J. F. GAIL.

BENDING MACHINERY.

APPLICATION FILED AUG. 2, 1909.

957,202.

Patented May 10, 1910.

5 SHEETS—SHEET 1.

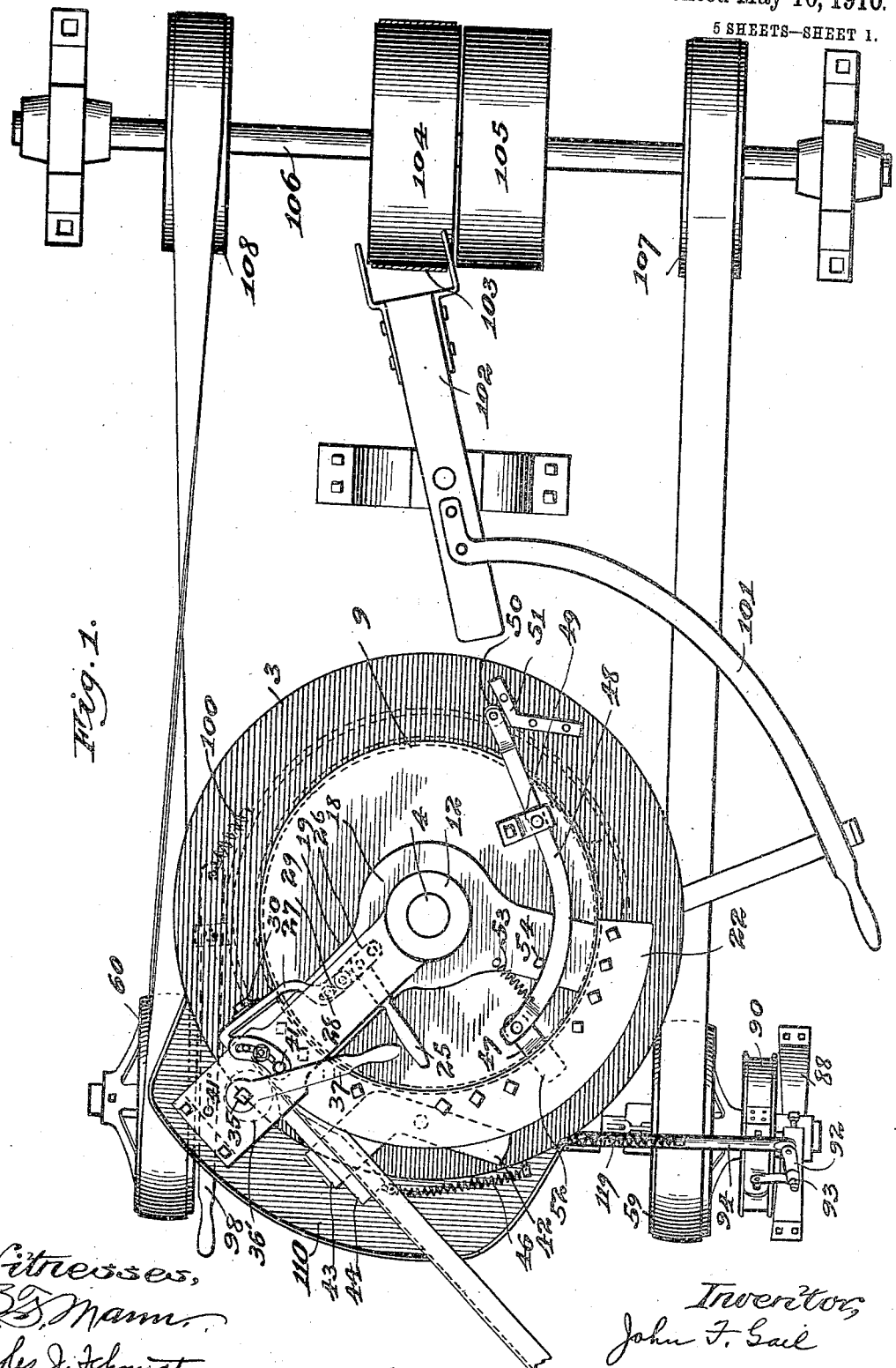

Fig. 1.

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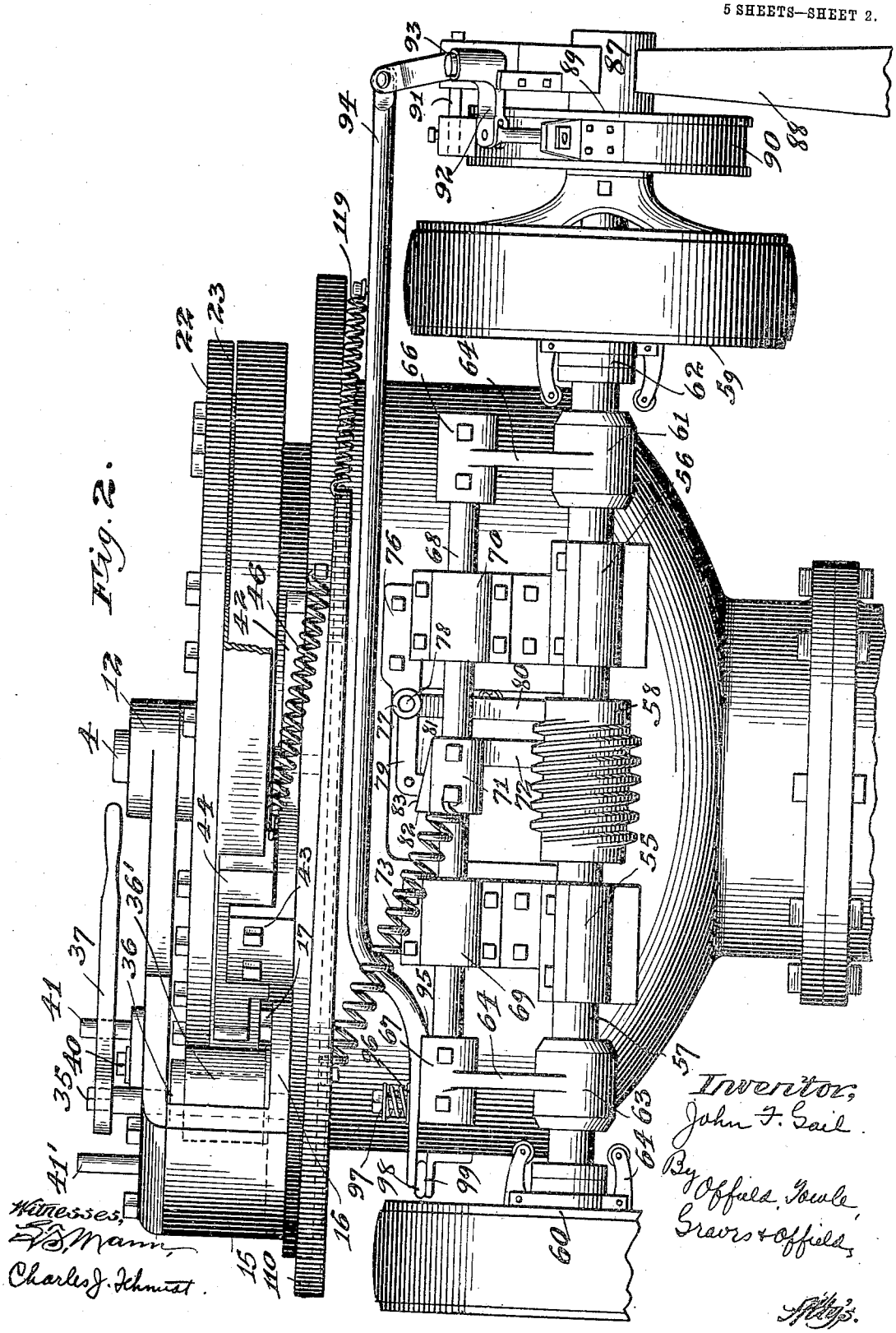
5 SHEETS—SHEET 2.

Fig. 2.



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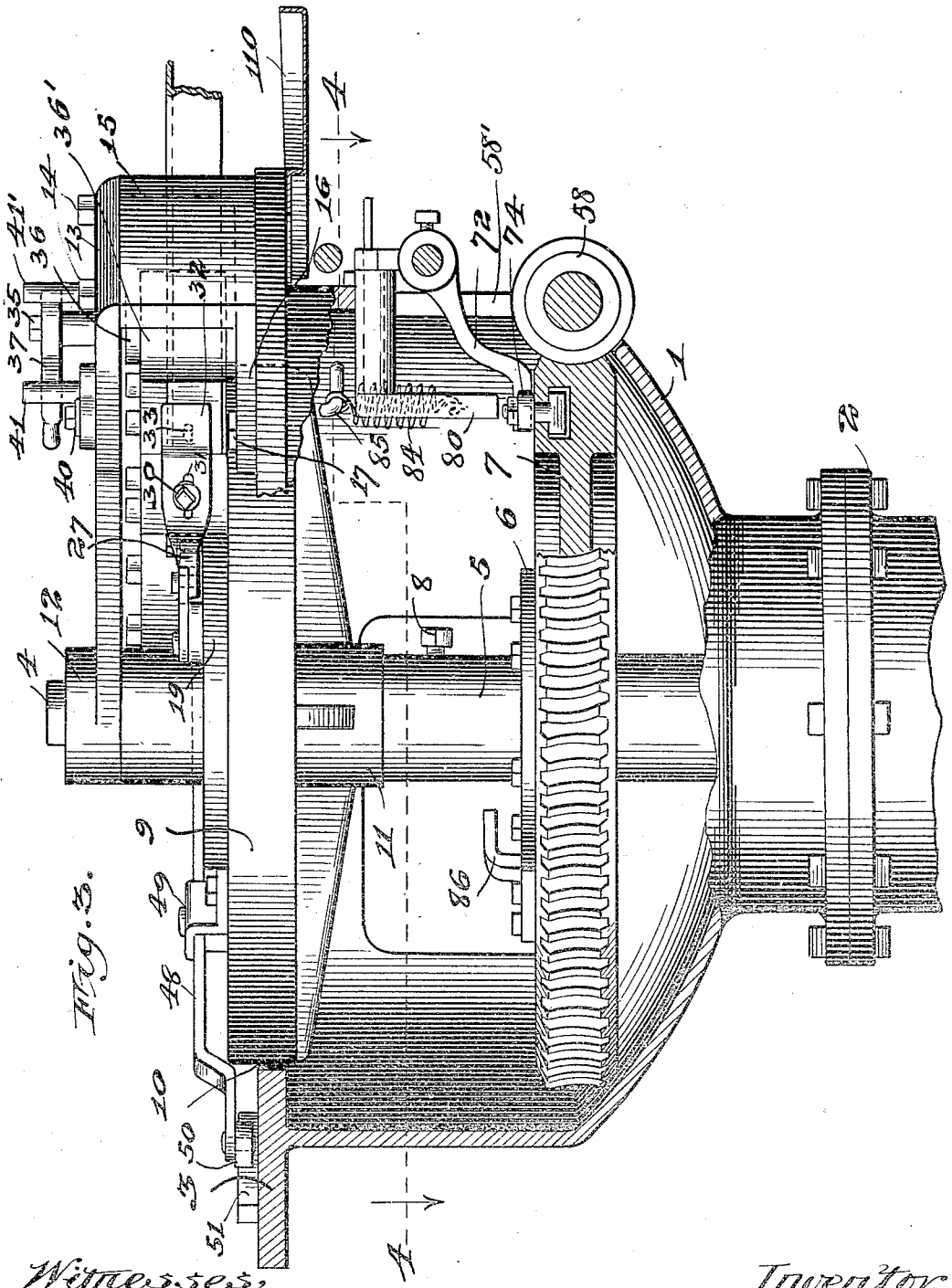

Fig. 3.

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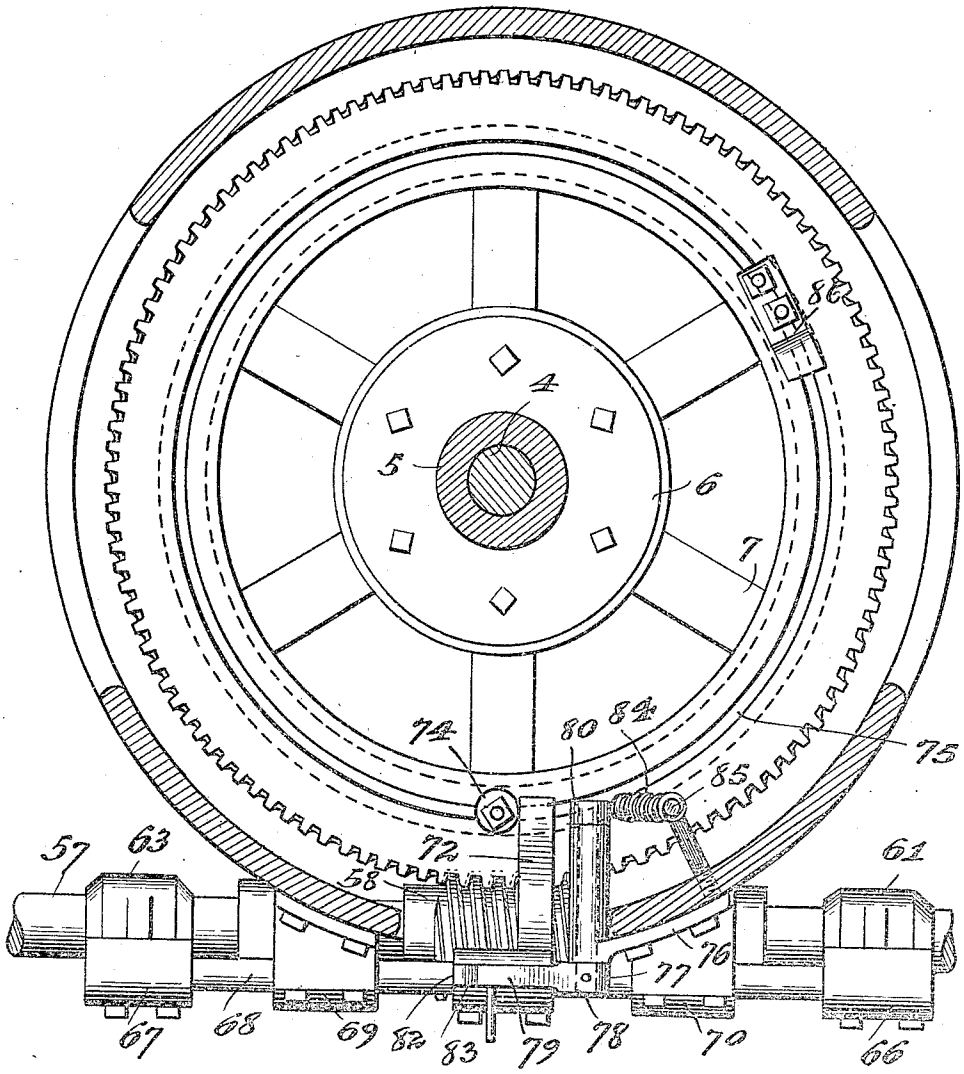
5 SHEETS—SHEET 4.

Fig. 4.



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5 SHEETS—SHEET 5.

Fig. 5.

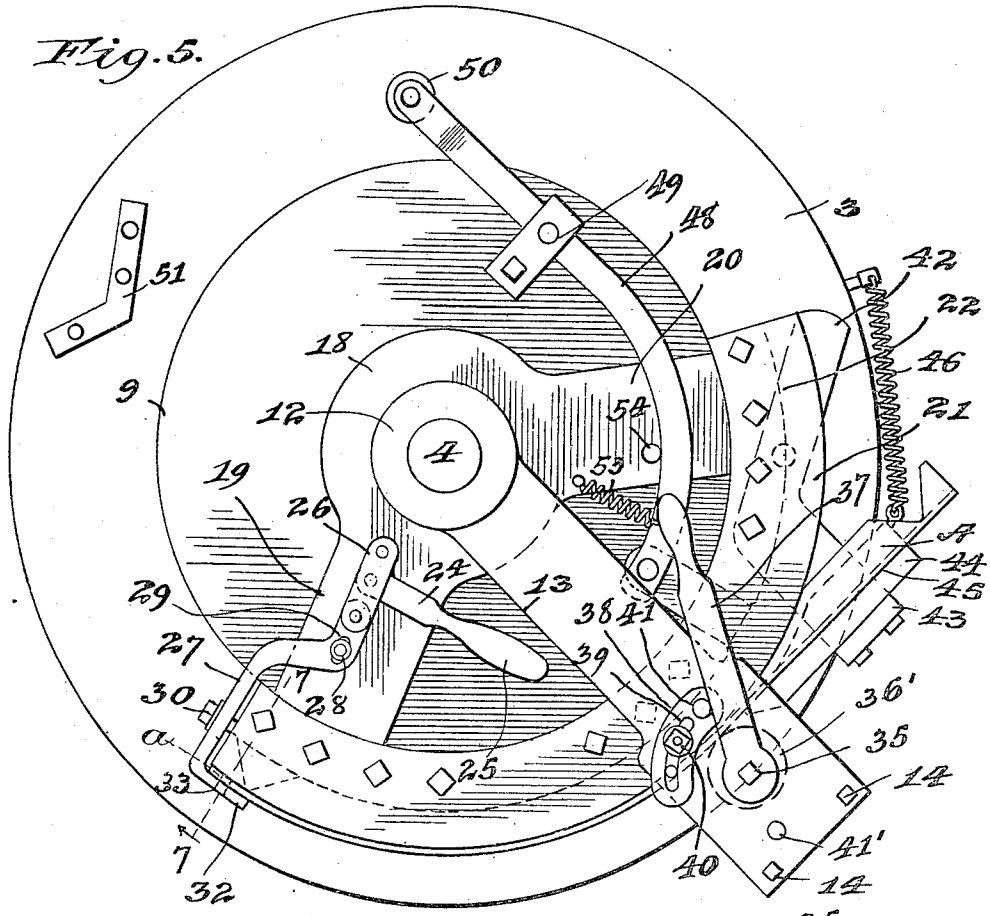


Fig. 6.

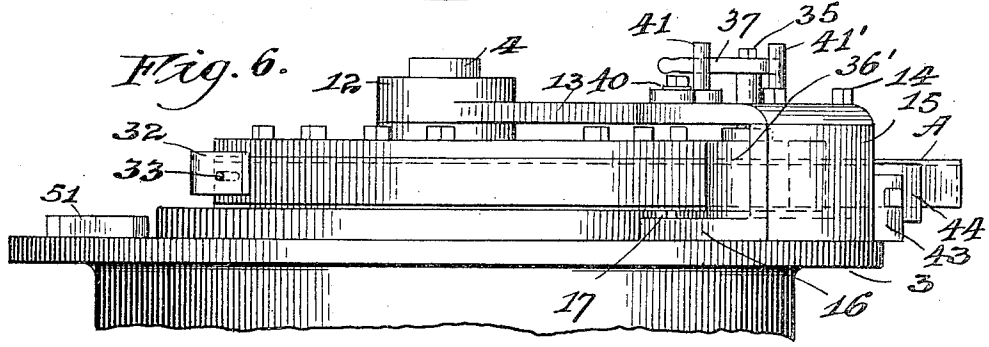
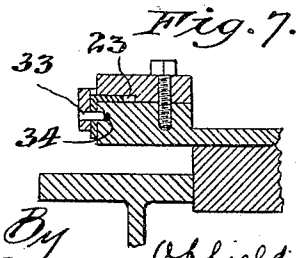


Fig. 7.



Witnesses,
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UNITED STATES PATENT OFFICE.

JOHN F. GAIL, OF KENOSHA, WISCONSIN, ASSIGNOR TO THE SIMMONS MANUFACTURING COMPANY, OF KENOSHA, WISCONSIN, A CORPORATION OF WISCONSIN.

BENDING MACHINERY.

957,202. Specification of Letters Patent. Patented May 10, 1910.

Application filed August 2, 1909. Serial No. 510,762.

To all whom it may concern:

Be it known that I, JOHN F. GAIL, residing at Kenosha, in the county of Kenosha and State of Wisconsin, have invented certain new and useful Improvements in Bending Machinery, of which the following is a complete, clear, full, and precise specification.

My invention relates to bending machinery particularly to a machine for bending straight lengths of angle bar into arc lengths.

One of the main objects of my invention is to provide a machine which is entirely automatic in its operation and into which it is necessary only to feed the straight lengths, the finished arc lengths being delivered from the machine at the end of the automatically performed forming steps.

Another object of my invention is to construct and arrange the machine parts in compact, simple and well balanced form so that the machine will occupy very little floor space and so that its efficiency of operation will be at a maximum.

Various other features in the construction and arrangement are also embodied in my invention, and in the accompanying figures which clearly illustrate the machine: Figure 1 is a plan view of the bending machine and counter shaft from which the machine is driven. Fig. 2 is an enlarged front elevation of the machine looking from the left of Fig. 1. Fig. 3 is a view looking from the left of Fig. 2, parts of the frame and controlling parts being cut away and omitted. Fig. 4 is a plan view taken from plane 4—4, Fig. 3. Fig. 5 is an enlarged plan view showing the traveling forming parts in a different position from that shown in Fig. 1. Fig. 6 is an elevation view of the upper section of the parts shown in Fig. 5, and Fig. 7 is a sectional view taken on plane 7—7, Fig. 5.

The machine supporting frame is in the form of a cylindrical drum or shell 1 bolted to the top of a standard 2, annular top plate 3 extending radially a distance both inwardly and outwardly. The main shaft 4 is vertical and extends axially through the drum and has suitable bearings at its lower end. The sleeve 5 has a flange 6 bolted to a worm-wheel 7 which is concentric with shaft 4 and which is held to the shaft by means of a set screw 8 engaging through the sleeve 5. A cylindrical table 9 extends in the opening 10 surrounded by the plate 3 and is held in position by engagement of its hub 11 with the sleeve 5. The table is secured to travel with the worm-wheel 7 and this may be accomplished by keying the table 9 to the shaft 4 or by securing its hub 11 to the sleeve 5. The upper end of shaft 4 journals in a bearing sleeve 12 from which extends an arm 13 secured at its outer end by means of screws 14 to the upper end of an angle member 15 whose base 16 is secured by means of bolts 17 to the top plate 3 adjacent the table 9.

The table 9 is strengthened by an upper hub 18 and radial webs 19 and 20 between whose ends extends the forming arc piece 21. This arc piece has bolted to its top a plate 22 whose end face at its front is recessed so that the plate forms, with the arc 21, the slot 23 for receiving one web of the angle bar sections to be bent, the outer face of the arc piece 21 engaging with the other web of the angle bar lengths. Pivoted at its elbow to the top of the web 19 is a bell crank lever 24 whose end terminates in a handle 25 and whose other end pivots to one end of a link 26. The other end of this link pivots to the rear end of a sliding lever 27 held in place by a bolt or pin 28 secured to the web 19 and extending through slot 29 and by a screw or pin 30 engaging with the end of arc piece 21 and extending through a slot 31 cut through the lever. The front end of the lever 32 is bent to be parallel with the front face of the arc piece 21 and carries a pin 33 for engaging in hole 34 in the arc piece 21 near its left end. The angle bar lengths "A" to be bent have holes *a* at their ends through which the pin 33 passes and the angle bar lengths are in this manner locked to the arc forming frame 21.

Journaled at its upper end in the frame 13 and at its lower end in the base 16 is a vertical shaft 35 on which is mounted eccentrically a cylindrical member 36 carrying a roller 36′. The upper end of the shaft receives a lever 37 by means of which the shaft may be rotated to bring the roller away from or toward the forming arc piece 21 which is bridged by the arm 13. A plate 38 has a slot 39 through which it may be adjustably secured to the arm 13 by means of a screw 40, this plate having a pin 41 forming a stop for the arm 37. Pivoted to the top plate 3 and disposed between the top

plate and the overhanging arc forming frame 21 is a lever 42 whose up-turned front end carries a guide piece 44 having a groove 45 for receiving the vertical web of the angle bar lengths to be bent. A spring 46 connecting between the piece 44 and the machine frame tends to swing the lever to carry the guide piece outwardly. The front end of the guide piece 44 is tapered so that the end may enter between the forming frame and roller and the pivot point of the lever 42 is so positioned that when an angle length is properly applied to the guide piece its end will properly find its way into the slot 23 and between the forming frame 21 and the roller 36′. Before the length is applied the lever 25 is swung about its pivot to slide the bar 27 forwardly to carry the pin 33 from the path of the section end, and when the hole *a* at the entrance end of the section registers with the hole 34 in the forming frame, the lever 25 is returned to move the bar 27 to carry the pin 33 through the hole *a* and into hole 34 thus to lock the entrance end of the length to the forming frame 21. When the pin 33 thus engages with the fed in length, the pivot of lever 24 and the pivots of the link 26 are in a common plane so that the pin 33 cannot be released except upon rotation of the lever 24. As will be shown later the table 9 oscillates to first draw the fed in length between the forming frame 21 and the roller 36′ and then in the opposite direction so that the formed length can be removed. After the lever 24 has been manipulated to lock a fed in length to the frame 21 the machine is started and the lever 37 is swung and held against the stop pin 41 so that the vertical web of the angle bar length will be held against the front face of the frame 21, the horizontal web of the bar being kept uniplanar by its engagement in slot 23, and after the table is moved forwardly the angle bar length will have been bent into arc form. When the rear end of a fed in length leaves the guide piece 44, the lever 42 is swung away from the frame 21 by the spring 46. When the table returns to its normal position the lever 37 is swung to withdraw the roller 36′ and lever 24 is swung to unlatch the pin 33 so that the formed length is ready for discharge from the machine. The discharge mechanism comprises a block 47 carried at the front end of a lever 48 pivoted at an intermediate point to a lug 49 secured to the oscillating table, the rear end of the arm pivoting a roller 50 which coöperates with a cam rail 51 secured to the top plate 3. The discharge block 47 extends into passageway 52 cut through the frame 21 and communicating with the slot 23. A spring 53 tends to hold the front end of lever 48 against the stop pin 54. In Fig. 5 the table has traveled a distance to draw in an angle bar length to be formed, the roller 50 being disengaged from the cam rail 51 and the lever 48 being held against the stop 54. After the angle bar length has been formed and the table returned to its normal position the roller 50 at the end of this return movement engages the cam rail 51 so that the lever 48 is swung and the discharge block 52 pushed outwardly to eject the angle bar section from the frame 21.

The driving mechanism is best illustrated in Figs. 2, 3 and 4. Bearings 55 and 56 are secured to the outside of the supporting drum 1 and journal a driving shaft 57. On this shaft and between the bearings is keyed a worm 58 which projects inwardly through opening 58′ and meshes with the worm wheel 7. Loosely mounted on the shaft to the right of bearing 56 is a forward driving pulley 59 and loosely mounted at the left end of the shaft is a reverse driving pulley 60. On the shaft between pulley 59 and bearing 56 is a clutch collar 61 adapted to cooperate with suitable clutch mechanism 62 to clutch the driving pulley 59 to shaft 57. Also mounted on shaft 57 between the bearing 55 and reverse pulley 60 is a clutch collar 63 adapted to actuate clutch mechanism 64 to clutch the pulley 60 to shaft 57. Extending from the clutch sleeves 61 and 63, respectively, are arms 64 and 65 terminating in sleeves 66 and 67 which are secured at the respective ends of a shaft 68, which shaft may reciprocate laterally through bearings 69 and 70 secured to the drum 1. Secured to the shaft 68 between these bearings is a sleeve 71 which has a cam arm 72 extending downwardly and through opening 59 into the interior of drum 1. A spring 73 connecting between the drum frame and the sleeve 71 tends to draw the shaft 68 to the left. In the normal position of the machine this movement is prevented by the engagement of the end of arm 72 with an adjustable cam block 74 carried by worm wheel 7. This cam block is best shown in Figs. 3 and 4 and may be adjustably secured in a slot 75 cut in the worm wheel. Bolted to the outside of the drum adjacent the upper end of the opening 59 is a plate 76 which supports a rearwardly extending sleeve 77 journaling a pin 78 whose front end supports a leftwardly extending latch arm 79 and whose rear end supports a downwardly extending cam arm 80. The left end 81 of arm 79 extends downwardly a distance to form a latching shoulder 81 for receiving the point 82 of the latch block 83 formed on the sleeve 71. A spring 84 connects between the arm 80 and a pin 85 extending from the drum, the effect of this spring being to rotate shaft 78 to hold the arm 79 downwardly in the path of latch block 83. A cam arm 86 is adapted to be adjustably positioned and secured in channel 75 of the worm wheel and extends up-

wardly to strike arm 80 when the table reaches the end of its forward movement. The right end of shaft 57 is further journaled and supported in a bearing 87 at the top of a standard 88, and carried by the shaft between the standard and the pulley 59 is a brake wheel 89 engaged by a brake strap 90 whose one end is secured to pin 91 extending inwardly from standard 88 and whose other end connects with one arm of the bell crank lever 92 pivoted to the standard at 93 the other arm of the lever pivoting to the right end of the brake rod 94, the arrangement being such that movement of the brake rod toward the right will cause the strap to clamp the brake pulley. In the normal position, before the machine is started, the brake rod is locked to the right and shaft 57 braked, locking being accomplished by the engagement of a shoulder 95 with the right end of the sleeve 67, the shoulder being formed on the brake rod. A spring 96 abutting against the left end of the brake rod and against a stud 97 extending from the sleeve 67 tends to hold the shoulder in such locking engagement with sleeve 67. As best shown in Figs. 1 and 2 a controlling lever 98 is pivoted on a bracket 99 extending from the side of the drum frame, a spring 100 connecting between the rear end and the drum frame and tending to swing the front end of said lever to the left. The front end of the lever 98 extends below the left end of the brake lever. The pivot arrangement of the lever is such that it may be swung both in vertical and horizontal planes.

The normal position of the driving mechanism is as shown in Figs. 2, 3 and 4, the clutch mechanism being inactive, the brake set and the arm 79 unlatched from the sleeve 71. After the operator has inserted an angle bar length into the machine he swings starting lever 101 to actuate suitable belt shifting mechanism 102 to shift the main driving belt 103 from the idle pulley 104 to the driving pulley 105 to thus start the counter shaft 106 and the pulleys 107 and 108 belted, respectively, to the forward and reverse main driving pulleys 59 and 60. To start the machine the operator first raises the lever 98 to lift the left end of the brake rod to unlatch the shoulder 95 from the sleeve 67 whereupon the brake rod is thrown to the left by the force of a spring 119 connecting between the brake rod and the machine frame. The lever 98 is then swung to the right against sleeve 67 to shift shaft 68 to the right to carry the collar 61 into position to actuate clutch mechanism 62 to clutch forward driving pulley 59 to shaft 57. During this movement the arm 79 travels over the latch block 83 until shoulder 81 drops into engagement with point 82 whereupon shaft 68 will be locked in its right position against the force of spring 73 and the forward driving pulley held in clutch engagement with shaft 57 during which time the worm wheel is oscillated in a forward or clockwise direction to bend the fed-in angle bar length. At the end of this forward movement the extension 86 strikes the arm 80 and lifts arm 79 to release sleeve 71 thus allowing spring 73 to throw the shaft 68 to its extreme left position to disengage clutch collar 61 from clutch mechanism 62 and to engage collar 63 with clutch mechanism 64 to clutch the reverse driving pulley 60 to shaft 57. The table will now move in reverse direction until cam block 74 engages with arm 72, this engagement causing shifting to the right of shaft 68 and disconnection of clutch sleeve 63 from clutch mechanism 64. When the shaft 68 is thrown to its extreme left by spring 73 the sleeve 67 passes to the left of shoulder 95 on the brake rod, and as the shaft 68 is carried toward the right upon engagement of cam block 74 with the arm 72, the sleeve 67 reengages with shoulder 95 to move the brake rod to the right to actuate the brake mechanism so that the shaft 57 is stopped when the parts assume their normal position. Thus the machine automatically reverses its direction and is automatically stopped at the end of each forming operation.

When a blank is to be inserted into the machine its end is first applied to the guide piece 44 and the lever 42 then swings to carry the end of the blank into slot 23 and against the front face of the forming frame 21 with the hole *a* of the blank registering with the hole 34 in the frame 21 and the locking pin is then applied as has already been described. Upon actuation of lever 98 the apparatus starts and the operator forces lever 37 around to press roller 36 against the blank, the vertical web of the blank being then bent into arc form against the front face of the frame 21, and the horizontal flange being upset and compressed in the slot 23. By means of the adjustable plate 38 the position of stop pin 41 can be adjusted so that the upper pressure can be brought to bear against the flange by the roller 36. A stop pin 41′ can also be provided for stopping the lever 37 when in its out position. In order that the blank will form more readily it may be lubricated, and a pan 110 provided for containing soft soap, grease or other lubricant to be applied to the blanks before they are formed. This pan may be supported from the top plate 3 as shown.

The machine described is well balanced, strong and compact. All the operative parts are within the top plate 3 and there are no parts which swing out during operation to endanger the operator. The blanks are firmly gripped and held in the machine until completely and accurately formed and are

then automatically ejected. The machine is automatic in its reversing operation and automatically stopped at the completion of a formation operation. The machine could also be used for bending flat bars against the front surface of the block 21 or could also be used for bending flat bars in the slot 23 in the direction of their planes.

Changes and modifications may be made both in construction and arrangement which will still come within the scope of my invention, and I, therefore, do not wish to be limited to the precise construction and arrangement shown, and I desire to secure the following claims by Letters Patent.

1. In a bending machine for bending blanks into curved shape, the combination of a stationary supporting frame, a forming block pivoted to said frame and having a forming surface corresponding to the shape into which the blanks are to be bent, said block having a hole at one end, a locking bar mounted to travel with said forming block and having a pin for passing through a hole at one end of a blank and into the forming block hole to clamp said end of the blank to the block, a companion block mounted on said frame adjacent said surface to form a gap, and means for rotating said block to draw the blank through said gap and thereby against said forming surface whereby said blank assumes the curvature of said surface.

2. In a bending machine for bending metal bars, the combination of a stationary supporting frame, a table rotatably pivoted in said frame, a forming block carried by said table and having a forming surface corresponding to the shape to which blank bars are to be bent, said block having a hole at one end, a bar suitably mounted on said table and carrying a pin at one end adapted to pass through a suitable hole at one end of a blank and into the hole of said block to lock said end of the blank to the block, lever mechanism for controlling said sliding bar, said lever mechanism being self locking when said bar has been moved thereby to clamp the blank to the block, a companion forming member mounted on said stationary frame adjacent said forming surface, and means for rotating said table to draw the blanks past said companion forming member whereby said blank is pressed against the forming surface to be bent in accordance with said surface.

3. In a bending machine for bending angle bar blanks, the combination of a stationary supporting frame, a table rotatably pivoted in said frame, a forming block carried by the table and having a forming surface and a slot, means for clamping one end of one web of a blank to one end of said surface, said slot receiving the other web of the blank, a companion forming member mounted on said frame adjacent said surface, means for rotating said table to draw a clamped blank over said companion block whereby said first web is pressed by said companion block against said surface to assume the shape of said surface, the other web of the blank being received and formed by said slot during rotation of the table, a discharge plate passing through said block adjacent said slot, and cam mechanism operated upon rotation of said table to move said plate to eject the blank from said slot after formation thereof.

4. In a bending machine for bending angle bar blanks, the combination of a stationary supporting frame, a table pivoted in said frame, a forming block carried by the table, said block having a forming surface corresponding to the shape to which a blank is to be bent and having a slot running parallel with said surface, means for clamping one end of a blank to one end of said surface, a companion forming member mounted on said frame adjacent said surface, means for oscillating said table forward and back, one web of said blank being drawn past said companion block and pressed against said surface by said block and the other web of the blank entering said slot during forward movement of the table whereby the blank is bent in accordance with the forming block, a plate passing through said block adjacent said slot, cam mechanism connecting with said plate and actuated upon reverse movement of said table to move said plate into said slot to eject from said slot the formed blank.

5. In a bending machine for bending metal bars, the combination of a supporting frame, a table pivotally mounted in said frame, a forming block carried by said table and having a forming surface, means for clamping one end of a bar to said block, a companion forming member mounted on said frame adjacent said block, driving means for said table, a main forward driving member, a main reverse drive member, clutch mechanism for controlling connection of said forward and reverse main driving members with the driving means for the table, means for adjusting said clutch mechanism to connect the main forward driving member with the driving means whereby said table is moved forwardly to cause the bar to be drawn along the companion member and to be pressed thereby against the forming surface to be bent in accordance with said surface, means operating at the end of the forward movement of the table to automatically actuate the clutch mechanism to disconnect the main forward driving member and to connect the main reverse driving member with the driving means whereby said table is returned to its normal position and means automatically controlled to forcibly eject

the formed bar from the machine at the end of the reverse movement.

6. In a bending machine for bending metal bars, the combination of a supporting frame, a table pivotally mounted in said frame, a forming block carried by said table and having a forming surface, means for clamping one end of a bar to said block, a companion forming member mounted on said frame adjacent said block, driving means for said table, a main forward driving member, a main reverse driving member, clutch mechanism for controlling connection of said forward and reverse main driving members with the driving means for the table, means for adjusting said clutch mechanism to connect the main forward driving member with the driving means whereby said table is moved forwardly to cause the bar to be drawn along the companion member and to be pressed thereby against the forming surface to be bent in accordance with said surface, latch mechanism adapted to engage with the clutch mechanism after actuation thereof to lock said clutch mechanism to maintain the connection of the main forward driving member with the driving means, means controlled by the forward movement of said table to actuate the latch mechanism to release the clutch mechanism after said bar has been formed, and means acting upon release of the latch mechanism to actuate the clutch mechanism to disconnect the main forward driving member and to connect the main reverse driving member with the table driving means whereby said table is returned to its normal position.

7. In a bending machine for bending metal bars, the combination of a supporting frame, a table pivotally mounted in said frame, a forming block carried by said table and having a forming surface, means for clamping one end of a bar to said block, a companion forming member mounted on said frame adjacent said block, driving means for said table, a main forward driving member, a main reverse driving member, clutch mechanism for controlling connection of said forward and reverse main driving members with the driving means for the table, means for adjusting said clutch mechanism to connect the main forward driving member with the driving means whereby said table is moved forwardly to cause the bar to be drawn along the companion member and to be pressed thereby against the forming surface to be bent in accordance with said surface, latch mechanism adapted to engage with the clutch mechanism after actuation thereof to lock said clutch mechanism to maintain the connection of the main forward driving member with the driving means, means controlled by the forward movement of said table to actuate the latch mechanism to release the clutch mechanism after said bar has been formed, means acting upon release of the latch mechanism to actuate the clutch mechanism to disconnect the main forward driving member and to connect the main reverse driving member with the table driving means whereby said table is returned to its normal position, and additional means controlled by the reverse movement of the table to automatically move the clutch mechanism to a position in which both forward and reverse main driving members are disconnected from the driving means and the table stopped.

8. In a machine for bending metal bars, the combination of a stationary supporting frame, a table rotatably pivoted in said frame, a forming block carried by the table and having a forming surface corresponding to the shape to which the bars are to be bent, means for clamping one end of a bar to said block, a companion block mounted on said stationary frame adjacent said forming surface, driving means for said table, a main forward driving member, a main reverse driving member, clutch mechanism for each main driving member, clutch actuating mechanism mounted on said stationary frame, means for moving the clutch actuating mechanism to connect the main forward driving member with the driving means to cause forward movement of the table whereby the bar is drawn over the companion block and pressed by said block against the forming surface to be bent, latch mechanism rendered effective upon movement of said clutch actuating mechanism to lock said clutch actuating mechanism in position to hold the main forward driving member in connection with the driving means, means controlled by the forward movement of the table to actuate the latch mechanism to release the clutch mechanism, means acting upon the release of said clutch actuating mechanism to move the clutch actuating mechanism to disconnect the main forward driving member and to connect the main reverse driving member with the driving means whereby the table is restored to its normal position, means controlled by the reverse movement of the table to move the clutch actuating mechanism to a neutral position in which both main driving members are disconnected from the driving means, and brake mechanism automatically acted upon during movement of the clutch actuating mechanism to neutral position to stop the machine when such neutral position is reached.

9. In a machine for bending metal bars, the combination of a stationary supporting frame, a table rotatably pivoted in said frame, a forming block carried by the table and having a forming surface corresponding to the shape to which the bars are to be bent,

means for clamping one end of a bar to said block, a companion block mounted on said stationary frame adjacent said forming surface, driving means for said table, a main forward driving member, a main reverse driving member, clutch mechanism for each main driving member, clutch actuating mechanism mounted on said stationary frame, means for moving the clutch actuating mechanism to connect the main forward driving member with the driving means to cause forward movement of the table whereby the bar is drawn over the companion block and pressed by said block against the forming surface to be bent, latch mechanism rendered effective upon movement of said clutch actuating mechanism to lock the said clutch actuating mechanism in position to hold the main forward driving member in connection with the driving means, means controlled by the forward movement of the table to actuate the latch mechanism to release the clutch actuating mechanism, means acting upon the release of said clutch actuating mechanism to move the clutch actuating mechanism to disconnect the main driving member and to connect the main reverse driving member with the driving means whereby the table is restored to its normal position, means controlled by the reverse movement of the table to move the clutch mechanism to a neutral position in which both main driving members are disconnected from the driving means, and brake mechanism engaged by the clutch mechanism during its movement to its neutral position and actuated whereby to stop the machine when such neutral position is reached.

In witness hereof, I hereunto subscribe my name this 30 day of July A. D. 1909.

JOHN F. GAIL.

Witnesses:

GUS JACOB,

C. E. HAWLEY.