May 29, 1934. E. H. WILSON 1,960,884

WORK CLAMPING MECHANISM FOR ANGLE MILLING MACHINES

Filed Nov. 15, 1930 3 Sheets-Sheet 1

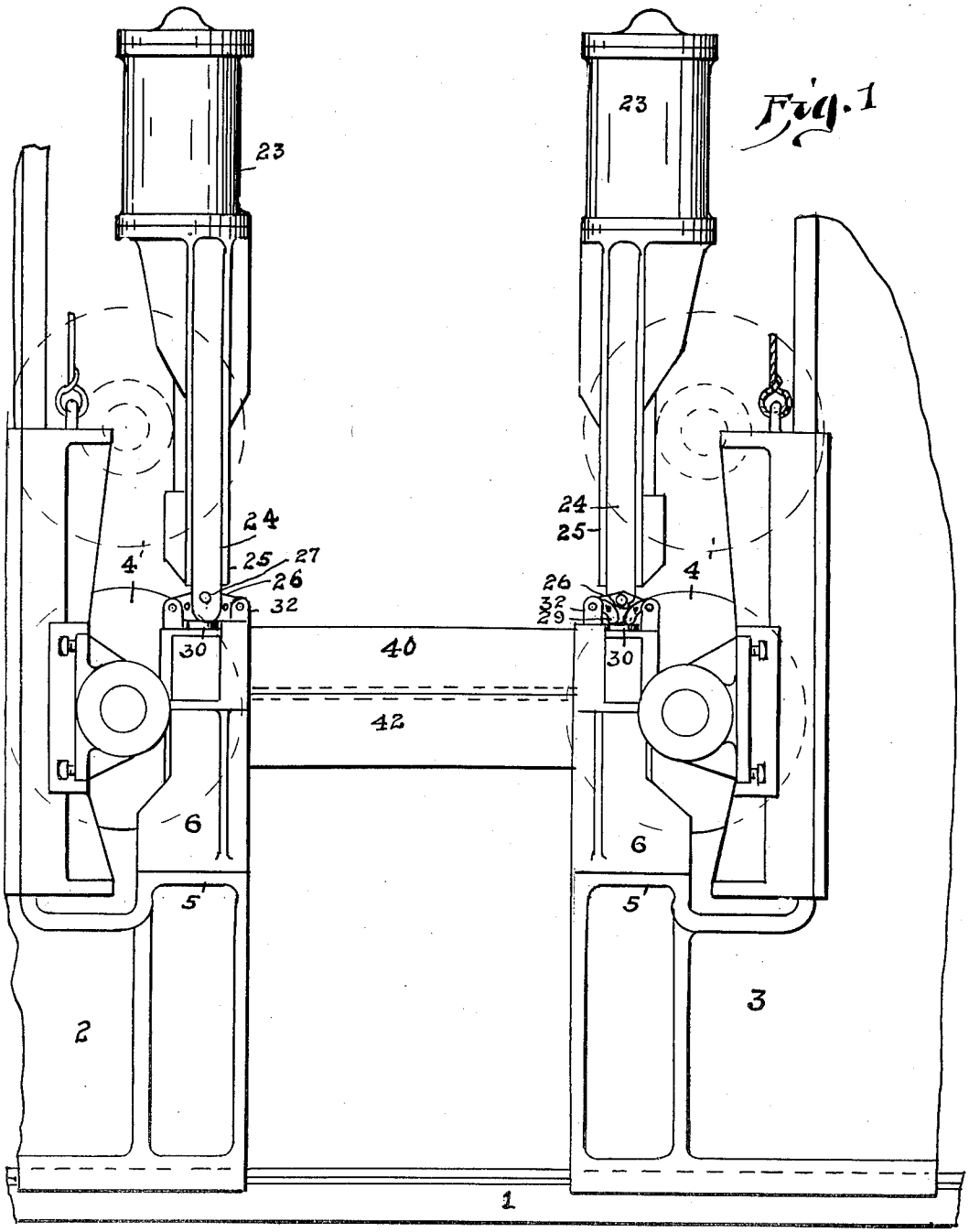


Fig. 1

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Fig. 2

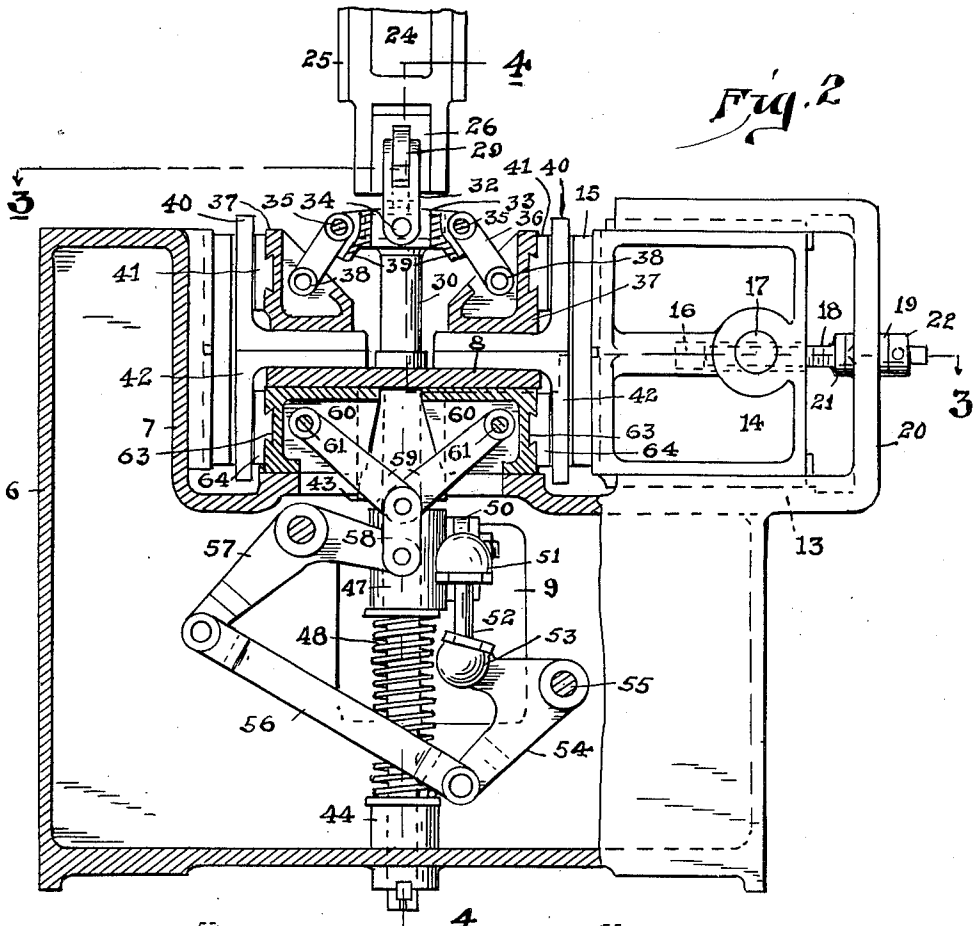
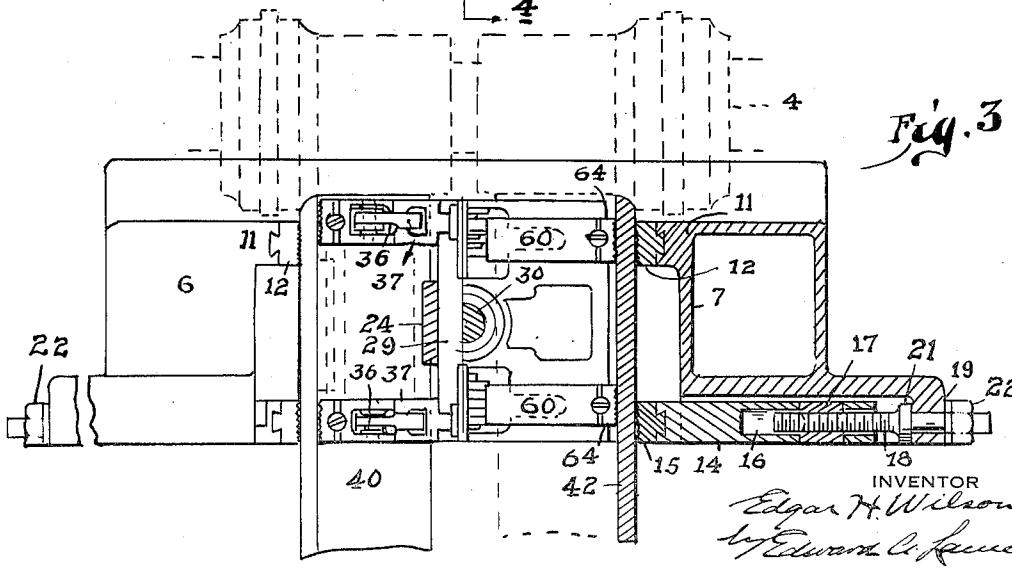


Fig. 3



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Fig. 4

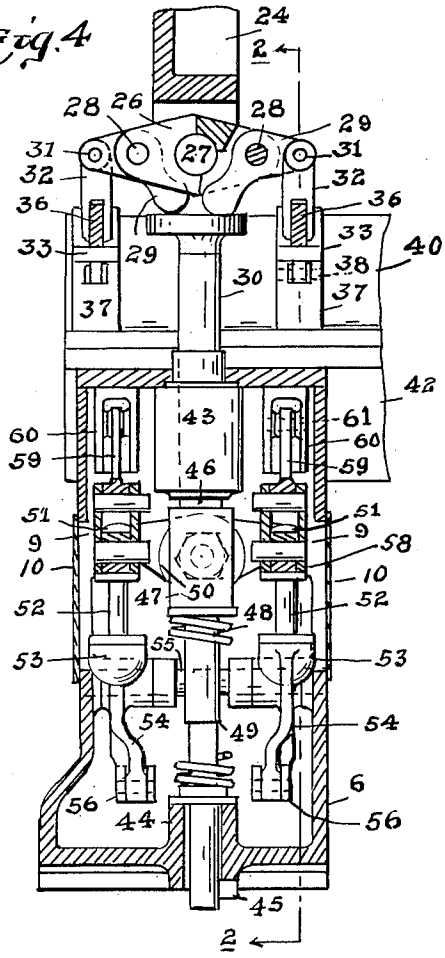


Fig. 11

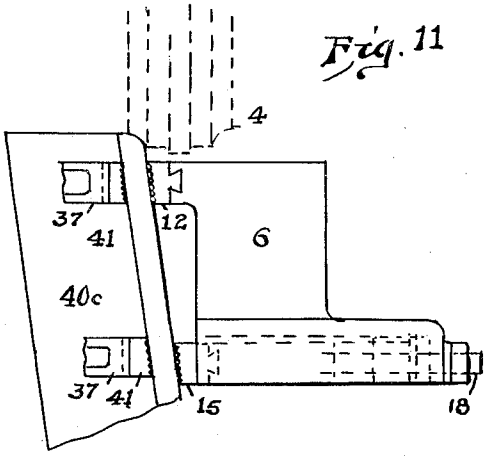


Fig. 5

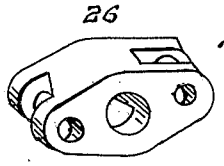


Fig. 6

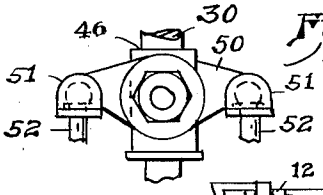


Fig. 10

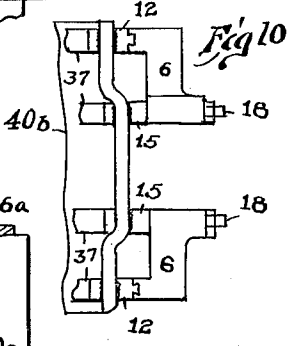


Fig. 7

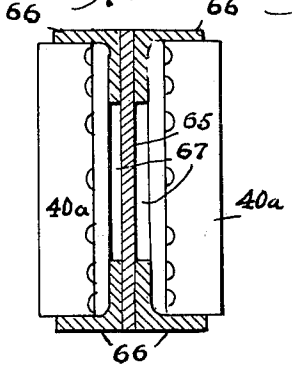


Fig. 8

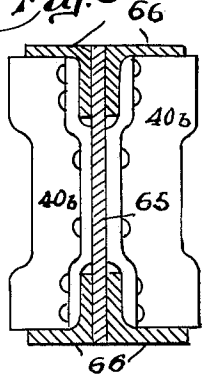
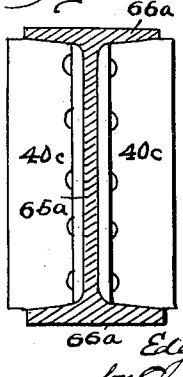


Fig. 9



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1,960,884

WORK-CLAMPING MECHANISM FOR ANGLE MILLING MACHINES

Edgar H. Wilson, Pittsburgh, Pa., assignor, by mesne assignments, to McClintic-Marshall Corporation, a corporation of Pennsylvania

Application November 15, 1930, Serial No. 495,846

6 Claims. (Cl. 90—59)

Angles are used to brace the flanges of beams and girders.

Where the girders are built up with their flanges formed by angles riveted or otherwise secured to the web member the angle braces are disposed transversely of the web with their ends supporting the beam-flanges, and the ends of the angles must be milled off to fit snugly up against the flanges of the beam. In some cases these angles are straight, filler-plates being placed between their intermediate portions and the web and in other cases the angles are pressed so as to bow in and bear flat against the web between the edges of the beam.

In the case of large I-girders whose flanges are integral with their webs the flanges are also braced by angles transversely disposed to the web and as the inner surfaces of such girder flanges are inclined the ends of the angles must be milled on the bias to fit against the same.

The object which I have in view is the provision of new and improved clamping means for holding the angles whether straight or bowed rigidly in place in the milling machine and also for presenting their ends in proper position for substantially straight or bias cuts to the millers.

For this purpose I have devised the improved clamping means, the principles of which are hereinafter described and claimed.

In the accompanying drawings, wherein I have illustrated a practical embodiment of the principles of my invention, Fig. 1 is an elevation showing two of my clamping mechanisms applied to a double milling machine, the structure of the milling machine being shown only in part.

Fig. 2 is a view partially in vertical section along the line 2—2 in Fig. 4 and partially an end view.

Fig. 3 is a horizontal section taken along the irregular line 3—3 of Fig. 2.

Fig. 4 is a vertical section taken along the line 4—4 in Fig. 2.

Fig. 5 is a perspective of the balance lever which is attached to the power head.

Fig. 6 is a side elevation of a second balance lever to which the lower clamping shoes are connected.

Fig. 7 is a cross sectional view showing a built up I-beam whose flanges are braced with angles and with filler blocks interposed between the angle braces and the web of the beam.

Fig. 8 is a similar view but with the filler blocks omitted and the intermediate portions of the angles bent in to bear against the web.

Fig. 9 is a similar view of an I-girder with the angle braces applied.

Fig. 10 is a fragmentary view in plan showing the clamping in the milling machine of an angle whose intermediate portion is bent to permit the omission of the filler blocks.

Fig. 11 is a fragmentary view in plan and on enlarged scale illustrating the use of my clamping mechanism for presenting an angle to the miller in such manner that the end of the angle will be finished on the bias.

Referring to the drawings, 1 represents the horizontal bed or base upon which are mounted the two opposed milling machines 2 and 3, and 4 represents the rotary millers mounted on horizontal axes in said machine. To provide for the milling of the ends of angles of different lengths one or more of the machines is arranged to be moved towards and away from the other in the usual manner.

As the structure of the milling machines per se is not the subject matter of my present invention, I have simply indicated the same in a general way.

As the angle clamping mechanisms for the two milling machines are similar I will proceed to describe one of the same.

5 represents a horizontal platform formed by one portion of the housing of the milling machine and upon said platform is mounted and secured the housing 6 for the clamping shoes and their operative linkage.

The housing 6 is a hollow casting which is provided in its upper portion with a sunken recess wherein the clamping shoes are housed. The inner and outer ends of said recess are open to provide clearance for the angles while the sides of the recess are defined by the vertical walls 7.

8 represents a table which comprises a horizontally disposed plate whose ends are supported by and secured to upwardly extending end walls 9 of the housing 6. The table is of such width to provide clearance at its sides for the depending flanges of the lower pair of angles.

The walls 9 are apertured to provide access to the linkage of the lower clamping shoes and such apertures may be covered by removable closure-plates 10.

At their inner ends, that is the end adjacent to the miller 4, the walls 7 of the housing 6 are provided with vertically disposed ribs 11 and said ribs are provided with vertically disposed dovetailed mortices which are engaged by the complementary tenons of the insert gripper bars 12 whose faces are serrated for engaging the angles and which form abutments against which the angles are to be clamped.

At the rear or outer end of the housing 6 and at either side of the sunken recess the wall of the housing is provided with upper and lower horizontal guideways 13 in which the vertically disposed slides 14 are arranged to move. The inner ends of said slides are provided with vertically disposed dovetailed mortices which are engaged by the complementary tenons of the in-

sert gripper-bars 15 which have serrated angle-engaging faces and which also form an abutment against which the angles are to be clamped. Each of said slides is strengthened along its edges and horizontally across its center by means of ribs which may be cast integrally with the slide. At its horizontal center the slide is provided with a cylindrical bore 16 extending inwardly from the outer end of the slide.

The bore is intersected by a cylindrical seat in which is mounted the cylindrical nut 17. A shaft 18 extends into the bore 16 and has a threaded intermediate portion which is screwed through the nut 17. The outer end of the shaft extends through a sleeve bearing 19 formed in a vertically disposed cross bar 20 whose ends are integral with the guideways 13. The outer end of the shaft is squared for the application of a tool and the shaft is prevented from longitudinal movement as by collars 21 and 22 stationary on the shaft at the inner and outer ends of the bearing 19. The outer collar 22 may be pinned in place so as to be removable to permit the assemblage and disassemblage of the parts.

It is obvious that the rotation of the shaft in the proper direction will cause the insert 15 to be advanced toward the center line of the housing or to be retreated therefrom.

23 represents a vertically disposed fluid pressure cylinder and piston mechanism supported above the housing 6 and having its piston rod connected to the head 24 which is slidable in the guides 25. The lower end of the head 24 is provided with parallel depending walls between which the balance lever 26 is pivoted as on the pin 27. The ends of the lever 26 are bifurcated, as best illustrated in Fig. 5, and in said ends are pivoted as at 28 the centers of the angular levers 29. The inner ends of the levers 29 engage from above the head which forms the upper end of a vertically disposed shaft 30 hereinafter to be more fully described while the outer ends of the levers 29 are pivotally connected as at 31 to the bifurcated upper ends of the links 32 whose lower ends are also bifurcated but disposed at right angles to their upper ends. The lower ends of the links 32 straddle the centers of the balance arms 33 and are pivotally connected thereto as at 34. The ends of the balance arms 33 are bifurcated and have pivotally attached thereto as at 35 the upper ends of the links 36 whose lower ends are pivotally attached in the interiors of the upper clamping shoes 37 as by means of wrist pins 38.

The upper clamping shoes are four in number and arranged in opposed pairs as illustrated, the members of a pair being linked to the opposite ends of the same balance arm 33.

The balance arms 33 are provided with inclined stop projections 39 with which the links contact to limit the inward movement of opposed shoes towards each other as the head 24 is elevated.

The bottoms of the upper shoes are flat so as to bear downwardly on the horizontal flanges of the top pair of angles illustrated at 40. The vertical outer faces of the upper shoes are provided with dovetailed mortices to receive the mating tenons of the insert clamping blocks 41 whose outer contact faces engage the vertical flanges of the angles 40 and clamp them against the inserts 12 and 15. When four angles are to be milled simultaneously the same are arranged in upper and lower pairs, the upper pair being indicated at 40 and the lower pair at 42. The lower angles are inverted with their horizontal flanges resting on the table 8 and their vertical flanges depending at the sides of the table and the horizontal flanges of the upper angles rest upon those of the lower angles and their vertical flanges extend upwardly, as shown in the drawings. Thus the upper shoes 37 clamp both the upper and lower angles to the table 8.

Where but two angles are to be milled they are placed with their horizontal angles resting on the table 8 and their vertical flanges extending upwardly at either side and the upper shoes are used to clamp the angles directly to the table.

The shaft 30 depends through a central hole in the table 8 and through a sleeve bearing 43 which is an integral part of or supported from the housing 6. The lower end of the shaft 30 extends through a sleeve bearing 44 carried by the bottom wall of the housing 6 and the shaft is prevented from rotary movement as by means of a key 45 engaging keyways in the wall of the bearing 44 in the shaft, the shaft however being free to move longitudinally.

Below the bearing 43 the shaft is reduced in diameter to provide a circumferential shoulder 46 which limits the upward movement along the shaft of block 47 which has a vertically disposed cylindrical bore mounted with a sliding fit on the shaft.

A helical spring 48 is coiled about the shaft 30 between the upper end of the bearing 44 and the lower end of the block 47, thus tending to hold the block against the shoulder 46 on the shaft and also tending to elevate the shaft and maintain its head in resilient contact with the inner ends of the angular levers 29.

The lower end of the shaft 30 is again reduced in diameter to form a second circumferential shoulder 49 which limits the downward movement of the shaft in the bearing 44.

50 is a balance lever, shown also in side elevation in Fig. 6, and which is pivotally mounted at its center on one side of the block 47 and has its ends provided with sockets 51 to receive the upper ball ends of the links 52 whose lower ball ends are received in sockets 53 on the upper end of the bell cranks 54. The bell cranks 54 are pivotally mounted at their angles on the horizontal shaft 55 supported in the housing 6. The other ends of the bell cranks 54 are connected by the links 56 to the lower end of a second pair of bell cranks 57 which are pivoted at their angles to a portion of the housing and other ends of which are connected by the links 58 with the pairs of toggle levers 59. The upper ends of the toggle levers 59 extend into the lower shoes 60 and are pivotally connected thereto as by the wrist pin 61.

The lower shoes move horizontally between the lower surface of the table 8 and the horizontal bearing surfaces 62 which are parts of the housing casting.

The vertical faces of the shoes 60 are provided with dovetailed mortices 63 in which fit the complementary tenons of the insert clamping blocks 64.

By means of the linkage interposed between the head 24 and the individual shoes, the force is transmitted equally to all of the eight shoes.

Thus the balance lever 26 divides the force equally between the two angular levers 29 which together transmit half of the force to the shaft 30 and which individually transmit a quarter of the force to each of the balance arms 33. The balance arms 33 transmit one-eighth of the force to each of the upper shoes 37.

Again the shaft 30 to which is transmitted one-half of the total force transmits one-fourth of said force to each of the balance levers 50 which in turn transmit one-eighth of the force to each of the lower shoes 60.

Again the linkage employed to transmit the force to the individual shoes allows for irregularities in the angles to be clamped such as arising from the irregular thickness of metal or distortion of the angles or irregular shapes of the angles and also where the angles are to be presented to the miller in such position as to be given a biased end. Such compensation however does not interfere with the force exerted by the individual shoes in clamping the angles in position.

Where the ends of the angles are to be simultaneously finished in substantially a plane at right angles to the longitudinal axis of the angles I employ both milling machines and both clamping mechanisms, the angles straddling the machines as illustrated in Fig. 1.

Thus in Fig. 7 I have illustrated a built up beam comprising a web 65 and flanges formed by angles 66. The angle braces, which are indicated at 40*a* have rectangularly milled ends. In this case filler blocks 67 are interposed between the intermediate portions of the braces 40*a* and the webs 65.

In Fig. 8 I have shown a similar beam but with the filler blocks 67 omitted and the intermediate portions of the angle braces 40*b* pressed inwardly so as to engage the web between the flange angles.

In Fig. 10 I have illustrated the arrangement of the clamping mechanism for holding the angles 40*b* in the milling machine so that both ends may be simultaneously milled. In such case by the proper rotation of the shafts 18 I adjust the gripper bars 15 so as to accommodate the intermediate portion of the angles 40*b*, and because of the compensatory ability of the linkage the clamping shoes are enabled to grip the angles firmly.

In Fig. 9 I show an I-girder with its flanges 66*a* integral with its web 65*a*. In such case the inner surface of the flanges are inclined and thus the angle braces 40*c* must be provided with biased ends, that is ends not disposed at substantially right angles to the axis of the angles.

In Fig. 11 I illustrate the arrangement of one of the gripping mechanisms for presenting the angle 40*c* to the miller 4 in proper relation to enable the biased end to be milled on the angle. In such case I use but one of the milling machines and one of the gripping mechanisms, and I retreat the gripper bar 15 relative to the gripper bar 12 so that the angle may assume its angular position such as illustrated. In such case the gripper bars 12 and 15 with properly inclined serrated faces are used and the gripping shoes are also provided with insert blocks 41 which have angularly disposed gripping faces.

In the case of previously known clamping mechanism for angle-milling machines it was impossible to clamp angle bars which were bowed or crimped without using filler blocks and again it was impossible to clamp angles in place to mill their ends on the bias. Again considerable trouble was encountered when the angles were twisted or irregular in shape or where their flanges were not disposed at right angles to each other.

These difficulties are solved by my invention, and a plurality of angles may be simultaneously milled regardless of whether they are straight, bowed or their ends are to be milled on the bias, and also regardless of their irregularities, and no filler blocks are required for their proper clamping in place. Their flanges are at all times held against springing while being milled.

Any number of angles from one to four may be clamped rigidly in place.

The provision of the table which is stationary and to which the angles are clamped is important. I am thus enabled to accurately position and rigidly hold the angles in place, a result which would be difficult if not impossible to accomplish were the angles to be wholly supported by movable shoes or other elements.

What I claim is:—

1. In work holding mechanism for angle-milling machines, the combination of a table upon which the angles may be loosely placed with their horizontal flanges resting upon one another on the table while the vertical flanges of the upper angles extend upwardly and those of the lower flanges extend downwardly at the sides of the table and the horizontal flanges of the angles extending inwardly towards the center of the table, abutments at the sides of the table, shoes movably mounted above the table and arranged to clamp the angles to the table and the vertical flanges of the upper angles to the abutments, shoes movably mounted below the table and arranged to clamp the lower angles to the abutments, a power member, a single force transmitting shaft positioned between said shoes and passing through said table, and equalizing means operatively connecting all of said shoes with said member and said shaft.

2. In work holding mechanism for angle-milling machines, the combination of a table upon which the angles may be loosely placed with their horizontal flanges resting upon one another on the table while the vertical flanges of the upper angles extend upwardly and those of the lower flanges extend downwardly at the sides of the table and the horizontal flanges of the angles extending inwardly towards the center of the table, abutments at the sides of the table, shoes movably mounted above the table and arranged to clamp the angles to the table and the vertical flanges of the upper angles to the abutments, shoes movably mounted below the table and arranged to clamp the lower angles to the abutments, a power member, a single force transmitting shaft positioned between said shoes and passing through said table, and equalizing lever connections between said shaft and all of the shoes whereby the force transmitted to the shaft is distributed equally to all the shoes.

3. In work-holding mechanism for angle milling machines, the combination of a table upon which the angles may be placed, the vertically disposed flanges of the upper angles extending upwardly and those of the lower angles extending downwardly at the sides of the table, a single force transmitting shaft positioned between said angles and passing through said table, four upper and four lower clamping shoes arranged to engage the angles from within to force them against the table and the abutments, and equalizing connections between all of said shoes and said shaft.

4. In work-holding mechanism for angle-milling machines, the combination of a table for the angles, abutments adjacent the sides of said table, a force transmitting shaft slidably mounted in said table, four upper and four lower clamping shoes capable of individual and relative adjustment arranged to engage the angles and to prevent lateral movement thereof, individual equalizing means operatively connecting said

shaft and each of said shoes, said upper shoes being arranged to move outwardly and downwardly while the lower shoes move outwardly only, and means to apply downward force to said shaft.

5. In work-holding mechanism for angle-milling machines, the combination of a stationary table for the angles, abutments adjacent each side of said table, a single power member positioned above the table, clamping shoes arranged above and below said table, equalizing levers carried by said member and connected to said upper shoes, a slidably mounted shaft in reacting relation to certain of said levers, additional equalizing means connecting the lower shoes with said shaft so that said lower shoes are indirectly operated by the action of certain of the levers carried by the power member pressing upon said shaft, whereby the force of said power member is distributed equally to all the shoes and the shoes assume relative different positions when the work is positioned other than at right angle with the abutments.

6. In work-holding mechanism for angle-milling machines, the combination of a table for the angles, abutments adjacent each side of the table for the angles, a power member positioned above the table, clamping shoes arranged above and below said table, means operatively connecting said member and said upper shoes, a slidably mounted shaft operatively connecting the lower shoes with the upper shoes and said power member, and means to move said shaft upwardly when said power member is retracted so as to release the lower shoes from their clamping positions.

EDGAR H. WILSON.