Aug. 4, 1936. R. E. BROCK ET AL 2,049,992

PIPE STRAIGHTENING MACHINE

Filed Dec. 18, 1933 3 Sheets-Sheet 1

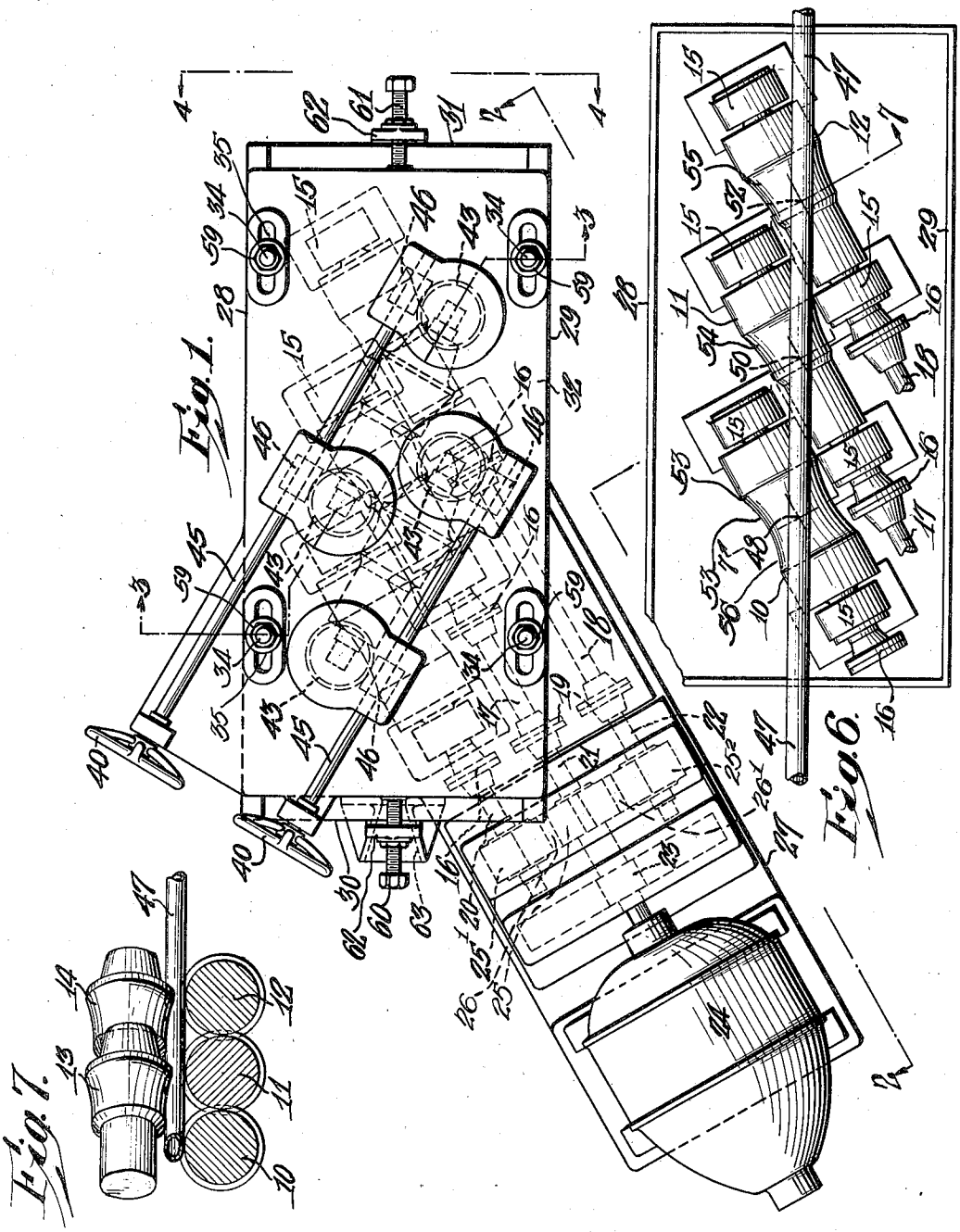


Fig. 1.

Fig. 6.

Fig. 7.

Witnesses:
Elmer W. Hackett
Walter Chism

Inventors
Richard Ewan Brock
and Edward T. Peterson
by Wm. Stuart Jackson and Son
Attorneys.

Aug. 4, 1936. R. E. BROCK ET AL 2,049,992

PIPE STRAIGHTENING MACHINE

Filed Dec. 18, 1933 3 Sheets-Sheet 2

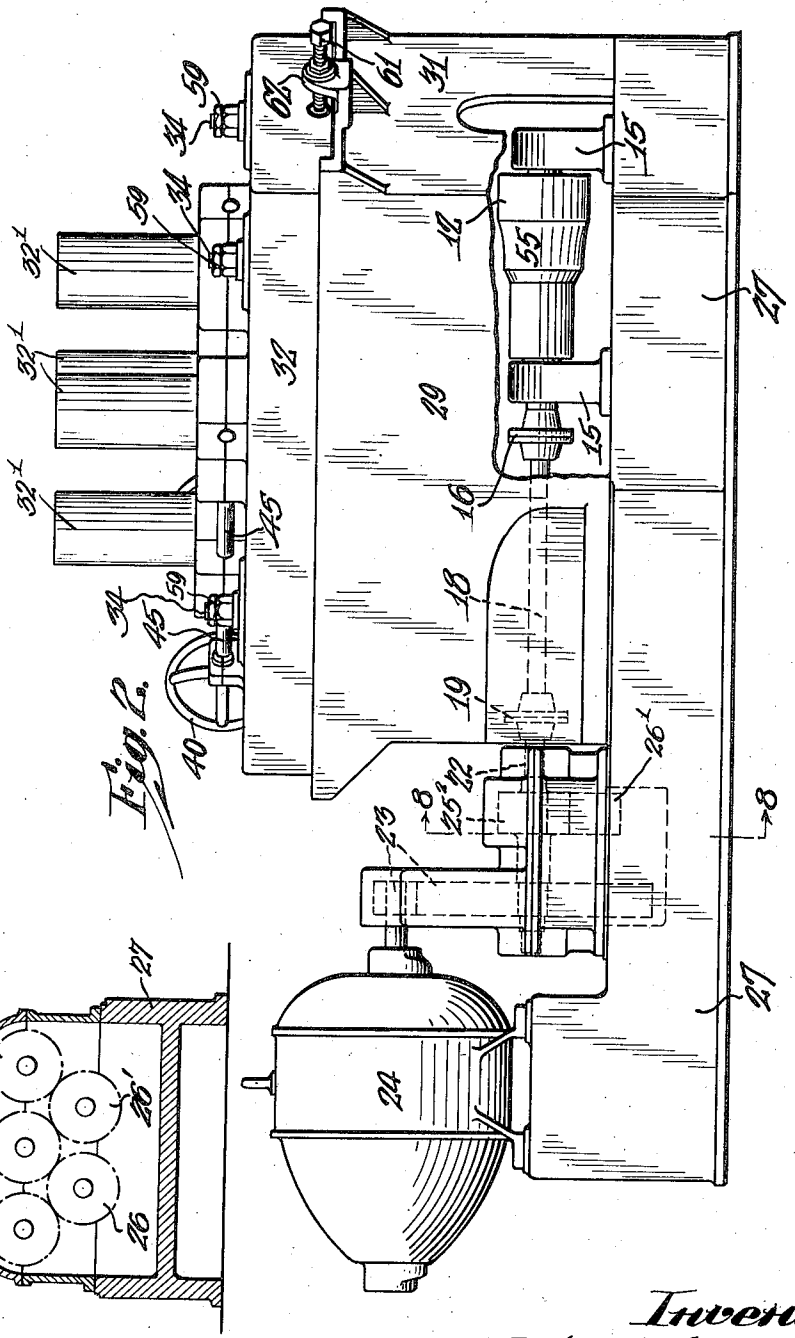


Fig. 2.

Fig. 8.

Witnesses:
Elmer W. Spacker
Walter Chisam

Inventors
Richard Egan Brock
and Edward T. Peterson,
by Burton Stull Gibson and Son
Attorneys.

Aug. 4, 1936. R. E. BROCK ET AL 2,049,992

PIPE STRAIGHTENING MACHINE

Filed Dec. 18, 1933 3 Sheets-Sheet 3

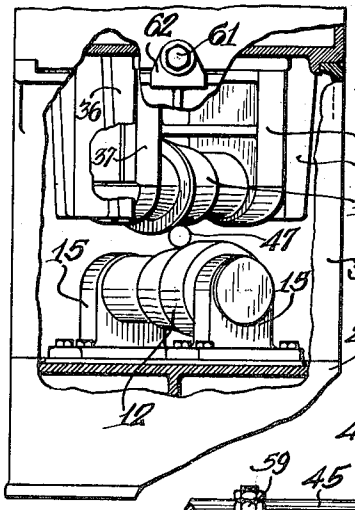


Fig. 4.

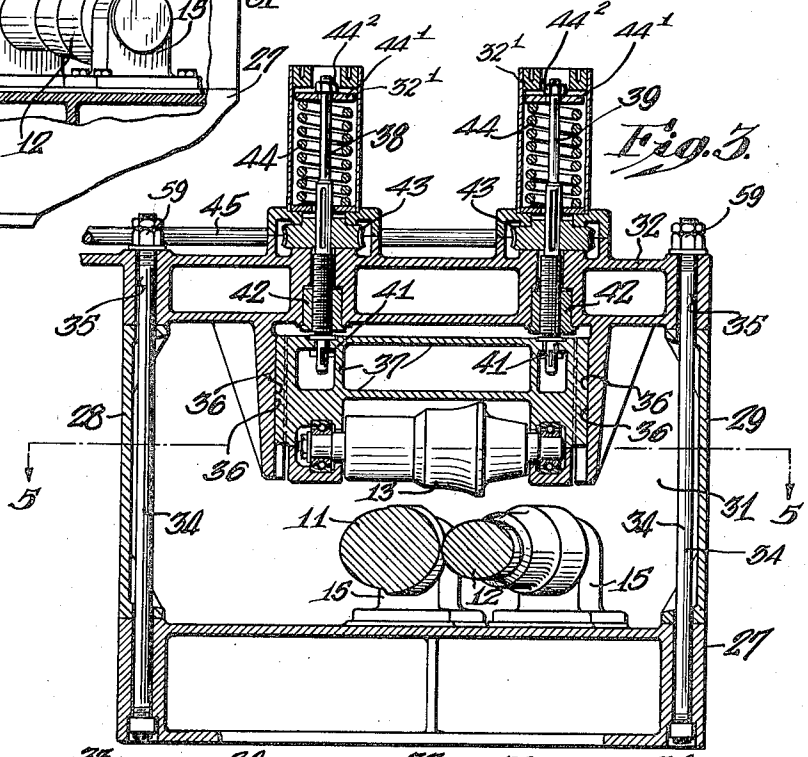


Fig. 3.

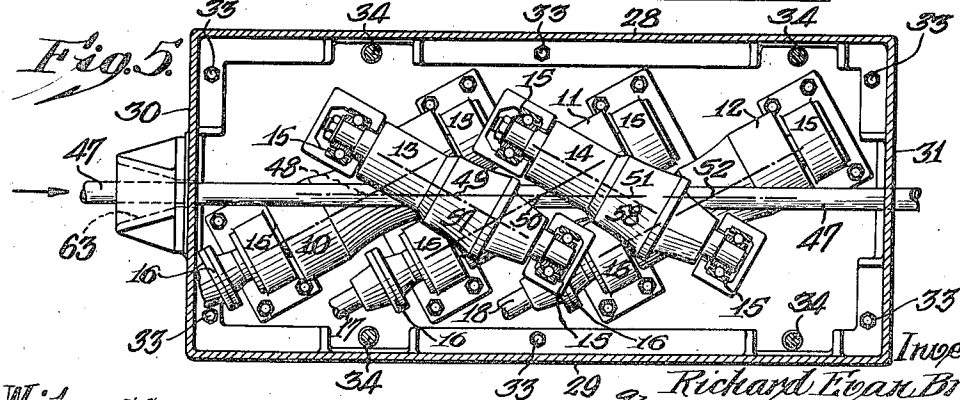


Fig. 5.

Witnesses:
Elmer W. Hoeke
Walter Chism

Inventors
Richard E. van Brock
and Edward T. Peterson.
by Wm. Scott Jelen
Attorneys.

Patented Aug. 4, 1936 2,049,992

UNITED STATES PATENT OFFICE

2,049,992

PIPE STRAIGHTENING MACHINE

Richard Evan Brock, Tarentum, and Edward T. Peterson, Reading, Pa.

Application December 18, 1933, Serial No. 702,854

20 Claims. (Cl. 153—60)

The present invention relates to a machine for straightening pipe, as well as for straightening solid and hollow rods, shafting and the like, all of which are called herein conventionally "pipe". The invention relates to that type of machine in which the pipe to be straightened is passed between relatively oblique rolls.

A purpose of the invention is to provide a pipe straightening machine of the character indicated adapted to easy and inexpensive manufacture and well suited to the needs of service.

A further purpose is to offset longitudinally cooperating relatively oblique rolls that operate in parallel planes on opposite sides of a pipe.

A further purpose is to provide a machine of the character indicated with two sets of cooperating rolls in which the rolls of each set are preferably parallel, preferably horizontal, usually preferably near together and successively offset longitudinally with respect to the rolls of the other set, and in which the sets of rolls operate in parallel planes on opposite sides of the pipe to be straightened.

A further purpose is to make a machine of the character indicated well adapted to take out short local bends. One set of rolls, normally the upper set, is made adjustable in the direction of the pipe travel, thereby permitting easy adjustment in the longitudinal distance between the point or points of pipe engagement of one roll of one set and the point or points of pipe engagement of the next roll of the other set.

A further purpose is to provide rolls of a desirable and novel form that will insure an easy guiding of the pipe to the proper path between the rolls and permit a variantly adjustable spacing between the point or points of pipe engagement of cooperative rolls on opposite sides of the pipe. We preferably shape the first roll both rearwardly and forwardly like a bell to limit any lateral movements of the approaching pipes from their correct paths, and preferably bell-shape the forward ends only of the succeeding rolls, using successive bell shaping on the lower rolls to keep the pipes from sliding laterally to one side and successive bell shaping on the upper rolls to prevent the pipes from sliding laterally to the other side.

Further purposes will appear in the specification and in the claims.

It has been elected to show one only of the different forms of the invention, selecting a form however that is practical and efficient in operation and which well illustrates the principles involved.

Figure 1 is a top plan view of a machine embodying a desirable form of the invention.

Figure 2 is an elevation of Figure 1 taken upon the line 2—2 thereof, and with the casing broken to show one of the bottom rolls.

Figure 3 is an irregular vertical section taken upon the line 3—3 of Figure 1.

Figure 4 is a fragmentary elevation from the line 4—4 of Figure 1, and with an end plate broken away to show the straightening rolls.

Figure 5 is a fragmentary section taken on the line 5—5 of Figure 3.

Figure 6 is a sectional plan view corresponding generally to Figure 5, but omitting the upper rolls and some of the structure seen in the latter figure.

Figure 7 is a fragmentary vertical zig-zag section, taken upon the line 7—7 of Figure 6, and also showing upper roll structure omitted in Figure 6.

Figure 8 is a somewhat diagrammatic section on the line 8—8 of Figure 2, illustrating the intergearing of the lower rolls.

Like numerals refer to like parts in all figures.

In the manufacture of various metal objects having round sections such as pipe, rod and shafting, either solid or hollow, it is necessary to perform a straightening operation to remove kinks, bends and irregularities. Our invention relates to a machine for performing straightening operations on metal objects of round sections.

Describing in illustration and not in limitation, and referring to the drawings:

In the illustrated embodiment of the invention the straightener rolls are in two sets that are preferably horizontal, the rolls of each set (where the set comprises more than a single roll) being relatively longitudinally offset, preferably parallel to one another and oblique to the roll or rolls of the other set, with the roll or rolls of the upper set adjustably intermediate the rolls of the lower set. One set, preferably the lower set, should include at least two rolls, and the other set either one less roll or the same number of rolls as the first set.

Suitably the lower set comprises three rolls 10, 11 and 12 and the upper set two rolls, 13 and 14. These points all lie substantially in a plane extending vertically through the pipe axis. Points 48, 50 and 52 also lie in one plane, while points 49 and 51 lie in a substantially parallel plane, both planes being parallel to the pipe axis.

The lower rolls turn in stationary bearings 15 and connect through couplings 16 with power application means. In the case of the rolls 11 and 12, the couplings 16 connect to shaft extensions

17 and 18, which in turn connect to the couplings 19. The coupling 16 on roll 10 makes connection to a shaft 20 and the couplings 19 operating rolls 11 and 12 are respectively connected to shafts 21 and 22. The middle shaft 21 is driven through reduction gearing 23 by a motor 24 and the outer shafts 20 and 22 are driven from and in the same direction as the middle shaft by the gear 25 on the middle shaft which meshes with gears 26 and 26' on stub shafts, the latter gears engaging driven gears 25' and 25^2 for the side rolls 10 and 12.

The supporting structure includes a stationary bed 27, stationary sides 28 and 29, stationary ends 30 and 31 and a stationary but horizontally adjustable top 32.

The sides and ends are held to the bed by steel bolts 33 and tension posts or bars 34, the latter members extending up through slots 35 of the top member 32.

The top structure 32 includes vertical slideways 36 for carriages or bearing structures 37 of the individual upper rolls which are vertically positioned by shafts 38 and 39 through adjustment wheels 40.

The shafts 38 and 39 have swivel connections at 41 with the bearing structures, thread through non-rotatable nuts 42, have longitudinally slidable (splined) connection with worm gears 43 and are strongly pressed upwardly by heavy springs 44, preferably the whole weight or nearly the whole weight of the upper rolls and their bearing structures being carried by the springs 44, thereby avoiding excessive friction between the shafts 38 and 39 and their non-rotatable nuts 42 and avoiding any need for strongly supporting the nuts from moving downwardly under the weight of the upper roll structure. The springs 44 press against washers 44' held by nuts 42^2 on the shafts 38 and 39. The springs are covered by caps 32'.

The adjustment wheels 40 are on horizontal shafts 45 that are mounted in suitable bearings and carry worms 46 in mesh with the worm gears 43.

The pipe 47 will usually pass between the rolls horizontally along a line bisecting the angles between the upper and lower rolls (see Figure 5), the points of engagement between the pipe and rolls being usually at substantially cylindrical portions of the individual rolls that in the plan view of Figure 5 will be at 48, 49, 50, 51 and 52 at the intersections of the pipe axis with axes of the respective rolls.

While, except with one size of pipe, the largest that the rolls may ordinarily handle, there will be a small freedom for lateral movement at each roll, the bell shaping of the lower rolls at 53, 54 and 55, respectively, closely limits any such movement toward the side 28 of the frame structure, and the bell shaping on the initial lower roll at 56 and the bell shaping on the upper rolls at 57 and 58 correspondingly closely limit any movement of the pipe 47 toward the side 29.

The pipe 47 is thus supported at intervals directly underneath and at other intermediate intervals directly above with usually a very small freedom of lateral play toward the side members 28 and 29, and the straightening of the pipe is due to the simultaneous rotation and longitudinal progression of the pipe between these upper and lower supporting surfaces.

It is found that the best positions for the upper supporting surfaces at 49 and 51 with respect to the lower supporting surfaces at 48, 50 and 52 is variant according to the character of the pipe bends and size of pipe; that usually with the smaller sizes of pipe and shorter bends the straightening action is more perfect when the supporting surfaces presented downwardly at 49 and 51 by the upper rolls have been shifted longitudinally of the pipe travel to positions for example relatively more close to the surfaces presented upwardly at 48 and 50 by the lower rolls, a condition obtained by horizontally shifting the upper rolls in the direction of the pipe travel.

In practice the same pipe having different characters of bends throughout its length may be sent through the machine with the upper rolls at one longitudinal setting, and again through the machine with the upper rolls at a different longitudinal setting, the result being a more perfect straightening of the bends than would be the case if the longitudinal setting of the upper rolls were not changed. This is not, however, generally necessary.

As illustrated, the top 32 carrying the upper rolls is shifted in the direction of pipe travel from one setting to any other, after suitably loosening the nuts 59 on the tension posts or rods 34, by means of adjusting screws 60 and 61 in upwardly projecting brackets 62 on opposite ends of the frame structure.

In operation, assuming the rolls first suitably set vertically and horizontally, the pipe 47 is pushed into the machine at the mouth 63, which guides the pipe into the space between the rolls where it is engaged below and above respectively by the lower and upper rolls.

The lower rolls, continuously rotating, strongly press the pipe against the first upper roll 13 as soon as the forward end of the pipe reaches the second lower roll. The upwardly directed surfaces at 48 and 50 of the lower rolls then press the pipe strongly against the downwardly directed surface at 49 of the first upper roll, and the pipe moves ahead rotating the upper rolls responsive to the drive of the lower rolls.

The rotation of the lower rolls progresses the pipe longitudinally through the rolls, at the same time straightening the pipe.

Unusual bends may require momentary or temporary adjustments in the vertical or/and in the horizontal position of the upper rolls and such bends in a pipe may make it desirable to send the pipe through the rolls more than once, with or without suitable vertical or/and horizontal adjustment or adjustments in the positions of the upper rolls between each time the pipe goes through the rolls.

It will be understood that any or all of the rolls may be bell shaped at both ends, or all of the rolls may be bell shaped at one end only. More usually however there will be little advantage in bell shaping nearly adjacent ends of upper and lower rolls. Thus in Figure 5 the lower and upper rolls 10 and 13 present nearly adjacent ends on the side of the pipe laterally toward the frame structure 29 and while one or other of these ends should be bell shaped, there will usually be little need for bell shaping both, so that bell shaping the end of the roll 13 toward the side 29 will eliminate or greatly reduce any need for bell shaping the end of the roll 10 toward the side 29.

It will thus be evident that all of the lower rolls might be bell shaped at both ends, in which event the need for any bell shaping on the upper rolls would be greatly reduced, or, if the two upper rolls were bell shaped at both ends, the middle lower roll 11 could be free from bell shaping

at both ends and the first roll 10 free from bell shaping at its forward end.

It will thus be seen that the important feature, intended to be illustrated conventionally in Figure 5, is that of a succession of bell shaped portions spaced along and vertically overlapping opposite sides of the pipe to limit closely any lateral movements of the pipes entering between the rolls, and that these bell shaped portions may be selectively on different rolls.

It will be evident that the axes of the lower rolls lie in the same plane and the axes of the upper rolls lie in another plane parallel to the first.

For convenience in designating the end of a roll which is bell shaped, we, in some cases, refer to the end of the roll farthest from the mouth 63 as the forward end of the roll, and the end of the roll nearest to the mouth 63 as the rearward end of the roll, using forward and rearward in relation to the direction of travel of the pipe.

It should be noted that the upper rolls are provided with separate vertical adjustments, so that, in some cases, the respective upper rolls may be at slightly different spacings from the plane of the axes of the lower rolls. In any case, in spite of such slight differences in the vertical positions of the upper rolls, the plane of the axes of the lower rolls will be generally parallel to the plane of the axes of the upper rolls. In many instances, the vertical positions of the two (or more) upper rolls will be the same.

The placement of each upper roll opposite a point between two lower rolls assists in bending action, and the radius of bend may be determined by adjustment of the distance between the point of engagement of a lower roll with the pipe and the point of engagement of the next upper roll with the pipe.

The upper rolls may or may not be driven, but it is not necessary to drive them.

It will be noted that the lower rolls not only feed the pipe through the rolls longitudinally, but also rotate the pipe as it moves longitudinally, thus greatly assisting in taking out bends. The upper rolls turn because of the longitudinal motion of the pipe and also because of the rotation of the pipe, thus assisting in removing bends. Wherever the pipe is in contact with a roll, whether an upper or a lower roll, it is free from contact on its opposite (lower or upper) side, and is drawn longitudinally across the roll under consideration and rotated upon that roll, while being held against lateral movement by other rolls. This composite motion produces straightening in a more effective manner than prior art devices of which we have knowledge.

In view of our invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain part or all of the benefits of our invention without copying the structure shown, and we, therefore, claim all such in so far as they fall within the reasonable spirit and scope of our invention.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In pipe-straightening mechanism, a plurality of first rolls having their axes oblique to the pipe in one plane parallel to the pipe and bell shaped toward one side of the pipe, each first roll longitudinally overlapping another first roll, and a second roll longitudinally obliquely across overlapping portions of first rolls and in a plane parallel to the first plane, the second roll bell shaped toward the other side of the pipe, oblique to the first rolls, the relatively oblique rolls presenting at points spaced longitudinally of the pipe cooperating surfaces to opposite sides of pipe travelling through between the first and second rolls.

2. In pipe-straightening mechanism, a plurality of first rolls having their axes oblique to the pipe in one plane parallel to the pipe and bell shaped toward one side of the pipe, each first roll longitudinally overlapping another first roll, one of said first rolls being bell shaped toward both sides of the pipe and a second roll longitudinally obliquely across overlapping portions of first rolls and in a plane parallel to the first plane, the second roll bell shaped toward the other side of the pipe, and said relatively oblique rolls presenting cooperating concaved surfaces to opposite sides of pipe travelling through between the rolls.

3. In pipe-straightening mechanism, a plurality of first rolls having their axes oblique to the pipe in one plane parallel to the pipe and bell shaped toward one side of the pipe, each first roll longitudinally overlapping another first roll, a second roll longitudinally obliquely across overlapping portions of first rolls and in a plane parallel to the first plane, the second roll bell shaped toward the other side of the pipe, and means for relatively moving the second roll toward and away from the plane of the axes of the first rolls.

4. In pipe-straightening mechanism, a plurality of first rolls having their axes oblique to the pipe in one plane parallel to the pipe, each first roll longitudinally overlapping another first roll, a second roll longitudinally obliquely across overlapping portions of first rolls and in a plane parallel to the first plane and means for moving the second roll relatively to the first rolls in a direction substantially longitudinal of the pipe travel between the rolls.

5. In pipe-straightening mechanism, a plurality of rolls in two sets, the axes of the rolls of the respective sets lying in planes generally parallel to and spaced from one another and the rolls of one set being oblique to and placed opposite points between rolls of the other set and common means for relatively moving the rolls of one set with respect to those of the other set longitudinally of the pipe.

6. In pipe-straightening mechanism, a set of lower rolls mounted to present pipe engagement surfaces at spaced points of one side of the pipe at a plane axial of the pipe, said lower rolls bell shaped on one side of the pipe, a set of upper rolls mounted oblique to the first to present pipe-engagement surfaces at spread points of the other side of the pipe intermediate the first points substantially in the said plane, said upper rolls bell shaped on the other side of the pipe and common means for shifting the rolls of one set with respect to the rolls of the other set to adjustably vary the relative spacings of pipe engagement surfaces of the rolls of one set with respect to the corresponding surfaces of the rolls of the other set.

7. In pipe-straightening mechanism, a plurality of lower rolls axially parallel and bell shaped toward their forward ends, a plurality of upper rolls longitudinally offset and oblique to the lower rolls, bell shaped toward their forward ends, which are on opposite sides of the pipe from the

forward ends of the lower rolls, and axially parallel to one another and the relatively oblique rolls lying in generally parallel planes and presenting cooperating surfaces to opposite sides of a pipe travelling through between the upper and lower rolls, common means for moving the upper rolls longitudinally of the pipe and other means for adjusting the upper rolls individually transversely of the pipe.

8. In pipe-straightening mechanism, a plurality of first rolls having their axes in one plane, parallel to one another, bell shaped toward the forward ends and one of them bell shaped toward both ends, a plurality of second rolls having their axes in a generally parallel plane, parallel to one another, oblique to the first rolls and bell shaped toward their forward ends, which are on opposite sides of the pipe from the forward ends of the first rolls, the relatively oblique rolls presenting cooperating surfaces to opposite sides of a pipe travelling through between the rolls, and engaging the pipe at longitudinally spaced points, means for moving the first and second rolls longitudinally of one another and means, independent of the longitudinally moving means, for moving the planes of the axes of the first and second rolls toward and away from one another.

9. In pipe-straightening mechanism, a plurality of successively longitudinally overlapping first rolls having their axes lying in a plane, said rolls being axially parallel to one another and bell shaped toward the forward ends and a plurality of second rolls having their axes lying in a plane parallel to the first plane, said rolls being axially parallel to one another, longitudinally offset and obliquely overlapping one another and overlapping the relatively overlapping portions of the first rolls and bell shaped toward their forward ends and means for moving the second rolls relatively toward and away from the plane of the axes of the first rolls.

10. In pipe-straightening mechanism, a plurality of lower rolls axially parallel and bell shaped toward one end, a plurality of upper rolls longitudinally offset and oblique with respect to the lower rolls, bell shaped toward an opposite end, the relatively oblique rolls lying in generally parallel planes and presenting cooperating surfaces to opposite sides of a pipe travelling through between the upper and lower rolls, means for adjusting one of the upper rolls relatively toward and away from the lower rolls and separate means for adjusting another upper roll relatively toward and away from the lower rolls.

11. In pipe-straightening mechanism, a plurality of first rolls having their axes in one plane, generally parallel to one another and bell shaped toward one side of the pipe, a plurality of second rolls oblique to the first rolls, carriages one supporting each of the second rolls, guides for each carriage, means for moving each carriage and its roll toward and away from the plane of the axes of the first rolls and separate means for moving the second rolls relatively to the first rolls lengthwise in the direction of travel of the pipe through between the rolls.

12. In pipe-straightening mechanism, a plurality of bell shaped lower rolls, a bell shaped upper roll cooperating with the lower rolls, a carriage carrying bearings rotatably supporting the upper roll, guides permitting vertical adjustment of the carriage, and means for varying the vertical position of the carriage comprising frame structure supporting the guides, vertical rods having swivel supporting connections at their lower ends with the carriage toward opposite ends thereof, nuts threading the rods and having non-rotatable downward supporting connections with the frame structure positively supporting the nuts from upward movements and upward spring supports for the rods resiliently counterweighting the carriage.

13. In pipe-straightening mechanism, two sets of rolls operating in substantially parallel planes on opposite sides of pipe and presenting, as a pipe guide, spaced rows of bell shaped portions to limit lateral movements of the pipe in a direction parallel to the said planes, the rolls of each set being oblique to the pipe and to the rolls of the other set, the pipe-engagement surfaces of three rolls of the one set having aproximately the same relative spacing as that between the pipe-engagement surfaces of two rolls of the other set and the rolls located to present the pipe-engagement surfaces of the rolls of one set along one side of the pipe in substantially staggered relation longitudinally of the pipe to the pipe-engagement surfaces of the rolls of the other set on the other side of the pipe, and means for driving the three rolls of the one set.

14. In pipe-straightening mechanism, two sets of rolls operating in substantially parallel planes on opposite sides of pipe and presenting, as a pipe guide, spaced rows of bell shaped portions to limit lateral movements of the pipe in a direction parallel to the said planes, the rolls of each set being oblique to the pipe and to the rolls of the other set and having the surfaces of pipe-engagement of its rolls staggered along the pipe with respect to the surface of pipe engagement of the rolls of the other set, means for driving the rolls of one set, a common mount for the rolls of the other set and means for adjusting the mount to vary the relative positions of the sets longitudinally of the pipe.

15. In a pipe-straightening machine, a plurality of longitudinally overlapping first rolls oblique to the pipe and positioned on one side thereof to cooperatingly engage the pipe on the said side at spaced points in a plane axial of the pipe and a second roll obliquely across the overlapping portions of the first rolls and positioned on the other side of the pipe to engage the pipe on the other side thereof at a point longitudinally intermediate the first points and substantially in the same axial plane and flare portions on the rolls to limit movements of the pipe in directions lateral to said plane, each of said rolls being free from direct opposition to any other roll on the other side of the pipe, leaving the pipe free to bend laterally at each of the rolls and transversely to the pipe axis.

16. In a pipe-straightening machine, laterally and longitudinally spaced first rolls oblique to the pipe and positioned on one side thereof to cooperatingly engage the pipe on the said side at spaced points thereof in a plane axial of the pipe, bearings for the first rolls, one bearing of one first roll overlapping and laterally adjacent the service portion of an other first roll, and a second roll oblique to the first rolls and to the pipe and positioned on the other side thereof to engage the pipe on the said other side intermediate the spaced first points of concurrent engagement of the pipe by the first rolls and substantially in the same plane axial of the pipe, each of said rolls being free from direct opposition to any other roll on the other side of the pipe, the pipe being free to bend laterally at

each of the rolls away from the roll and transversely to the pipe axis.

17. In a pipe-straightening machine, three laterally and longitudinally spaced driver rolls oblique to the pipe on one side thereof to concurrently engage spaced points of the pipe at a common plane axial of the pipe, bearings for the rolls, the bearings of the second roll respectively laterally adjacent overlapped portions of the first and third rolls and one bearing of the first roll and one bearing of the third roll laterally adjacent respective overlapped portions of the intermediate second roll, longitudinally and laterally spaced fourth and fifth rolls oblique to the three rolls, oblique to the pipe and located to cooperatingly concurrently engage the pipe on the other side thereof at points thereof at the said common axial plane and flare portions on the rolls to limit lateral movement of the pipe with respect to the said common plane.

18. In pipe straightening mechanism, a plurality of bell-shaped lower rolls, a plurality of bell-shaped upper rolls cooperating with the lower rolls, carriages, one for each upper roll providing bearing support thereof, a guide for each carriage permittng upward and downward movements thereof, frame structure supporting the guides, and means for each carriage providing the weight thereof with spring support and the carriage with a positive downward adjustment against the upward spring retraction.

19. In pipe-straightening mechanism, a plurality of first rolls having their axes oblique to the pipe and generally parallel to present pipe-engagement surfaces at spaced points of concurrently the same side of the pipe, a plurality of second rolls oblique to the pipe and oblique to the first rolls to present pipe-engagement surfaces concurrently to the other side of the pipe at spaced points thereof staggered longitudinally of the pipe with respect to the first points, carriages, each providing bearing support for one of the second rolls, guides for the carriages, means for moving each carriage toward and away from the pipe, a common mount for the guides and thereby of the carriages and their respective second rolls, and means for adjusting the mount longitudinally of the pipe.

20. In pipe-straightening mechanism, three successively overlapping first-set rolls longitudinally oblique to the pipe travel to present pipe-engagement surfaces at spaced points of concurrently the same side of the pipe, two second-set rolls on the other side of the pipe, oblique to the pipe and to the three first-set rolls to present their engagement surfaces concurrently to the opposite side of the pipe at points thereof one intermediate the overlap portions of the middle and one outer first-set roll and the other intermediate the overlap portions of the middle and other outer first-set roll, and means for adjusting the second-set rolls toward and away from the pipe.

RICHARD EVAN BROCK
EDWARD T. PETERSON.