Oct. 6, 1942. J. F. STAROBA 2,297,809

PIPE BEND MACHINE

Filed April 1, 1940

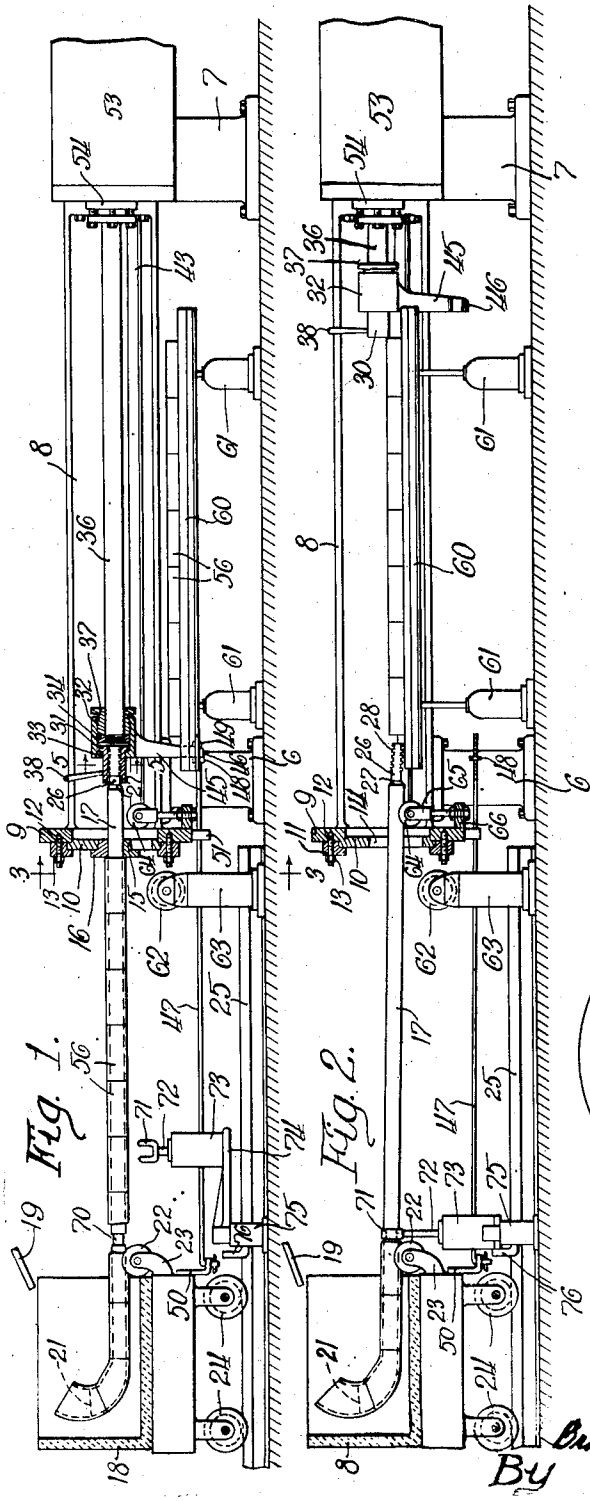


Fig. 1.

Fig. 2.

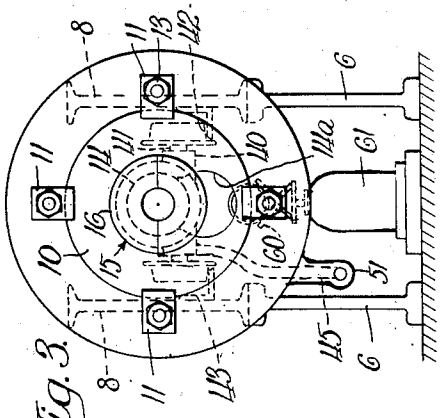


Fig. 3.

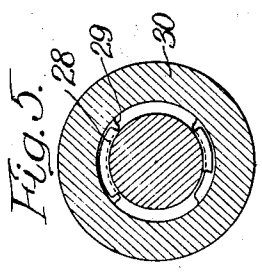


Fig. 5.

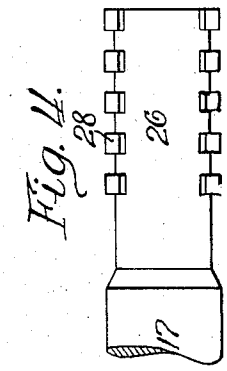


Fig. 4.

Inventor:
Joseph F. Staroba
By Brown, Jackson, Boettcher & Dienner
Attys.

Patented Oct. 6, 1942 2,297,809

UNITED STATES PATENT OFFICE

2,297,809

PIPE BEND MACHINE

Joseph F. Staroba, Chicago, Ill., assignor to Taylor Forge & Pipe Works, Cicero, Ill., a corporation of Illinois

Application April 1, 1940, Serial No. 327,111

8 Claims. (Cl. 153—48)

My invention relates to the manufacture of pipe fittings, such as elbows, U-bends, and analogous articles.

It is known to produce pipe bends by forcing straight tubular blanks over a curved enlarging mandrel, by relative movement between the latter and the blanks, thus forming bends of greater diameter than the blanks.

The instant invention is directed to the provision of a machine of comparatively simple construction and operation for producing bends in the above manner with expedition and facility. More specifically, it has to do with a machine having a pull rod extending from the mandrel of appropriate length for receiving a plurality of blanks, in association with means for moving the rod lengthwise, comprising quick detachable coupling means, and means for positioning a plurality of blanks for movement onto the pull rod over the rearward end thereof, by means of the mechanism for operating the rod, whereby the blanks may be loaded onto the pull rod with a minimum of delay, to the end of increased production and corresponding lowered cost. Further objects and advantages of my invention will appear from the detail description.

In the drawing:

Figure 1 is a central lengthwise vertical sectional view of a pipe bend machine embodying my invention, showing the parts in the positions which they occupy when the mandrel rod is in its forward position ready to be pulled rearward for forcing the blanks over the mandrel, certain parts beng shown in elevation, and other parts being partly broken away;

Figure 2 is a view similar to Figure 1 but showing the parts in the position which they occupy when a plurality of blanks is to be loaded onto the mandrel rod;

Figure 3 is a sectional view taken substantially on the line 3—3 of Figure 1, on an enlarged scale, omitting the mandrel rod and the blanks thereon, and the furnace draw bar;

Figure 4 is a detail view, on an enlarged scale, of the rearward end of the mandrel rod; and

Figure 5 is a sectional view, on an enlarged scale, taken substantially on line 5—5 of Figure 1.

The frame of the machine may be of any suitable construction and, as shown, comprises uprights or standards 6 and 7 appropriately anchored to a suitable foundation, these standards supporting side I-beams 8 suitably secured thereon. An annular cross member 9 is suitably secured, as by welding or by other suitable means, to the forward ends of I-beams 8. An annular plate 10, circumferentially rabbetted, is appropriately mounted on the front face of cross member 9, as by means of suitably disposed clips 11 and associated studs 12 and nuts 13. Plate 10 is provided with a rearwardly tapering circular opening 14, concentric with cross member 9, this opening receiving the two sections of the correspondingly tapered split ring 15 provided, at its forward end, with an outer flange 16, seating against the front face of plate 10.

Split ring 15 fits snugly, but not tightly, about a mandrel rod 17, extending forwardly thereof into a head or furnace 18. Suitable means, conveniently one or more gas burners 19, is provided for heating blanks on the rod 17 and on a suitably curved enlarging mandrel 21 secured to the forward end of rod 17, within furnace 18. A grooved roller 22 is supported, by means of a bracket 23 suitably secured to the furnace, in position for supporting the forward portion of the mandrel rod and the blanks thereon. Furnace 18 is suitably mounted on wheels 24 traveling upon parallel rails, one of which is shown at 25, extending forwardly from the frame in alignment therewith.

The rearward end portion of mandrel rod 17 is formed to provide a reduced neck 26 connected to the body portion of the rod by an outwardly and forwardly inclined shoulder 27. Neck 26 is provided, at opposite sides thereof, with a series of mutilated threads 28 disposed for interengagement with two series of mutilated threads 29 disposed interiorly of a coupling member 30, open at its forward end and defining a socket which receives the neck 26 of rod 17. Coupling member 30 is provided, at its rear end, with an outer circumferential base flange 31 disposed within a sleeve 32 provided at its forward end with an inwardly extending circumferential flange 33 which seats against the forward face of flange 31. A collar 34 is screwed or otherwise appropriately secured upon the forward end of a piston rod 36, within sleeve 32, and a nut 37 fits about piston rod 36 and screws into sleeve 32, from the rearward end thereof, the forward end of this nut seating against collar 34. In that manner coupling member 30 is attached to piston rod 36 for movement therewith and may be turned for coupling and uncoupling mandrel rod 17 to and from sleeve 32, the coupling means being similar, in construction and operation, to locking means of known type such as is commonly employed for locking breech blocks in guns. Conveniently, coupling member 30 is provided with a handle 38

to facilitate turning of that member in desired direction.

Sleeve 34 is provided, at opposite sides of its lower portion, with laterally extending tubular bosses 40, in which are suitably secured stub shafts 41 carrying flanged wheels 42 which travel upon angle rails 43 suitably secured to the inner faces of I-beams 8. The sleeves 32 and the parts carried thereby thus constitute a cross-head mounted upon the rails 43 for reciprocation lengthwise of the frame. This cross-head is provided, at one side thereof, with a suitably disposed depending arm 45 having, at its lower end, an eye 46 which receives the rearward end of a furnace drawbar 47. This end of the drawbar is threaded for reception of two nuts 48 and 49 disposed at the front and at the back, respectively, of eye 46, and the forward end of the drawbar is suitably attached to furnace 18, as by being bent at right angles and inserted through a plate 50 suitably secured to the rearward end of the furnace. Conveniently, cross member 9 is provided with a depending finger 51 suitably apertured for reception of drawbar 47. When this bar is secured to arm 45 of the cross-head, as shown in Figure 1, furnace 18 will be moved along the rails 25 with the cross-head, maintaining constant the relation between the latter and the furnace. The nuts 48 and 49, in conjunction with the threaded portion of drawbar 47, provide convenient means of adjusting the effective length of the drawbar, for positioning the mandrel 21 in the furnace 18 to best advantage with respect to heating of the blanks.

Piston rod 36 extends rearward into a cylinder 53, through a stuffing box 54, the forward end of this cylinder being bolted or otherwise suitably secured to I-beams 8. A piston (not shown) is mounted for reciprocation within cylinder 53 and is suitably secured to the rearward end of piston rod 36. The cylinder 53 is shown fragmentarily only and is, of course, of appropriate length and supported in a suitable manner, as by a suitable rearward extension of the main frame of the machine and appropriate supports and securing means associated therewith. It will be understood that suitable means is provided for admitting and exhausting liquid under pressure to and from the interior of cylinder 53, at opposite sides of the piston therein, for moving the piston rod 36 forward and rearward at the desired rate and thus reciprocating the cross-head and the parts attached thereto. Piston and cylinder means of this type for reciprocating a cross-head or other member attached to a piston rod is known, and it is not thought necessary to describe such means in greater detail here. Any other suitable means may be provided, within the broader aspects of my invention, for imparting desired movement in either direction to the mandrel rod or for reciprocating the cross-head. Suffice it to state that suitable means is provided for imparting the desired reciprocatory movement to the cross-head and the mandrel rod.

Mandrel rod 17 is of a length to receive thereon a plurality of straight tubular blanks 56, disposed in endwise contact, of a length to form desired bends when forced over the mandrel 21. In Figure 1, the parts are shown in the positions which they occupy at the beginning of the draw stroke, for forcing the blanks 56 successively over the mandrel in the rearward movement of mandrel rod 17, as a continuous operation. In the positions of the parts shown, the rearward end of the rearmost blank upon rod 17 seats in a recess in the front face of split ring 15, the latter providing an abutment for the rearmost blank. Piston rod 36 is then forced rearward, thus pulling mandrel rod 17 rearward and forcing the blanks successively over the mandrel 21, until the piston rod reaches the limit of its rearward effective stroke. That completes a drawing operation, at the end of which a partially formed blank may remain upon the mandrel 21, with several blanks remaining upon the mandrel rod 17 and the rearward portion of the mandrel, as shown in Figure 2. The mandrel rod is then again charged with blanks, and the drawing operation is repeated.

A trough 60 of substantially inverted V-shape in cross section, conveniently formed of two angle members welded together, is supported for vertical movement by two hydraulic jacks 61. The vertex of this trough is disposed in the vertical plane of the common axis of mandrel rod 17 and piston rod 36. The trough 60 is of proper length to receive a suitable number of blanks 56 disposed thereon end to end for charging the mandrel rod 17. In its normal lowered position, trough 60 is disposed below mandrel rod 17 and piston rod 36 and spaced therefrom a proper distance such that the blanks 56 in the trough clear the cross-head and the parts carried thereby, so as not to interfere with operation of the machine in the manner above described. Liquid under pressure may be supplied to and exhausted from the jacks 61 for raising and lowering the trough, means for thus operating the jacks being well known and requiring no illustration nor detailed explanation here.

During the drawing operation, the proper number of blanks is placed in the trough 60, which is then in its lowered position. At the end of the drawing operation, the mandrel rod 17 is returned to its forward position. A grooved roller 62, carried by a hydraulic jack 63, disposed adjacent cross member 9, is then raised into position to support, in co-operation with roller 22, the mandrel rod 17. The rearward end of the latter rod is then uncoupled from piston rod 36, which is returned to its rearward position. Roller 62 is then moved downward, lowering the rearward end of mandrel rod 17 onto a grooved supporting roller 64, carried by a fork 65 having a depending screw stem adjustable through a bracket 66 welded or otherwise suitably secured to the rearward face of cross member 9, at the lower portion thereof. To permit of this lowering of the rearward end of mandrel rod 17, the sectional blank abutment ring 15 is removed from plate 10, and the latter is provided with an opening 14a of appropriate size extending downward from opening 14. After the rearward end of the mandrel rod has been lowered onto roller 64, roller 62 continues its downward movement until it has been returned to its normal position shown in Figure 2. It will be understood, of course, that furnace drawbar 47 is detached from arm 45 of the cross-head, conveniently by removal of nut 49, preliminary to rearward movement of piston rod 36 for charging the mandrel rod. Accordingly, during such rearward movement of the cross-head, furnace 18 remains in its forward position, as shown in Figure 2.

After the rearward travel of the cross-head, the trough 60 is raised so that, when the cross-head reaches its position shown in Figure 2, trough 60 is in position to dispose the blanks carried thereby between the rearward end of

mandrel rod 17 and the lower portion of the forward end of coupling member 30. The mandrel rod is then disposed at a slight inclination downward and rearward such that the blanks 56 when moved forward along trough 60, by forward movement of the cross-head, will readily pass on to neck 26 of the mandrel rod and be directed by the inclined shoulder 27 onto the body of the rod. In that manner the mandrel rod is charged with the proper number of blanks 56 during the forward stroke of the cross-head.

Blanks 56 may be of such interior diameter as to fit snugly upon the mandrel rod 17, while not having a sufficiently tight fit thereon to provide appreciable frictional resistance to movement of the blanks along the rod. Since the mandrel rod, during charging thereof with blanks, is inclined downward and rearward, the weight of this rod and the associated mandrel may, in most cases, safely be relied upon to prevent forward movement of the mandrel rod during loading or charging thereof. There is the possibility, however, that some of the blanks may have a comparatively tight fit on the mandrel rod, due to slight deformation of the blanks or other causes, such as would tend to cause forward movement of the mandrel rod to an objectionable extent during the loading operation. In order to guard against that, suitable means may be provided for retaining the mandrel rod against such movement. I have shown a simple form of such means, in which the mandrel rod 17 is provided, a suitable distance from the mandrel 21, with a circumferential groove 70. This groove is intended to receive a forked head 71 at the upper end of piston rod 72 of a hydraulic jack 73 operable in a known manner for raising and lowering the head 71. This jack may be mounted upon an arm 74 pivoted to swing about a vertical axis, by means of a stud at the upper end of a post 75 disposed to one side of the furnace track. Normally arm 74 extends parallel with track rails 25 in position to clear the furnace 18 when the latter is moved along the rails. When the furnace is in its forward position, arm 74 may be swung into position to extend across the track, in the rear of the furnace, such swinging movement of the arm being limited by a stop 76 secured to post 75. When jack 73 is thus positioned, boss 71 is disposed below groove 70 in alignment therewith. Upon actuation of jack 73 for moving the fork 71 upward into its operative position, this fork enters groove 70 and effectively restrains mandrel rod 17 against forward movement.

After the blanks 56 have been loaded onto the mandrel rod from trough 60, the cross-head remains in its forward position with the forward end of coupling member 30 in proximity to, but spaced slightly rearward of, the rearward end of mandrel rod 17. Jack 73 is then actuated to lower fork 71 into its normal position, arm 74 being then returned to its normal position clear of the furnace track. The blanks may then be slid along the mandrel rod, a short distance, after which the rearward portion of the mandrel rod is raised, by means of jack 63 and roller 52, sufficiently to dispose this rod in horizontal position with neck 26 thereof aligned with the coupling member 30. The cross-head is then advanced a short distance, sufficient to cause entry of neck 26 of the mandrel rod into coupling member 30, to the proper extent, and the coupling member is then turned so as to cause interengagement of threads 29 thereof with threads 28 of neck 26, thus securing the mandrel rod to the cross-head for movement therewith. After that has been done, the forward travel of cross-head is continued for a short distance, sufficient to provide sufficient clearance between the rearmost blank and plate 10 to permit replacement of the sections of split ring 15 with expedition and facility. In that connection it will be appreciated that when the mandrel rod has been returned to its normal horizontal position and coupled to the cross-head, the roller 62 may be returned to its normal lowered position and the blanks may be slid forward along the mandrel rod into endwise contacting relation. After replacement of the blank abutment ring 15, in the manner stated, nut 49 is screwed onto the furnace drawbar 47, which has been inserted through eye 46 at the lower end of arm 45. The cross-head is then moved rearward, moving the furnace with it. This rearward movement of the cross-head serves first to seat the rearward end of the rearmost blank on the mandrel rod 17 in the recess in the blank abutment ring 15, after which, in the continued rearward travel of the cross-head, constituting the draw stroke of the machine, the blanks are successively forced over the mandrel 21 in the manner above described.

The drawing of my invention herein disclosed is more or less diagrammatic, in certain respects, and discloses only those features which are necessary to an understanding of my invention. In practice, as will be understood by those skilled in the art, changes in construction and arrangement of parts of my invention may be resorted to, without departing from the field and scope thereof, and I intend to include all such variations, as fall within the scope of the appended claims, in this application in which the preferred form only of my invention is disclosed.

I claim:

1. In a pipe bend machine, a reciprocating cross-head, a mandrel rod of a length to receive a plurality of tubular blanks, a mandrel at the forward end of said rod, quick detachable means coupling the rearward end of said rod to said cross-head, removable blank abutment means normally fitting about said rod and confined against rearward movement, means for supporting said rod in its forward position in substantial alignment with said cross-head when detached therefrom, and blank supporting means positionable to dispose blanks between said cross-head and the rearward end of said rod in substantial endwise alignment with the latter and in the path of forward travel of a part carried by said cross-head, when said rod is detached from said cross-head and the latter has been moved rearward away from said rod.

2. In a pipe bend machine, a reciprocating cross-head, a mandrel rod of a length to receive a plurality of tubular blanks, a mandrel at the forward end of said rod, quick detachable means coupling the rearward end of said rod to said cross-head, removable blank abutment means normally fitting about said rod confined against rearward movement, means for supporting said rod in its forward position in substantial alignment with said cross-head when detached therefrom, and a blank receiving trough for supporting a plurality of tubular blanks end to end, said trough normally being disposed to position blanks therein clear of said rod and said cross-head and being positionable to dispose said blanks between said cross-head and the rearward end of said rod in substantial endwise alignment with the latter and in the path of forward travel of a

part carried by said cross-head, when said rod is detached from said cross-head and the latter has been moved rearward away from said rod.

3. In a pipe bend machine, a reciprocating cross-head, a mandrel rod of a length to receive a plurality of tubular blanks, a mandrel at the forward end of said rod, quick detachable means coupling the rearward end of said rod to said cross-head, removable blank abutment means normally fitting about said rod confined against rearward movement, means for supporting said rod in its forward position in substantial alignment with said cross-head when detached therefrom, a blank supporting trough normally disposed below said rod and said cross-head substantially parallel therewith and adapted to support a plurality of tubular blanks in endwise alignment, and means for raising said trough into position to dispose said blanks in substantial alignment with said rod between the rearward end thereof and a part carried by said cross-head, when said rod is detached from said cross-head and the latter has been moved rearward away from said rod.

4. In a pipe bend machine, a mandrel rod of a length to receive a plurality of tubular blanks, a mandrel at the forward end of said rod, means for reciprocating said rod comprising a detachable coupling at the rearward end of said rod, removable means providing an abutment for the rearward end of the rearmost blank on said rod, means for supporting and retaining said rod in its forward position in substantial alignment with said reciprocating means when uncoupled therefrom, and means for positioning blanks between the rearward end of said rod and said reciprocating means for charging of the blanks onto said rod over the rearward end thereof by said reciprocating means, when said rod and said reciprocating means are uncoupled.

5. In a pipe bend machine, a mandrel rod of a length to receive a plurality of tubular blanks, a mandrel at the forward end of said rod, means for reciprocating said rod comprising quick detachable coupling means at the rearward end of said rod, removable means providing an abutment for the rearward end of the rearmost blank on said rod, means for supporting and retaining said rod in its forward position in substantial alignment with said reciprocating means when uncoupled therefrom, and means for positioning blanks between the rearward end of said rod and said reciprocating means for charging of the blanks onto said rod over the rearward end thereof by said reciprocating means, when said rod and said reciprocating means are uncoupled.

6. In a pipe bend machine, a reciprocating member, a mandrel rod of a length to receive a plurality of tubular blanks, a mandrel at the forward end of said rod, means detachably securing the rearward end of said rod to said member, removable means surrounding said rod and providing an abutment for the rearward end of the last blank thereon during the rearward stroke of said rod with said member, means for supporting and retaining said rod in its forward position in substantial alignment with said member when detached therefrom, and means for positioning blanks for charging of said rod, said positioning means being supplementary to and cooperating with said reciprocating member in charging said rod with a plurality of blanks moved thereonto over the rearward end thereof by the forward stroke of said member.

7. In a pipe bend machine, a reciprocating cross-head, a mandrel rod of a length to receive a plurality of tubular blanks, a mandrel at the forward end of said rod, detachable means coupling the rearward end of said rod to said cross-head, removable blank abutment means normally fitting about said rod and confined against rearward movement, means for supporting and retaining said rod in substantial alignment with said cross-head when detached therefrom, and means for positioning blanks for charging of said rod, said positioning means being supplementary to and cooperating with said cross-head in charging said rod when uncoupled from said cross-head with blanks moved onto said rod over the rearward end thereof by forward movement of said cross-head.

8. In a pipe bend machine, a reciprocating cross-head, a mandrel rod of a length to receive a plurality of tubular blanks, a mandrel at the forward end of said rod, quick detachable means coupling the rearward end of said rod to said cross-head, removable blank abutment means normally fitting about said rod confined against rearward movement, means for retaining said rod against forward movement and supporting it in substantial alignment with said cross-head when detached therefrom, and means for positioning blanks for charging of said rod, said positioning means being supplementary to and cooperating with said cross-head in charging said rod when uncoupled from said cross-head with blanks moved onto said rod over the rearward end thereof by forward movement of said cross-head.

JOSEPH F. STAROBA.