on the vertical uprights 11 of the housing.

A similar rack-bar arrangement is provided for the outer lower roller assemblies 15 and 17 and, in describing the arrangement on one side of the machine, there is provided a pair of bars 83 that connect the roller assembly 15 to a rack 84, the rack being connected together by an equalizing bar 85 to be driven by a pair of pinions 86, the pinions being driven by a worm-wheel jack assembly 87 which is being driven by the motor 82 by an extension of the shaft 81. It should be noted that the selection of the ratios of the jacks 77, 78 and 87 is such that the relative displacement of the various roller assemblies that make up the two outer sets is maintained at the equal spacing relationship. Upon the operation of the motor 82 the spacing of rollers is adjusted while preserving their equal distances.

In referring now to FIGS. 2 and 3, it is noted that each roller assembly in the vicinity of the passline is provided with racks 88, 89 and 91. The rack for the lower roller, identified as 91, is large enough to engage at the same time the upper racks 88 and 89. The lower rack 91, as shown in FIG. 3, is connected to a piston cylinder assembly 92 which moves the rack 91 towards and away from the other two racks 88 and 89, the rack 91 being mounted slidably on the non-rotational portion of the arbor housing of the lower roller 15. In this manner, once the positioning of the rollers has been accomplished, they may be conveniently and quickly locked by operation of the piston cylinder assembly 92.

In accordance with the provisions of the patent statutes, I have explained the principle and operation of my invention and have illustrated and described what I consider to represent the best embodiment thereof.

I claim:

1. In a straightening machine for straightening rolled sections,

a housing including a support member extending in a direction parallel to the path of travel of the rolled sections when brought to the machine,

a plurality of straightening roller assemblies, at least one of said roller assemblies comprising a frame for rotatably supporting said one roller assembly in an operative position with respect to at least one other straightener roller assembly, said frame having an opening that forms outer and inner extensions relative to said path of travel, said inner extension arranged to rotatably support said one roller assembly and said outer extension arranged adjacent a portion of said support member, and

selectively operable fluid force exerting means arranged between said outer extension of said frame and said adjacent portion of said support member for securing said frame to said support member so that in one case the frame is fixedly held relative to said support member and in another case the frame is allowed to move relative to the support member in the direction of said path of travel.

2. In a straightening machine according to claim 1, a gear train received in said frame,

means for interconnecting the gears of said train so

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as to constitute the train a unitary assembly and allow the unitary assembly to be removed from and inserted in said frame,
 said one roller assembly having a rotatable arbor,
 a separate gear mounted on said arbor arranged to mesh with one of the gears of said train, and
 means for securing said unitary train assembly to said frame.

3. In a straightening machine according to claim 2 wherein said fluid force exerting means for securing said frame to said support member comprises a piston cylinder assembly carried by said frame arranged to exert a holding pressure against said support member.

4. In a straightening machine according to claim 1 including at least two straightening roller assemblies on one side of said path of travel, comprising:

separate frames for each of said two roller assemblies adjustable on said support member relative to a straightening roller assembly on the other side of said path of travel and which roller assemblies cooperate to straighten a workpiece and wherein the outer two roller assemblies of the cooperative set are equally spaced with reference to the intermediate roller assembly,

means for positioning said adjustable roller assemblies relative to said support member at equal distances with respect to the roller assembly on the other side of said path of travel,

said positioning means comprising a jack for each adjustable roller assembly,

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a means common to each jack for driving said jacks at the same revolutions per minute, and
 said jacks having different gear ratios so that when operating they displace the adjustable roller assemblies in a manner to maintain their equidistance relationships with the other roller assemblies.

5. In a straightening machine according to claim 4 including racks secured to the cooperative adjustable roller assemblies and a third rack secured to the cooperative roller assembly on the other side of the path of travel,

said third rack being long enough to simultaneously engage the racks of said adjustable roller assemblies, and

means for moving said third rack into engagement with the racks of the adjustable roller assemblies once the roller assemblies have been adjusted to lock the three roller assemblies in their adjusted positions.

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