

Sept. 21, 1971

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3,606,786

SINGLE BAR MODULE BENDER

Filed April 17, 1969

5 Sheets-Sheet 1

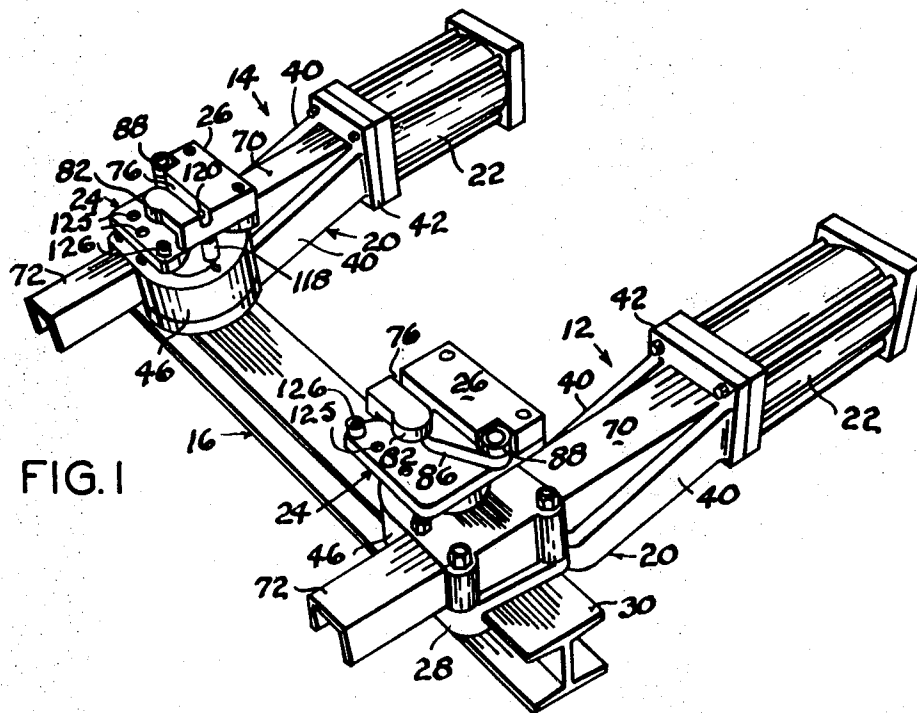


FIG. 1

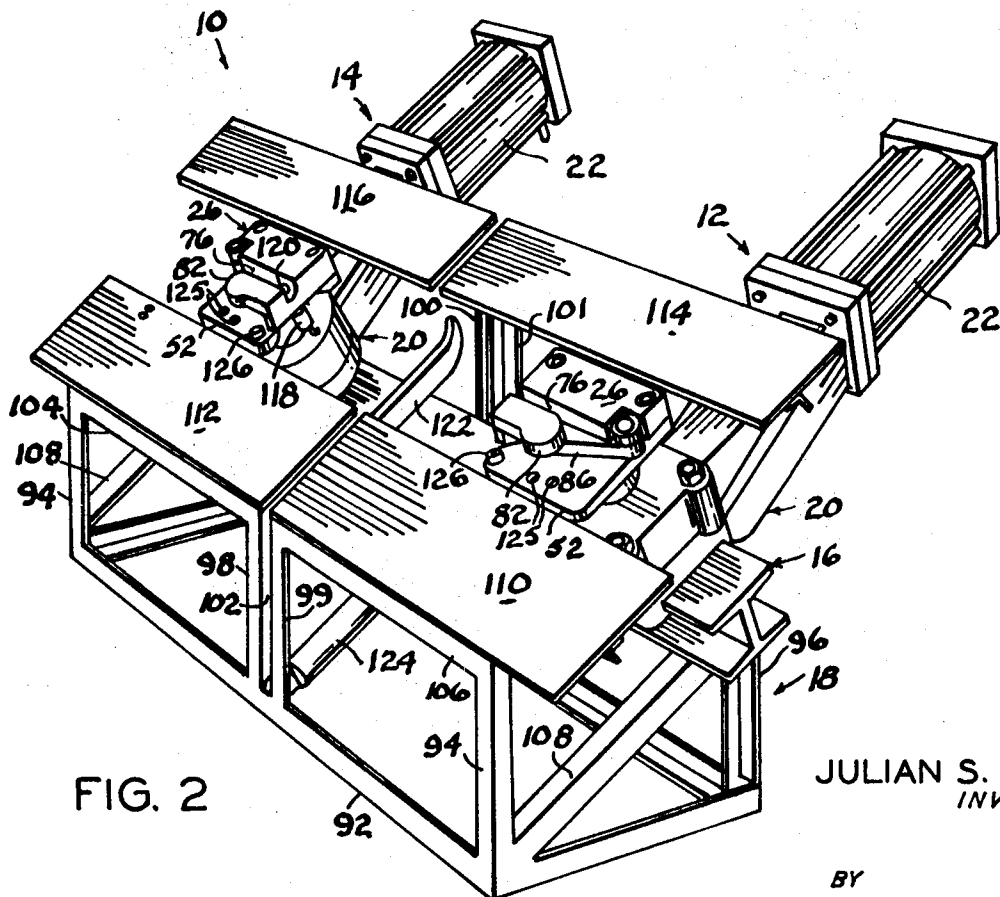


FIG. 2

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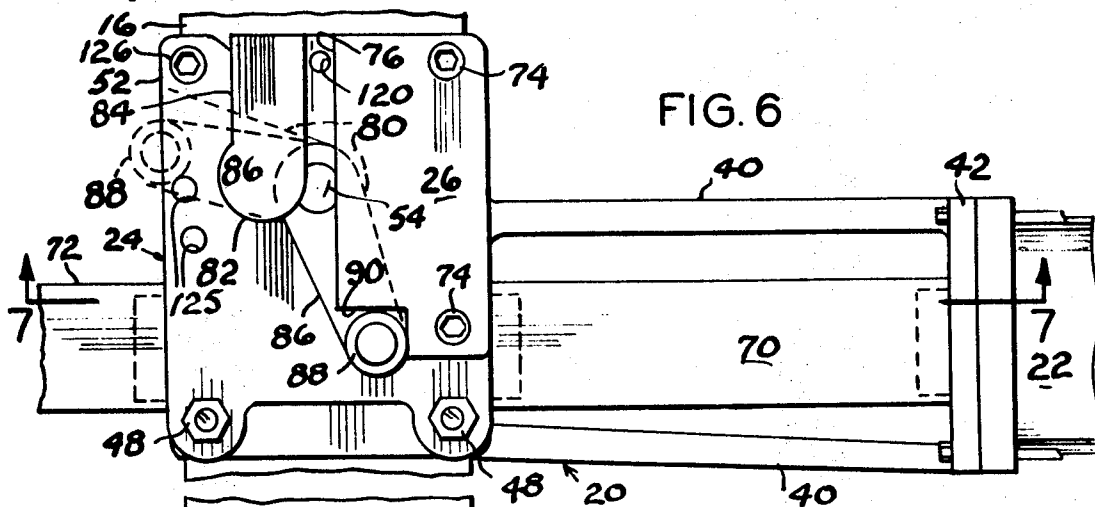


FIG. 6

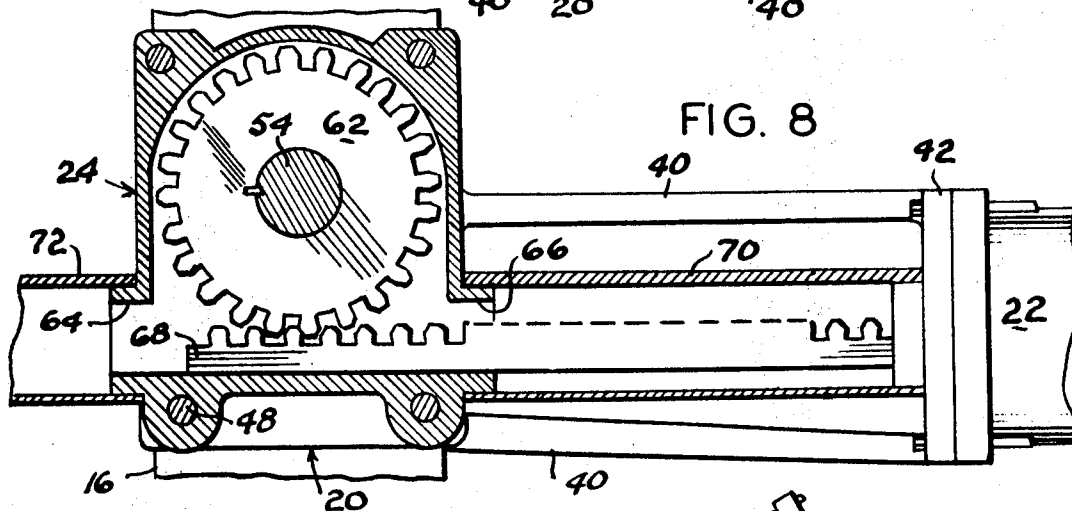


FIG. 8

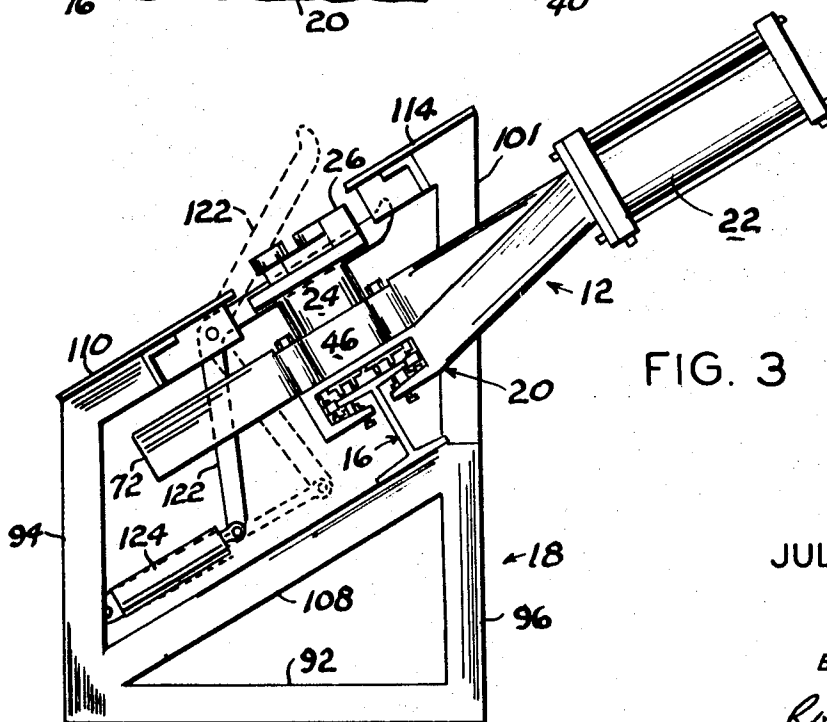


FIG. 3

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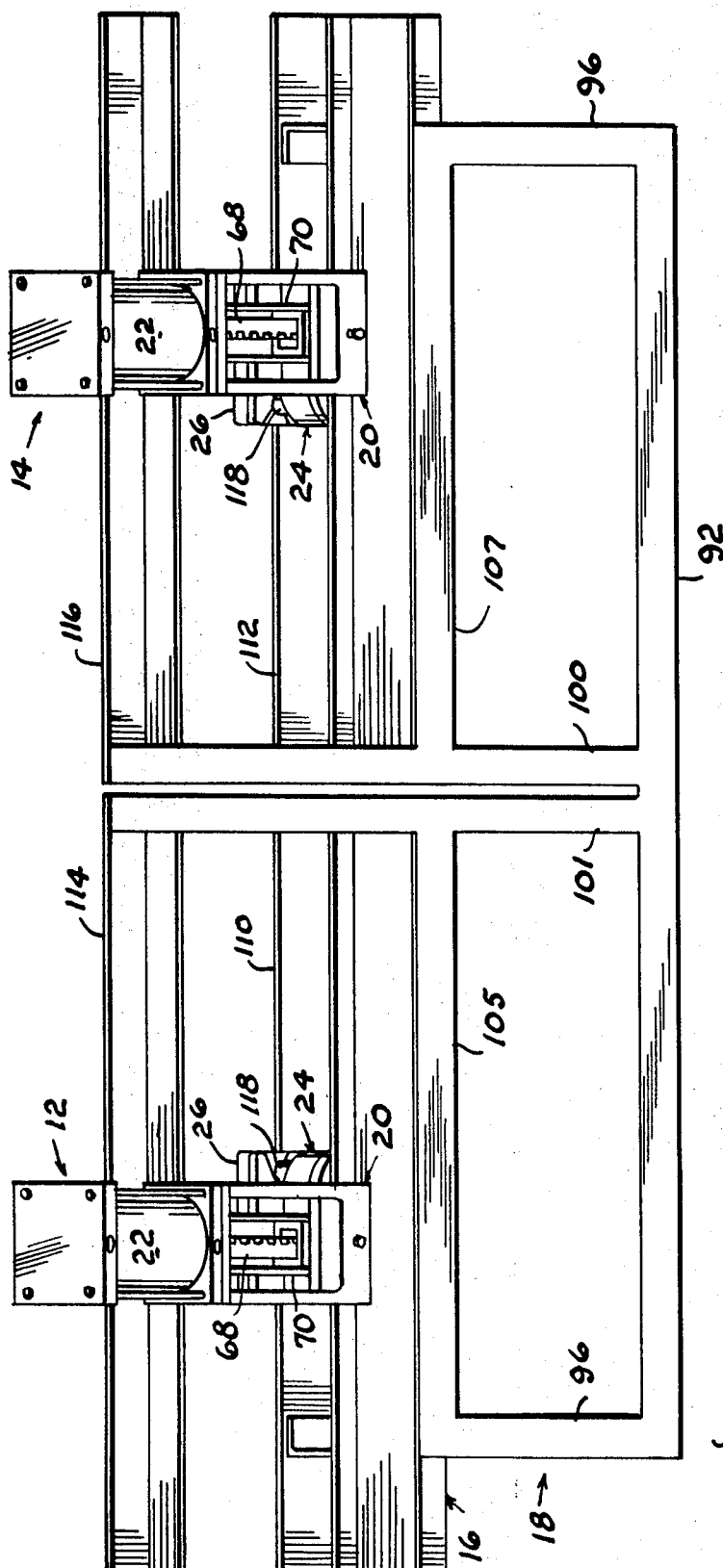


FIG. 4

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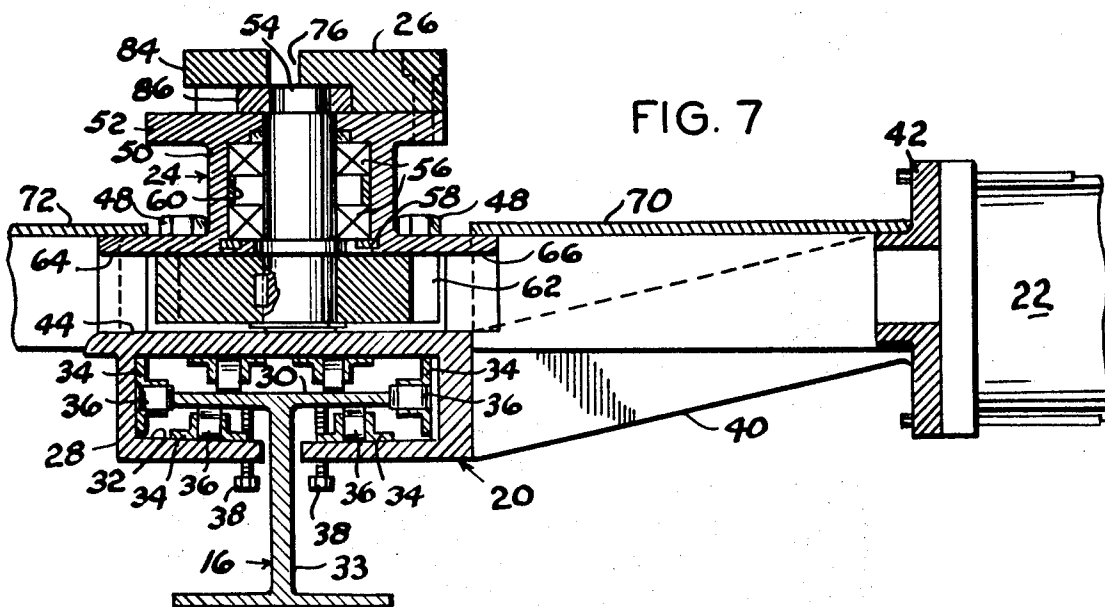
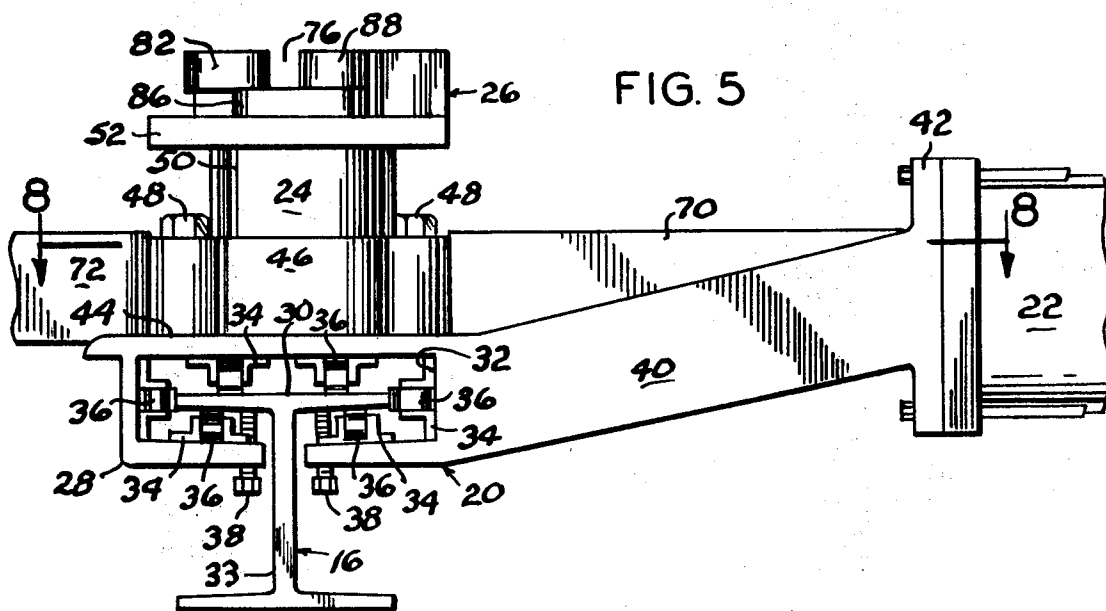
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SINGLE BAR MODULE BENDER

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5 Sheets-Sheet 4



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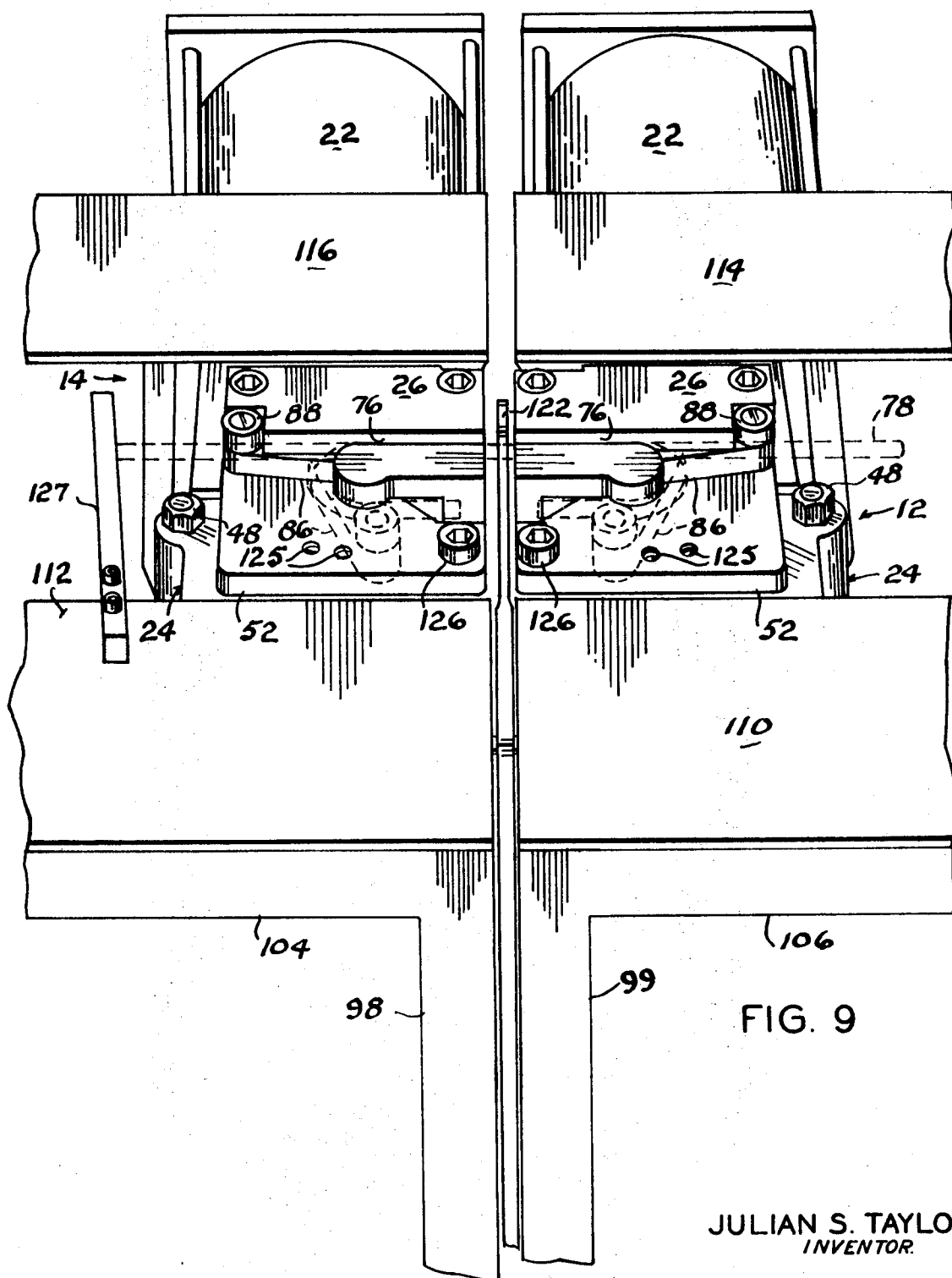
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SINGLE BAR MODULE BENDER

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5 Sheets-Sheet 5



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SINGLE BAR MODULE BENDER

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U.S. Cl. 72—321

4 Claims

ABSTRACT OF THE DISCLOSURE

A bending machine including a rotatable shaft secured to one end of a pitman. Means on the bending machine loosely positions an end portion of a rod to be bent with the longitudinal axis of the rod extending diametrically across the axis of the shaft and forms an arcuate bending shoulder having its axis off-set laterally and toward the other end of the rod with respect to the free end of the pitman. Means on the free end of the pitman, on that side of the rod to be bent opposite the bending shoulder, force bends the rod around the bending shoulder in response to rotation of the shaft in one direction.

BACKGROUND OF THE INVENTION

(1) Field of the invention

The present invention relates to bending machines and more particularly to a bender for rods, or the like.

Most bending machines provide a central arbor or mandrel mounted on a rotating apertured plate so that the bending pin or finger may be placed in a selected one of the apertures to engage an end portion of a rod or bar and force bend it around the mandrel. This type of bending action exerts a longitudinal pull or movement of the rod or bar around the mandrel rather than bending it from a fixed position. Therefore, when a bar is to be bent, for example to form a double hook or return bend at each end, one end portion of the bar must be bent in the bending machine and then the bar reversed end for end to form the other bend. If two benders simultaneously attempt to bend both ends of a bar, the bar would be stretched or the benders would be pulled out of their foundations.

(2) Description of the prior art

As mentioned hereinabove, conventional benders bend an end portion of the bar around a mandrel concentrically positioned on a rotating plate which results in moving the bar longitudinally from the direction of its other or unbent section toward the bend. This invention forms the bend by rotating a pitman against the end portion of a bar to be bent around an arcuate bending shoulder wherein the pivoting axis of the pitman is off-set with respect to the axis of the bending shoulder in a manner to eliminate longitudinal movement of the bar toward the position of the bend.

There are no bending machine patents of which I am aware which accomplish this function, namely, simultaneously forming bends in both end portions of a bar.

SUMMARY OF THE INVENTION

The single bend module bender includes a cylinder support mounted at one end on a beam and connected with a power cylinder at its other end. A housing is mounted on the beam connected end of the cylinder support. The housing journals a shaft having a gear thereon in mesh with a gear rack reciprocated by the power cylinder for rotating the gear in a to and fro action. One end of the shaft projects above the housing and is connected with one end of a pitman which journals a bar engaging roller at its other end. A bending plate overlies the pitman and housing and is provided with a bar receiving slot

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extending diametrically across the axis of the shaft and forms an arcuate bending shoulder having its axis off-set with respect to the axis of the shaft and pitman roller in a direction to progressively shorten the radius of the bend being formed in the bar around the bending shoulder in response to rotation of the pitman. In the example illustrated, a pair of the single bend module benders are positioned in parallel relation on a beam for movement toward and away from each other according to the length of the bar to be bent.

The principal object of this invention is to provide a single bar module bending means for simultaneously forming bends in opposing end portions of a bar.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a pair of cooperating bender modules, per se;

FIG. 2 is a perspective view of the modules of FIG. 1 supported by a frame;

FIG. 3 is an end elevational view, to a larger scale, of FIG. 2;

FIG. 4 is a rear elevational view of FIG. 3;

FIG. 5 is a fragmentary side elevational view, to a larger scale, of FIG. 1 rotated to a horizontal position;

FIG. 6 is a fragmentary top view of FIG. 5;

FIG. 7 is a vertical cross-sectional view, partially in elevation, taken substantially along the line 7—7 of FIG. 6;

FIG. 8 is a fragmentary cross-sectional view, partially in elevation, taken substantially along the line 8—8 of FIG. 5; and

FIG. 9 is a fragmentary front elevational view, to a further enlarged scale, illustrating, by solid and dotted lines, a bar bending action of the modules.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Like characters of reference designate like parts in those figures of the drawings in which they occur.

In the drawings:

The reference numeral 10 indicates, as a whole, a pair of the benders 12 and 14 adjustably mounted and supported in parallel relation on an elongated I-beam or rail 16 in turn supported by a frame or stand 18. The benders 12 and 14 are mirror images of each other and in the interest of brevity, only the bender 12 will be described in detail.

Referring now more particularly to FIGS. 5 through 8, the bender 12 comprises a cylinder support 20, pressure cylinder 22, housing assembly 24 and a head or table 26. The cylinder support 20 comprises an enlarged end portion 28 which extends transversely across the upper flange 30 of the rail 16 and is transversely provided with a downwardly open tongue-groove or slot 32 which loosely surrounds the rail flange 30 and its stem 33. A plurality of roller journalling brackets 34 are secured to the respective walls of the support defining the slot 32 so that these rollers 36 contact the respective upper, lower and side surfaces of the rail flange 30, as viewed in FIGS. 5 and 7, for movement of the support 20 longitudinally of the rail for the reasons presently explained. Alternatively, the roller type chains, or the like, may be secured to the rail or the walls forming the slots 32 to achieve the adjustable movement of the module benders 12 and 14 along the rail.

The support 20 is maintained in a selected position on the rail by set screws 38, or the like, threadedly engaged with the support and frictionally contacting the depending surface of the rail flange 30. A pair of spaced-apart arms 40, integrally connected with the cylinder support end portion 28, project laterally of the rail 16 and are integrally joined to a centrally apertured end plate 42 di-

mentioned for connection with one end of the pressure cylinder 22 for supporting the latter in a conventional manner.

As shown in FIG. 5, the arms 40, at their ends opposite the rail 16, project angularly upward above the plane defined by the rail flange 30, so that the longitudinal axis of the cylinder 22 is positioned above the upper surface 44 of the support end portion 28 for the purposes presently apparent.

The housing 24 is substantially spool-like in side elevation comprising a thickened base portion 46 overlying and secured to the upper surface 44 of the cylinder support by bolts 48 with its stem portion 50 extending upwardly from the base portion 46 and terminating in an upper flange 52 parallel with respect to the base portion 46 and forming an upper surface. The housing 24 is centrally bored for receiving a vertical shaft 54 and is counter-bored from its depending end for receiving bearings 56 in the counterbore which journal the shaft 54. A ring clip 58 and spacer 60 maintain the bearings in place. The housing base 46 is further counterbored for receiving a spur gear 62 which is coaxially secured to the depending end of the shaft 54. The housing base 46 is provided with laterally projecting aligned openings 64 and 66 disposed above the cylinder support surface 44 at one side of the spur gear 62 and longitudinally aligned with the axis of the pressure cylinder 22. A spur rack 68, in mesh with the teeth of the spur gear 62, extends longitudinally through the housing openings 64 and 66 and is connected at one end portion with the piston, not shown, of the cylinder 22 which reciprocates the rack 68 as hereinafter explained.

An inverted U-shaped channel 70 overlies the rack 68 between the adjacent surfaces of the housing 24 and support plate 42 as a guard for the rack. Similarly a second inverted channel member 72 is secured to the housing walls defining the lateral opening 64 as a guard for the rack when extended during the bend forming action as hereinafter explained.

The head or table 26 is substantially plate-like in general configuration and overlies the spool top or flange 52 and is secured thereto by set screws 74. The table 26 is provided in its upper surface with an upwardly open slot 76 extending parallel with respect to the longitudinal axis of the rail 16 and diametrically across the vertical axis of the shaft 54. The slot 76 is dimensioned for loosely receiving an end portion of a bar or rod 78 (FIG. 9). The table 26 overlies the upper end of the shaft 54 and that portion of the table 26 overlying the shaft is angularly undercut from its bottom surface substantially one-half its thickness, along the dotted lines 80 (FIG. 6), so that a portion of the table overhangs, in spaced relation the upper end portion of the shaft 54. One side wall forming one side of the rod receiving slot 76 is tangent to a surface which forms an arcuate shoulder 82 greater than 180° curved around a vertical axis in a direction opposite the cylinder 22 with the curve of the shoulder 82 terminating in lateral spaced relation with respect to the side edge 84 of the table opposite the cylinder 22. As may be seen from an examination of FIG. 6, the vertical axis of the shoulder 82 is off-set laterally with respect to the longitudinal axis of the slot 76 and off-set, toward the end of the slot opposite the shoulder, with respect to a diametric line taken through the axis of the shaft 54 perpendicular to the longitudinal axis of the slot. The undercut portion of the table, indicated by the dotted lines 80, is for the purpose of receiving a bending finger or pitman 86 which is rigidly secured coaxially at one end portion to the upper end of the shaft 54. The opposite end of the pitman 86 has secured thereto on its upper surface a roller 88 normally nested by a socket 90 formed in the end surface of the table 26 in laterally off-set relation with respect to the adjacent surface of the table forming one side wall of the slot 76 opposite the bending shoulder 82 so that the pitman roller 88, in its inactivated position, is

normally off-set laterally of the rod 78 when received by the slot 76.

Referring to FIGS. 2, 3 and 4, the frame 18 is substantially rectangular in general configuration formed of angle iron members, or the like, comprising an interconnected base portion 92 joined to forward and rearward end legs 94 and 96, respectively, and intermediate spaced-apart parallel legs 98-99 and 100-101. The intermediate legs form a vertical upwardly open slot 102 medially the length of the frame for the purposes presently explained.

The forward end legs 94 and forward intermediate legs 98-99 are interconnected by top members 104 and 106. Similarly the rear legs 96 are joined to the rear intermediate legs 100-101 by members 105 and 107. End braces 108 extend angularly forward and downwardly from the upper end of the respective rear end legs 96 toward the depending end of the respective forward leg 94 and base 92 which receive and support adjacent the rearward legs, the rail 16 having the benders 12 and 14 supported thereon on respective sides of the rearward intermediate legs 100-101. Forward frame top plates 110 and 112, elongated rectangular in configuration, overlie the forward edge portion of the frame in cooperating spaced relation with respect to the slot 102 and extend angularly upwardly in the plane of the housing spool end portion 52. The respective forward legs are extended angularly upward toward the benders 12 and 14 to support the plates 110 and 112. The plates 110 and 112 project laterally of the respective ends of the frame 18 co-extensive with respect to the length of the rail 16. A pair of upper similar frame top plates 114 and 116 are similarly mounted on the rearward intermediate legs 100-101 in longitudinal aligned relation and in the plane of the upper surface of the table 26. As shown in the drawings these plates 110-112 and 114-116 are arranged in parallel spaced relation on respective sides of the bender tables 26 for access to the latter between these plates.

As shown more clearly in FIGS. 1 and 2, a one-way acting pressure cylinder 118 is mounted on the housing 24 above its base 46 and below the table 26 and below the end portion of the slot 76 opposite the bending shoulder 82, for initially lifting the rod 78 out of the slot 76 after the bend is completed. This is accomplished by forming a hole or bore 120 in the end portion of the slot 76 overlying the one-way acting cylinder 118 coaxial with respect to the piston, not shown, of the cylinder 118 so that when the cylinder is actuated its piston rod is extended outwardly through the bore 120 to contact the rod 78 and lift, or partially lift, the rod out of the slot.

A rod ejecting crank arm or finger 122 is positioned within the slot 102 below the plane of the frame top plates and is pivotally connected with the frame for vertical pivoting movement through the slot and ejecting a fabricated rod as hereinafter explained. One end portion of the finger 122 is pivotally connected with another pressure cylinder 124, pivotally connected with the frame, for actuating the finger 122 after the initial lifting action of the one-way acting cylinder 118.

OPERATION

When used for simultaneously bending opposite ends of a rod the benders 12 and 14 are positioned in a selected position in accordance with the length of the rod 78 to have bends formed in respective end portions thereof. The rod 78 is manually positioned within the aligned rod receiving slots 76, as shown in FIG. 9, wherein the benders 12 and 14 have been moved toward each other for bending a relatively short rod. While the spur gear 62, gear rack 68 and cylinder 22 is illustrated and described as a preferred means for rotating the shaft 54 and pitman 86, it seems obvious that other shaft rotating means may be utilized such as a conventional motor driven gear train driving a chain entrained around a sprocket mounted on the shaft 54 in place of the spur gear. The longitudinal position of the rod 78 with respect

to the benders is guided by a stop 127 (shown only in FIG. 9), adjustably secured to the plate 112 so that one end of the rod may be positioned against the stop. The cylinders 22 are actuated to extend their pistons and move the gear rack 68 thus rotating the spur gear 62 which in turn rotates the pitmans 86. The pitman rollers 88 contact the respective end portion of the rod 78 and bend it around the bending shoulder 82, shown by the dotted line position of the pitman (FIGS. 6 and 9) thus bending the rod 78, as shown by dotted lines in FIG. 9. It will be noted that the axis of rotation of the pitman 86 is the vertical axis of the shaft 54 which, being off-set with respect to the vertical axis of the bending shoulder 82, thus eliminates any axial or longitudinal movement of the rod toward the bend by virtue of the decreasing radius of the bend being formed around the bending shoulder 82 by such off-set positions of the vertical axis. The housing flange 52 is provided with a plurality of threaded apertures 125 for receiving a stop pin 126 for contact by the pitman 86 and limiting the rod bending action as desired. When the bend has been completed and the cylinders 22 are returned to position the pitmans in the solid line position in FIGS. 6 and 9, the cylinders 118 are actuated to initially lift the rod 78 and the cylinder 124 is actuated to pivot the ejecting finger 122 which lifts the fabricated rod 78 out of the table slots 76 for deposit on the inclined surface of the plates 110 and 112 thus completing one cycle of the operation.

Obviously the invention is susceptible to changes or alterations without defeating its practicability, therefore, I do not wish to be confined to the preferred embodiment shown in the drawings and described herein.

I claim:

1. A rod bending machine, comprising:

a housing having an upper surface;
a shaft vertically journaled by said housing and projecting above said upper surface;
means for rotating said shaft;

a plate-like table overlying said upper surface,
said table having a transverse slot in its upper surface extending diametrically across the upper end of said shaft for freely receiving one end portion of a rod to be bent,

said table having an outer substantially semicircular surface tangent with and extending laterally of one side of the slot, forming a bending shoulder, the vertical axis of said shoulder being laterally off-set with respect to the longitudinal axis of the slot and off-set toward the other end portion of a rod to be bent with respect to a diametric line taken through the vertical axis of said shaft perpendicular to the longitudinal axis of the slot,

said table being undercut from its lower surface in that area underlying and extending transversely of that end portion of the slot overlying said shaft and extending beyond the axis of said shaft and said bending shoulder toward the other end of the slot;

a pitman connected at one end portion with said shaft, the other end portion of said pitman projecting beyond and laterally of the undercut end portion of the slot opposite the position of said bending shoulder; and

a roller journaled by said other end portion of said pitman on an axis parallel with respect to the axis of said shaft,

the spacing between the periphery of said roller and the axis of said shaft being substantially equal to one and one-half times the diameter of a rod to be bent combined with the diameter of said bending shoulder.

2. A rod bending machine, comprising:

a housing having an upper surface;
a shaft vertically journaled by said housing and projecting above said upper surface;
means for rotating said shaft;

a pitman connected at one end portion with said shaft;
a roller journaled by the other end portion of said pitman on an axis parallel with respect to the axis of said shaft;

a table mounted on the upper surface of said housing and overlying at least a portion of the shaft connected end of said pitman; and,

rod locating means on said table for positioning an end portion of a rod to be bent with its longitudinal axis intersecting the axis of said shaft,

said table having a bending shoulder defined by an outer at least semi-circular surface tangent with and extending laterally of the surface of a rod to be bent opposite said roller, the vertical axis of said shoulder being laterally off-set with respect to the longitudinal axis of a rod to be bent and off-set toward the other end portion of a rod to be bent with respect to a diametric line taken through the vertical axis of said shaft perpendicular to the longitudinal axis of the rod to be bent,

the spacing between the periphery of said roller and the axis of said shaft being substantially equal to one and one-half times the diameter of a rod to be bent combined with the diameter of said bending shoulder.

3. Structure as specified in claim 1 in which said rotating means includes:

a spur gear mounted on said shaft;
a gear rack meshing with said spur gear; and,
a pressure cylinder supported by said housing,
said pressure cylinder having a piston rod connected with and reciprocating said gear rack.

4. Structure as specified in claim 2 in which said rod locating means includes:

a spur gear mounted on said shaft;
a gear rack meshing with said spur gear; and,
a pressure cylinder supported by said housing,
said pressure cylinder having a piston rod connected with and reciprocating said gear rack.

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72—217, 459