Dec. 16, 1947. A. H. ISENBERG ET AL 2,432,666

SHEET METAL BENDING ROLLS

Filed May 17, 1946 2 Sheets-Sheet 1

Fig. 1.

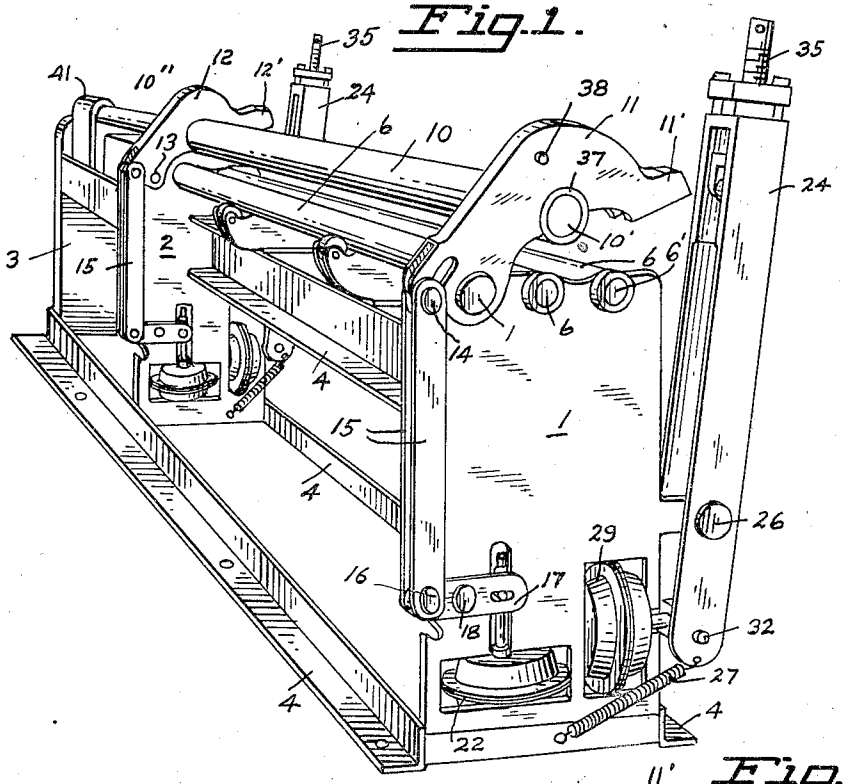


Fig. 2.

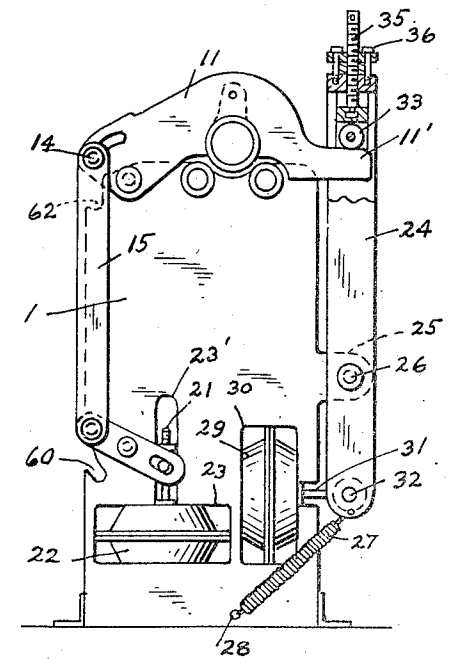
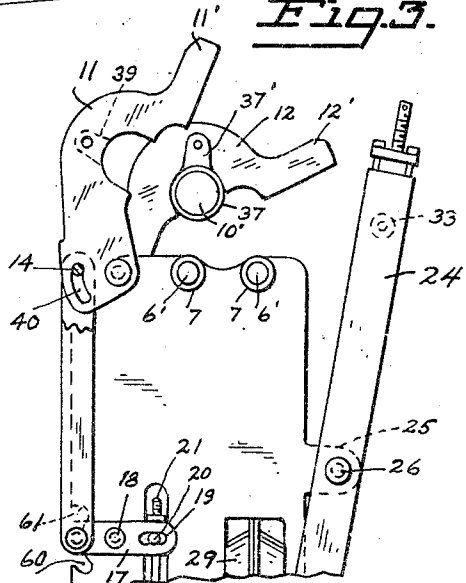


Fig. 3.



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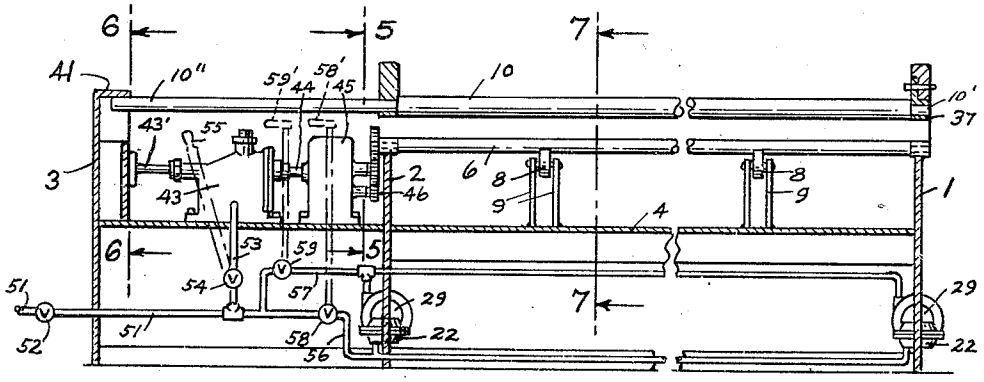


Fig. 4.

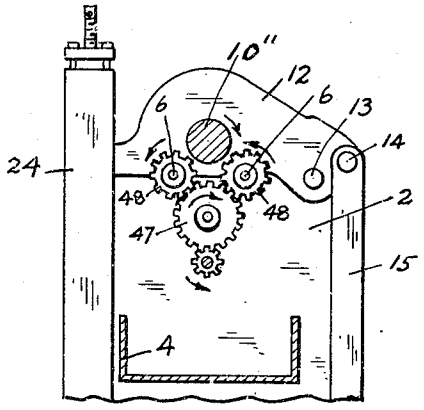


Fig. 5.

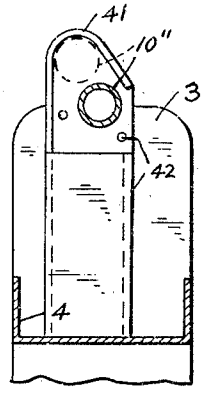


Fig. 6.

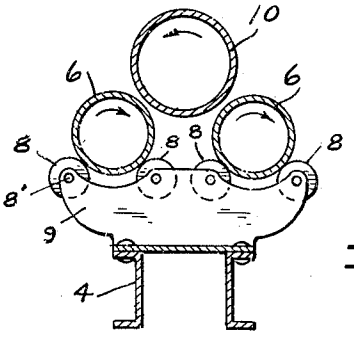


Fig. 7.

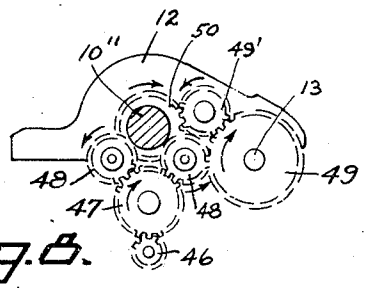


Fig. 8.

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SHEET METAL BENDING ROLLS

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8 Claims. (Cl. 153—61)

1

This invention relates to power actuated rolls for bending or forming sheet metal into tubular form, and the principal object of the invention is to provide improvements in this type of machine whereby its operation is greatly facilitated and the work may be turned out more rapidly.

Particular features and advantages of the invention will appear in the following description and in the accompanying drawings.

In the drawings,

Fig. 1 is a perspective view of the bending roll machine as seen from the tube discharge end, and with the upper pressure roll released.

Fig. 2 is a straight end elevation of the machine showing the pressure roll locked down in operating position and with a portion of one of the locking latch bars broken away to reveal the latch roller.

Fig. 3 is a view similar to that of Fig. 2 but showing the latch bars released and with the nearest yoke of the pressure roll thrown back, leaving its bearing on the free end of the pressure roll.

Fig. 4 is a side elevation of the machine with the frame and some portions in section so as to reveal the assembled operating elements.

Fig. 5 is a vertical cross section of the upper portion of the machine taken along the line 5—5, of Fig. 4.

Fig. 6 is a vertical cross section of the upper portion of the machine taken along the line 6—6, of Fig. 4.

Fig. 7 is a vertical cross section of the upper portion of the machine taken along the line 7—7, of Fig. 4.

Fig. 8 is a view of the pressure roll yoke as of Fig. 5 but showing three more gears for positively driving the pressure roll.

Briefly described the machine comprises a pair of spaced forming rolls, with a pressure roll mounted on pivoted yokes to swing down into pressure applying relation to a sheet of metal placed across the forming rolls and latched, and the operation of the yokes, locking latches, and turning of the rolls all being accomplished preferably by fluid pressure controlled by valves manipulated by an operator at one end of the machine while another operator guides the sheet metal and removes the formed tubes or suitably curved sheet.

In the drawings the frame of the machine includes three vertically disposed plates 1, 2, 3, the first and last being at the extreme ends of the machine (which may be of 20 feet more or less in length) and plate 2 is at an intermediate point

2

spaced from plate 1 at the ends of the length of rolls required.

These plates are securely joined and braced by channels and angle bars generally designated 4 preferably all welded in place to form a long rigid structure.

Extending longitudinally of the frame is a pair of spaced forming rolls 6, 6 which may be solid or hollow, and which rolls are of reduced diameter at their extreme ends as at 6', and rotatably supported in bearings 7 mounted on the upper edge of frame plates 1 and 2.

Rolls 6 are given intermediate support at intervals by any desired number of sets of supporting rollers 8 carried on brackets 9 in turn supported on the frame member 4 of the machine, two such sets being shown in Figs. 1 and 4, and in which figures the brackets 9 will be seen to comprise spaced side plates embracing the pivots 8' at opposite sides of the rollers 8 to firmly support them against outward spreading by the heavy downward pressure to which rolls 6 are subjected.

Extending longitudinally above and between the forming rolls 6, 6 is the main pressure roll 10 which also may be hollow or solid, and which is also preferably of reduced diameter at its ends as at 10' and 10'' (as by a solid bar inserted and secured in the hollow main portion) and which reduced ends are revolvably supported in suitable bearings in overhead yoke members 11, 12 respectively pivoted at one end as at 13 to frame plates 1 and 2, the yokes being preferably bifurcated at their ends and in straddling relation to the frame plates so as to put their pins 13 in double shear.

By means of these yoke mountings the upper or pressure roll 10 may be raised and lowered with respect to the lower or forming rolls 6, and to this end the yokes are each pivoted at their heels outwardly of pivots 13 as at 14 to a pair of vertically disposed links 15 straddling the frame plate, and which links are in turn pivoted at their lower ends as at 16 to one end of a rocker arm 17; also preferably double and straddling the frame plate; and which rocker arm is pivoted at 18 to the frame plate, and pivoted at its opposite end by means of a slot 19 to a cross pin 20 projecting laterally from a plunger rod 21 of a fluid power cylinder device 22 mounted in an opening 23 cut in the frame plate, plunger rod 21 also operating within an extension 23' of this opening.

By the construction above described it will be seen that by operation of the fluid power devices 22 the plunger rods 21 may be forcibly raised to pull links 15 downward and raise yokes 11 and

thereby raise the pressure roll 10, and that upon relaxing of the fluid pressure device the yokes and upper roll may be lowered.

Yokes 11, 12 are each provided with an extending nose 11', 12', at their opposite ends adapted to be engaged by pivoted latch bars 24 and locked down in pressure position as shown in Fig. 2 when the latch bars are swung inward, or released when the latch bars are swung outward as in Figs. 1 and 3.

These latch bars 24 are also preferably of double spaced side construction as indicated and straddle a lug 25 projecting from the frame plate and to which they are pivoted as at 26 nearer to the lower end of the bar so as to form of the bar a longer lever above the point of pivoting.

The lower ends of the latch bars are connected by coiled tension springs 27 hooked at their opposite ends to the machine frame as at 28 so as to normally urge the latch bars to swing outwardly at their upper ends to released position, and they are forcibly swung against the spring tension to locked position, each by a fluid power cylinder device 29 mounted in an opening 30 in the frame plate and provided with a power plunger rod 31 pivotally connected at 32 with the lower end of the latch bar. Thus, when fluid pressure is applied to the power device 29 the latches are locked, and when the fluid pressure is released the latches are opened by releasing springs 27.

In Fig. 2 the upper forward wall of the latch bar 24 is broken away to show a roller 33 carried by the latch bar to engage over the beveled upper side of nose 11' of the yoke and pull it down as the latch bar is swung to latching position.

This roller is carried on a carriage 34 which is mounted to slide vertically within the latch bar and which may be adjusted vertically by means of a pressure screw 35 which may be locked at any point of vertical adjustment as by bolts 36. By this means the final position of the pressure roll may be determined as may be required for the particular thickness of sheet metal being rolled or the curve desired.

When rolling thin sheet metal to tubular form, the rolled shape may easily be removed by springing it open and pulling it out when the rolls are released as in Fig. 1, but if the metal is thick and the tube small it can only be removed by sliding it endwise from the upper roll about which it will be coiled. To meet this latter requirement the outer end 10' of upper roll 10 is removably mounted in yoke 11, effected by providing a ring bearing 37 for the reduced outer end 10' of the roll suspended from the yoke by a pin 38 which passes through a lug 37' extending from the top of the bearing. This lug is preferably tapered toward its upper end and fits in a corresponding recess 39 depressed into the inner side of yoke 11, so that when pin 38 (preferably a taper pin) is knocked out the yoke can be swung back to the position shown in Fig. 3; as permitted by slot 40 in heel of yoke 11; and with the bearing 37 hanging freely on the end of the roll so that it may readily be slid off of the end of the roll (if required) to permit the closely rolled sheet metal tube to be slid endwise from the forming roll 10.

When swinging back the outer end yoke 11 as above described, and shown in Fig. 3, there would be no outboard support for the forming roll which might be projecting anywhere from 10 to 20 feet or more from the other yoke 12 in which it has complete embraced bearing support, but which would break on account of the great overhang of

the upper roll. To obviate this, the roll 10 is also extended in the opposite direction beyond yoke 12 preferably for a distance of from 5 to 10 feet as indicated at 10'' in Fig. 4 and where this extension comes to a stop against the upper end of a fixed socket member 41 rigidly secured as at 42 to the end frame plate 3 of the machine. Thus the roll 10 prevented by this socket from tipping upward or sidewise, and resting with its weight in its bearing in yoke 12, projects freely and firmly forward of yoke 12 for rough handling in sliding off a heavy formed tube, when its outer support by yoke 11 is taken away as described.

As the control of the yokes and latches is preferably by fluid pressure, it is also desirable to drive the rolls by the same source of power, and hence 43 designates any conventional type of fluid pressure operated motor, such as a compressed air motor having a rotary output shaft 44 and which preferably connects through any conventional speed reducing gear device 45 having a final driving pinion 46 in turn engaging an idler pinion 47 carried by frame plate 2 and meshing pinions 48, 48 respectively secured to the adjacent ends of rolls 6, 6, so as to drive both in the same direction.

In machines for very heavy work it may be desirable to also positively drive the upper roll 10, and in which case it suffices to add three spur pinions as indicated in Fig. 8 and wherein 49 is a relatively large idler pinion carried on a pivot concentric with the axis of yoke pivot 13 meshing with one of the roll pinions 48, and also with an idler pinion 49' carried by the yoke 12 and which latter pinion meshes with a pinion 50 secured to the reduced portion 10'' of the upper roll, the pinions of course being all of proper pitch relations to maintain the surface speed of all three rollers uniform, and pinion 50 offset to avoid pinion 48, and pinion 49' being thick enough to engage it from the offset plane of pinion 49—all as well understood to anyone familiar with gearing so as to require no further details.

The air motor 43 actually employed on the first machine built was firmly secured to the frame of the machine as was the gear reduction device 45, and the particular air motor had a centering brace 43' extending from its rear end to the frame.

The actual fluid operated power devices 22, 29 used were of the regular diaphragm type as used for motor truck air brakes, tho any conventional cylinder and piston device could be used. In Fig. 4 the air piping and control valves are shown as a pipe 51 coming from any source of air pressure, a main shut-off or service valve 52, branch pipe 53 leading to the air motor 43 with a valve 54 operated by means of an extension handle 55, two other branch pipes 56, 57 leading respectively to the power devices 22, 22, and 29, 29, and the pipes being respectively valved as at 58 and 59 at a height convenient to a standing operative, or provided with extension operating handles as dotted at 58' and 59', these two valves preferably being any conventional type of remote control air valve with pressure bleed off when closed to break the operating pressures to the power devices, in the well known manner to avoid the use of separate exhaust valves, tho the latter may be used if desired.

In operating the machine, from the position of Fig. 2, the valves are successively operated to—first release the pressure in power devices 29 so that springs 27 will throw out the latch bars 24 to position shown in Fig. 1, pressure is ap-

plied to devices 22 to raise the upper roll 10 to the position shown in Fig. 1, the sheet of metal is positioned to start between the rolls, pressure is released from devices 22 to lower roll 10, pressure applied to devices 29 to swing the latch bars again to locking position of Fig. 2, valve 54 is opened to start the air motor 43 to revolve the rolls.

After the rolling of the sheet metal is completed the air motor is stopped, upper roll raised to position shown in Fig. 1 and the tubular or formed sheet sprung open sufficient to remove it laterally from roll 10, tho as previously stated, if the formed tube is too stiff for springing open pin 38 is knocked out to release the bearing 37 at the end of roll 10, yoke 11 is thrown back to position shown in Fig. 3, the bearing 37 is slipped off the end of the roll if necessary and the formed tube may then be slid off of the roll endwise.

A minor feature of the machine not described is the provision of limit notches 60, 61, 62 in plates 1 and 2 to receive the transversely extending pivot pins 16, 14 of double links 15 to form limit stops, useful in assembling the machine, or overhauling the power device 22 so as to support the parts involved which are very heavy in a big machine for which the invention is primarily intended.

From the above description it will be evident to anyone skilled in this art that while we prefer the use of compressed air as an operating fluid, it may be water or oil and the exhaust fluid returned for further use as commonly understood, or when using air, a negative pressure may be employed and applied to the opposite sides of the diaphragm or piston power devices 22, 29. Also various other modifications in the details of construction may be made, but the arrangement shown has proven extremely effective and satisfactory in regular use in industry.

We therefore claim:

1. In a sheet metal forming machine of the type having a set of three rolls between which the sheet metal is carried to curve the sheet to tubular form, the improvement which comprises a pair of spaced yokes respectively at opposite ends of the operative portions of one of the rolls providing bearing supports therefor and pivotally mounted to provide for bodily swinging the roll toward and away from the other rolls, fluid operated power devices arranged for swinging said yokes to so swing the roll, and a pair of pivotally mounted latches arranged respectively to engage said yokes for locking them with their roll in operative position, and fluid operated power devices arranged for swinging said latches to yoke locking position.

2. In a construction as set out in claim 1 means associated with each latch for adjusting the effective pressure of the roll adjacent the yoke which it engages.

3. In a machine as set out in claim 2, motor driving means arranged for driving all three rolls simultaneously.

4. In a construction as set out in claim 1 means associated with each latch for adjusting the effective pressure of the roll adjacent the yoke which it engages, fluid operated motor means for revolving some of the rolls, and manually operated valve means arranged for selectively controlling said fluid operated power devices and motor means.

5. In a sheet metal forming machine of the type having a set of three rolls between which

the sheet metal is carried to curve the sheet to tubular form, the improvement which comprises a pair of spaced yokes respectively at opposite ends of the operative portions of one of the rolls providing bearing supports therefor and pivotally mounted to provide for bodily swinging the roll toward and away from the other rolls, fluid operated power devices arranged for swinging said yokes to so swing the roll, means locking said yokes with their roll in operative position, said roll provided with a rigid extension projecting materially beyond one of said yokes to function as a lever for supporting said roll when released from operative position, rigid bracket means arranged to engage said extension when the roll is so released, and means for freeing the other yoke entirely from said roll to permit the sliding of formed tubular sheet metal longitudinally therefrom.

6. In a sheet metal forming machine of the type having a set of three rolls between which the sheet metal is carried to curve the sheet to tubular form, the improvement which comprises a pair of spaced yokes respectively at opposite ends of the operative portions of one of the rolls providing bearing supports therefor and pivotally mounted to provide for bodily swinging the roll toward and away from the other rolls, fluid operated power devices arranged for swinging said yokes to so swing the roll, means locking said yokes with their roll in operative position, said roll provided with a rigid extension projecting materially beyond one of said yokes to function as a lever for supporting said roll when released from operative position, rigid bracket means arranged to engage said extension when the roll is so released, and means for freeing the other yoke entirely from said roll to permit the sliding of formed tubular sheet metal longitudinally therefrom comprising an annular bearing engaging the roll and releasably secured to said yoke.

7. In a machine as set out in claim 1, the machine including longitudinally extending frame members and vertically disposed solid end plates at the ends of the rolls, and said yokes being bifurcated to straddle said end plates and pivoted therethrough for swinging.

8. In a machine as set out in claim 1, the machine including longitudinally extending frame members and vertically disposed solid end plates at the ends of the rolls, and said yokes being bifurcated to straddle said end plates and pivoted therethrough for swinging, and said latches being also bifurcated to straddle a portion of the end plates and pivoted therethrough for swinging.

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