I. L. HUGHES.

APPARATUS FOR STRAIGHTENING METAL BARS.

APPLICATION FILED APR. 26, 1909.

1,045,031. Patented Nov. 19, 1912.

4 SHEETS—SHEET 1.

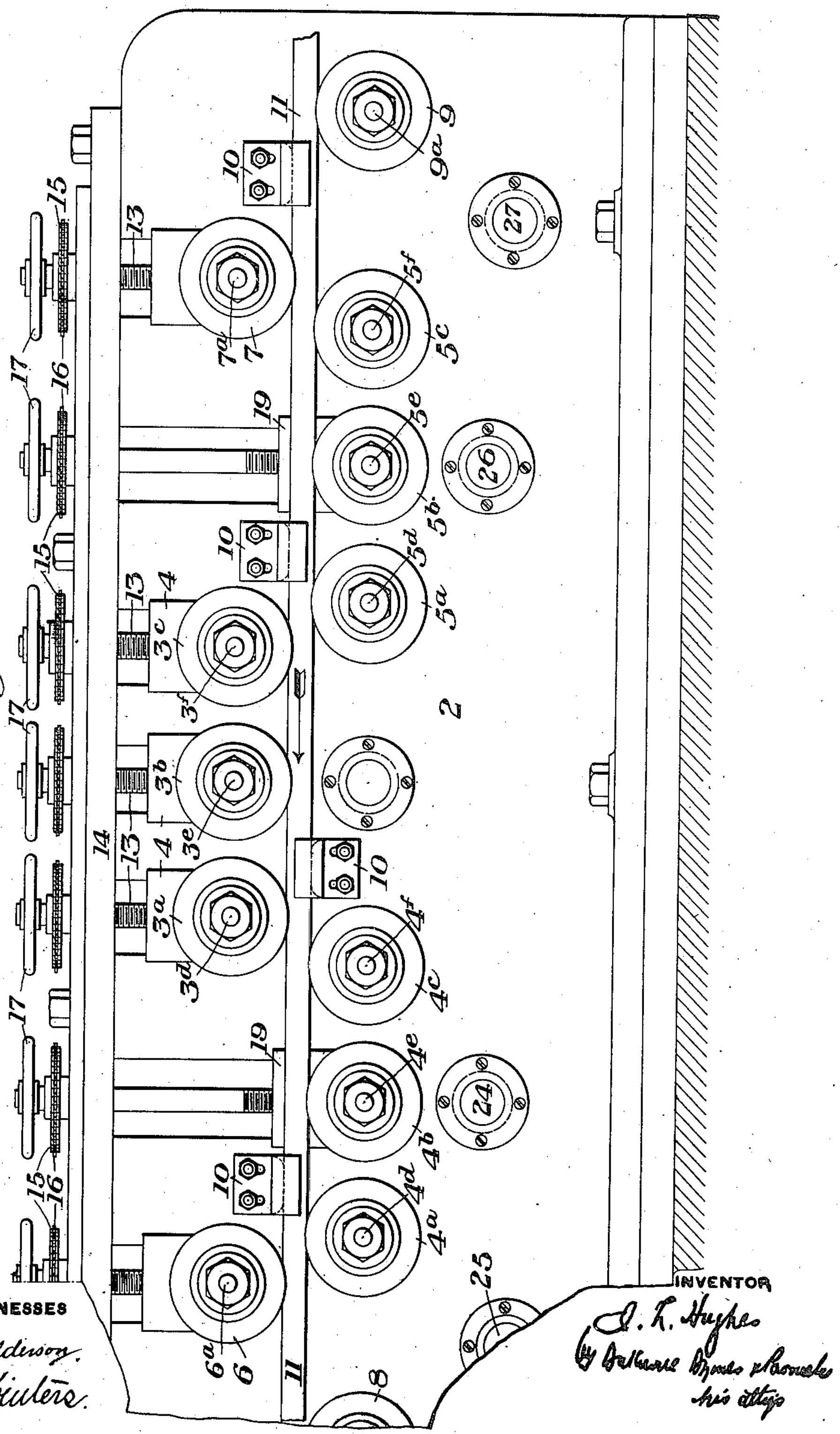

Fig. 1.

WITNESSES

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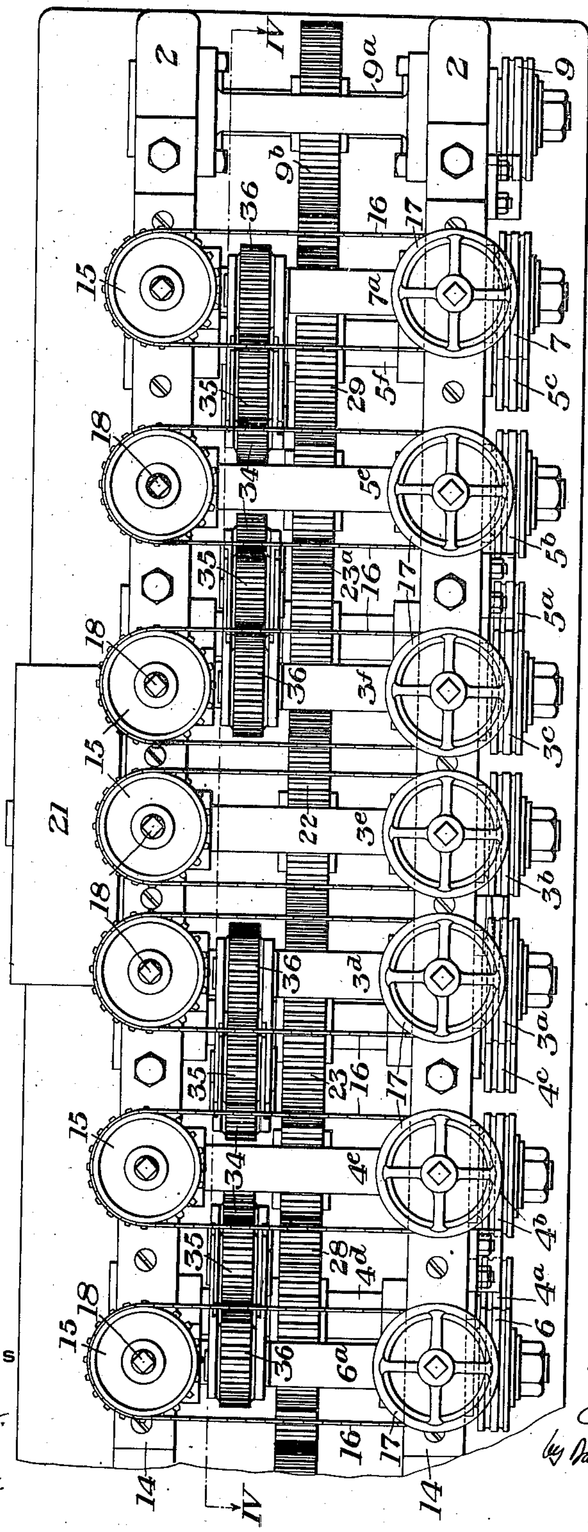
4 SHEETS—SHEET 2.

Fig. 2.



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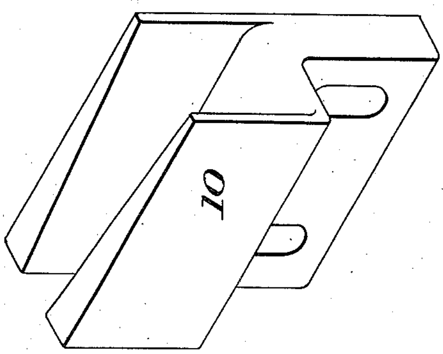

Fig. 5.

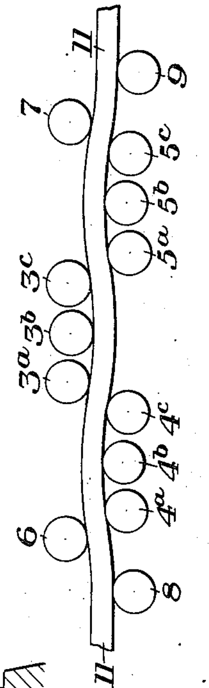

Fig. 6.

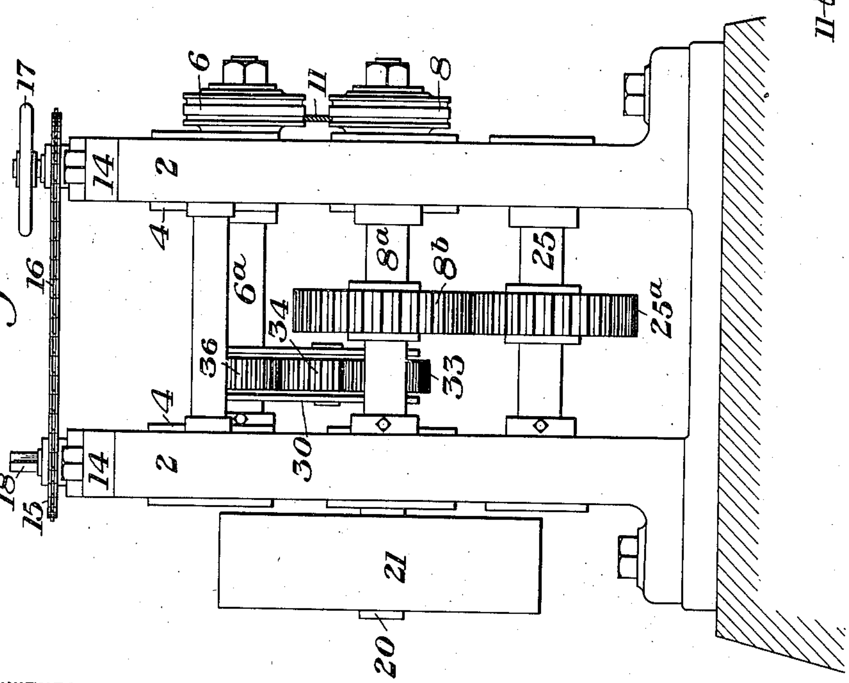

Fig. 3.

WITNESSES

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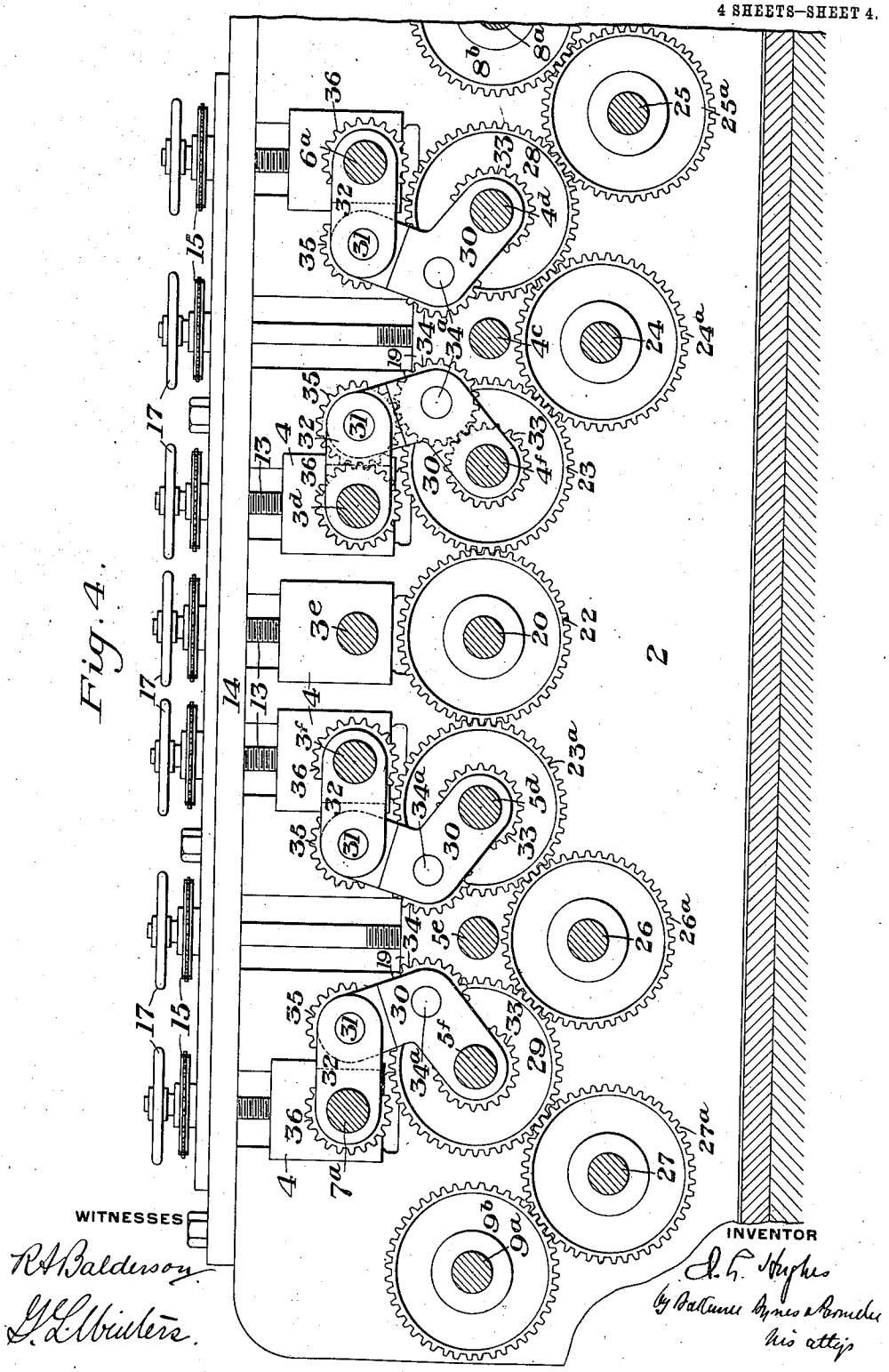
4 SHEETS—SHEET 4.

Fig. 4.



UNITED STATES PATENT OFFICE.

ISAAC LAMONT HUGHES, OF YOUNGSTOWN, OHIO.

APPARATUS FOR STRAIGHTENING METAL BARS.

1,045,031. Specification of Letters Patent. Patented Nov. 19, 1912.

Application filed April 26, 1909. Serial No. 492,255.

To all whom it may concern:

Be it known that I, ISAAC LAMONT HUGHES, a citizen of the United States, and resident of Youngstown, in the county of Mahoning and State of Ohio, have invented a new and useful Apparatus for Straightening Metal Bars, of which the following is a specification.

My invention relates to the straightening of metal bars, rods and similar rolled metal sections.

The object of my invention is to provide apparatus of improved construction having novel means for straightening the bars by which irregularities caused by the rolling operation are removed without damage to the surfaces of the finished shapes and the shapes are put into the desired straight condition. Heretofore in straightening such materials, particularly what is known to the trade as tire-iron, which has a very hard, smooth finish, it has been found that the skin formed on the materials during the rolling operation easily becomes cracked and broken when being straightened. When the skin or surface of such materials becomes cracked or broken, the material is defective and must be disposed of at a loss. Such materials have been straightened in "bumpers" or gag presses in which a gag is placed between the metal and the reciprocating arm of the gag press at the desired points in the length of the bar. In straightening bars in this manner, but one bend or curve is put in the shape at each stroke of the moving ram of the gag press and the shape is supported at but two points on one side and by the gag at a single point on its opposite side. With such apparatus the cost of straightening the materials is very high and the straightening operation is slow, the output of mills manufacturing such shapes being limited to practically the amount of materials which can be straightened.

My invention consists in providing a series of sets of multiple straightening rollers having the opposite sets of rollers arranged so as to be adjustable with relation to each other, the rollers in each multiple set also being adjustable relatively to one another.

The invention also consists in arranging and adjusting the rollers in such manner that the shape being straightened is simultaneously subjected to bending in a plurality of reverse curves and is supported at a plurality of points on the arc of each curve in which the shape is bent.

The invention further consists in providing the series of sets of straightening rollers having the opposing sets of rollers arranged to straighten successive bars or other shapes which vary slightly in size without crushing or distorting the bars of the larger sizes.

The invention still further consists in providing means for adjusting the rollers with relation to one another and means for adjusting the opposing sets of rollers and also in improved means for driving the multiple rollers by which at least one of the rollers of each set is positively driven while in any of its adjusted positions.

Referring to the accompanying drawings forming part of the specification, Figure 1 is a side elevation showing one form of apparatus constructed and arranged in accordance with my invention; Fig. 2 is a top plan of the same; Fig. 3 is an end elevation of the apparatus shown in Figs. 1 and 2; Fig. 4 is a sectional side elevation on the line IV—IV of Fig. 2 showing the arrangement of the spur driving gears and the idler gears; Fig. 5 is a perspective view showing a detail of the adjustable guides forming part of the apparatus; Fig. 6 is a diagrammatic side elevation showing the sets of rollers as adjusted with relation to each other in accordance with my invention, a flat bar being shown in its position between the rollers while being straightened.

In the drawings the numeral 2 designates the housings of the straightening machine in which the rollers 3^a, 3^b and 3^c forming one multiple set are adjustably secured, the shafts of these rollers being carried in suitable bearings 4 which are movably mounted in the windows of the housings 2, and preferably the rollers are overhung as shown in the drawings.

4^a, 4^b and 4^c represent the rollers forming one of the lower series or sets of multiple rollers and 5^a, 5^b and 5^c represent the multiple rollers forming another set of the lower series of multiple rollers.

By reference to Fig. 1 it will be seen that two single rollers 6 and 7 of the upper series of rollers are mounted in their windows in the housings in the same manner as the rollers 3^a, 3^b and 3^c and that single rollers

8 and 9 of the lower series of rollers are provided to support the outer end portions of the bars while being operated upon.

Adjustably secured to one of the housings 2 are the guides 10 which serve to hold and guide the bar or other shape 11 during its passage between the sets of rollers of the straightening apparatus. The rollers 6, 7, 8 and 9 are secured respectively on the ends of the shafts 6^a, 7^a, 8^a and 9^a. The rollers 3^a, 3^b and 3^c forming one multiple set are secured respectively on the shafts 3^d, 3^e and 3^f. The multiple set of rollers 4^a, 4^b and 4^c are secured respectively to the shafts 4^d, 4^e and 4^f while the rollers 5^a, 5^b and 5^c forming one of the lower sets of multiple rollers are secured respectively on the shafts 3^d, 3^e and 5^f. Each shaft of the rollers in the upper series is journaled in bearing blocks or boxes 4 which are vertically adjustable in the windows of the housings 2. Projecting vertically into the screw threaded openings in the top of each of these blocks is the threaded end of a screw shaft 13. The upper ends of the screws 13 are journaled in a continuous housing cap or cap bar 14, which extends longitudinally over the top of each of the housings so as to close the top of the windows in the housing. Instead of having the continuous cap bar as shown, a separate cap for each window may be used when so desired. Mounted on the upper end of each of these screw shafts 13 is a sprocket wheel 15, the wheels on the opposite housings being connected by sprocket chains 16 so as to cause the screw shaft 13 in the journal box 4 on one end of each shaft to rotate with the screw shaft in the journal box 4 on the opposite end of the same shaft. The upper end of each of the screw shafts 13 on one housing of the apparatus is provided with a hand wheel 17 by which the rollers are adjusted vertically by the operation. Each shaft 13 not provided with a hand wheel, is provided with a squared portion 18 by which it can be adjusted independently, the sprocket chains 16 being disconnected at such time.

The shafts of the central rollers 4^b, 5^b in the lower series of sets of rollers are also provided with journal boxes 19 supported so as to be adjustable in the windows of the housing in which they are mounted in the same manner as those for the upper series of rollers. Preferably the rollers 8 and 9 and the rollers 4^a, 4^c, 5^a and 5^c are journaled in the same horizontal plane. The horizontal axis of the central roller 4^b and 5^b in each of the two lower sets of multiple rollers is slightly above the plane of the axes of the other rollers in these sets. The rollers 6 and 7, 3^a and 3^c of the upper series of rollers are in approximately the same horizontal plane, while the axis of the central roller 3^b of the upper set or sets of multiple rollers is adjusted slightly below the horizontal plane of the axes of the other rollers in this set or sets.

By slightly advancing the central roller of each of the sets of rollers toward the opposing sets of rollers, the bar is caused to be curved in a long sweep while passing through the rollers and in reversely opposite directions. As shown in the drawings, the material is passed through these rollers from right to left while being straightened and is first curved upwardly and then downwardly and then again upwardly in long sweeping reverse curves. Preferably the sweep of the curves gradually diminishes toward the exit end of the machine and the bars run out straight from the last set of rollers. Each roller in each series contacts with the metal being straightened and the metal is supported at a plurality of points on the curved surface of the bar contacting with each series of multiple rollers. By subjecting the metal to bending in alternately opposite directions, kinks and other irregularities present in the metal after the completion of the rolling operation are removed and the material will be delivered in a straightened condition while the surface of the metal shapes will not be cracked or otherwise damaged.

Secured on the shaft 20 which is mounted in suitable bearings on the housings 2 is a driving pulley 21 which is connected by a belt with any suitable prime mover. The shaft 20 is provided with a spur gear 22 which meshes with spur gears 23 and 23^a located on the shafts 4^f and 5^d. Also mounted in suitable bearings in the housings 2 are the shafts 24, 25, 26, and 27, each having an idler gear 24^a, 25^a, 26^a and 27^a. The shafts 8^a and 9^a are also provided with driving gears 8^b and 9^b while the shafts 4^d and 5^f have spur gears 28 and 29.

Pivotally mounted between the housings 2 by one end on shafts 4^d, 4^f, 5^d and 5^f are the pair of knees or bent arms 30 one of these arms being on each side of the idler pinions employed to transmit motion from the bottom rollers to the top series of rollers. The upper ends of the bent arms 30 are pivotally connected by the pins or shafts 31 to one end of the links 32, the opposite ends of the links 32 being pivoted to the shafts 3^d, 3^f, 6^a or 7^a for the upper series of rollers.

Mounted on the shafts 4^d, 4^f, 5^d and 5^f are the spur driving pinions 33 which mesh with and drive the idler pinions 34 on the pins 34^a. The pinions 34 also mesh with and drive the idler pinions 35 on the shafts 31, the pinions 35 also meshing with the driving spur pinions 36 on the shafts 3^d, 3^f, 6^a and 7^a for the top series of rollers.

By reference to Fig. 4 it will be seen that the pulley shaft 20 is provided with a spur gear 22 which is in mesh with similar spur

gears 23 and 23^a on the shafts 4^f and 5^d. The spur gears 23 and 23^a in turn mesh with idler gears 24^a and 26^a, which are also in mesh with spur gears 28 and 29 on the shaft 4^d and 5^f. The gears 28 and 29 also mesh with idler gears 25^a and 27^a, which in turn mesh with and drive the spur gears 8^b and 9^b which are mounted on the shafts 8^a and 9^a for the rollers 8 and 9. Also mounted on the shafts 4^d, 4^f, 5^d and 5^f are the spur gears 33, each of which meshes with an idler gear 34 on the bent arms 30. The idler gears 34 also mesh with idler gears 35 which are also mounted on the bent arms 30 and the gears 35 also mesh with driving spur gears 36 which are mounted on the shafts 3^d, 3^f, 6^a and 7^a for the rollers 3^a, 3^c, 6 and 7. This arrangement of gearing permits of the upper rollers 6, 3^a, 3^c and 7 being positively driven in the opposite direction to the lower rollers 8, 4^a, 4^c, 5^a, 5^c and 9.

By means of the idler gearing on their respective arms the rollers on the driving shafts of the upper series are arranged so as to be adjustable vertically toward and away from the lower series of sets of rollers without disengaging the gears, the gearing always being in mesh in all positions of these rollers.

It will be readily understood from the foregoing description that at least part of the rollers in each series are positively driven in the right direction to feed the shafts being straightened through the passes formed by the grooves in the opposing rollers.

The advantages of my invention result from the provision of staggered multiple sets of rollers in which one set of multiple rollers is adjustable with relation to the others and in which at least one roller of each set is adjustable toward and away from the shape being straightened independently of the other rollers in the same multiple set, so that the shape may pass through the rollers in a long sweeping curve and by which the rollers are arranged to contact at a plurality of points on the opposite sides of the reverse curves formed on the shape during the straightening operation.

Obviously, should it be necessary to straighten a shape in two directions, the material can be straightened in one direction and then passed through the straightening machine and be straightened on the opposite sides of the shape to those straightened by the first operation.

Modifications in the construction and arrangement of the apparatus may be made without departing from my invention. Instead of the grooved rollers shown, the contour of the grooves may be changed to suit the cross-section of the shape to be straightened. Instead of having the sets of bars adjustable with relation to each other the middle roller may vary in size from the others in the same set, in this way making the desired bend in the bar. The apparatus is applicable to other uses than straightening the bar of rectangular cross-section shown in the drawings, as for instance to flanged shapes including T-head rails, angles, I-beams and channels, and other changes may be made within the scope of the appended claims.

I claim:

1. Apparatus for straightening metal bars and the like comprising a series of sets of rollers, each set staggered with respect to the other sets, one roller of each set being adjustable relatively to the others in the same set, and means for rotating said rollers.

2. Apparatus for straightening metal bars and the like comprising a series of sets of rollers, each set staggered with respect to the other sets, one roller of each set being adjustable relatively to the others in the same set, and means for rotating at least part of said rollers.

3. Apparatus for straightening metal bars and the like comprising a series of sets of rollers, each set staggered with respect to the other sets, one set of rollers being adjustable toward the opposite set, one roller of each set being adjustable relatively to the others in the same set, and means for rotating at least one roller in each set.

4. Apparatus for straightening metal bars and the like comprising a series of sets of rollers, each set staggered with respect to the other sets, one set of rollers being adjustable toward the opposite set, one roller of each set being adjustable relatively to the others in the same set, and means for rotating said rollers.

5. Apparatus for straightening metal bars and the like comprising a series of sets of rollers, each set staggered with respect to the other sets, one roller of each set being adjustable relatively to the others in the same set, and intermeshing spur gearing for driving the rollers.

6. Apparatus for straightening metal bars and the like comprising a series of sets of rollers, each set staggered with respect to the other sets, the staggered sets engaging opposite sides of the shape being straightened, and means for rotating the rollers.

7. Apparatus for straightening metal bars and the like comprising a series of sets of rollers engaging one side of the materials being straightened, a set of rollers on the opposite side of the materials and intermediate the adjacent opposing sets of rollers engaging with the opposite side of the materials, and means for rotating at least part of said rollers.

8. Apparatus for straightening metal bars and the like comprising a set of at

least two rollers engaging one side of the materials being straightened, and a plurality of sets of rollers engaging with the opposite side of the materials, the set of rollers engaging with the one side of the materials being between the sets of rollers on the opposite side thereof, at least one roller in each set of rollers being adjustable relatively to the others in the same set, and means for rotating the rollers.

9. In apparatus for straightening metal bars and the like, the combination with a set of rollers engaging with one side of the materials being straightened, of two sets of opposing rollers engaging the opposite side thereof, the set of rollers on one side being intermediate the opposing sets on the opposite side of the materials.

10. In apparatus for straightening metal bars and the like, the combination with a set of rollers engaging with one side of the materials being straightened, of a plurality of sets of opposing rollers engaging the opposite side of the materials, the set of rollers on one side of the materials being intermediate the opposing sets of rollers on the opposite side thereof, and means for adjusting the rollers on one side toward and away from those on the opposite side of the materials.

11. Apparatus for straightening metal bars and the like comprising a series of sets of rollers, each set staggered with respect to the other sets, the adjacent sets engaging opposite sides of the materials being straightened, the rollers in one set being arranged to contact with the materials at a plurality of points between the end rollers of the adjoining sets on the opposite sides of the materials, and means for rotating at least part of said rollers.

12. Apparatus for straightening metal bars and the like comprising a series of sets of rollers engaging opposite sides of the materials being straightened, each set being staggered with respect to the other sets, the rollers in each set being arranged to contact with the materials at a plurality of points between the end rollers of the adjoining sets on the opposite side of the materials being straightened.

13. Apparatus for straightening metal bars and the like comprising a series of sets of rollers, a plurality of rollers in at least part of the sets, and the sets of rollers being disposed successively in staggered relation on opposite sides of the pass formed between the rollers.

14. Apparatus for straightening metal bars and the like comprising a plurality of sets of rollers, the sets being disposed successively in staggered relation on opposite sides of the pass formed between the rollers and the points of contact on the rollers of each set being disposed in the arc of a circle.

15. Apparatus for straightening metal bars and the like comprising a plurality of sets of rollers, the sets being disposed successively in staggered relation on opposite sides of the pass formed between the rollers, and the peripheral points of contact on at least one set of rollers being disposed in the arc of a circle.

16. Apparatus for straightening metal bars and the like comprising a series of sets of rollers, each set staggered with respect to the other sets, at least one set of rollers being adjustable toward the opposite set, one roller of each set being adjustable relatively to the others in the same set, and means for positively rotating at least part of said rollers.

In testimony whereof, I have hereunto set my hand.

ISAAC LAMONT HUGHES.

Witnesses:
H. G. R. BENNETT,
RAY MCLAUGHLIN.