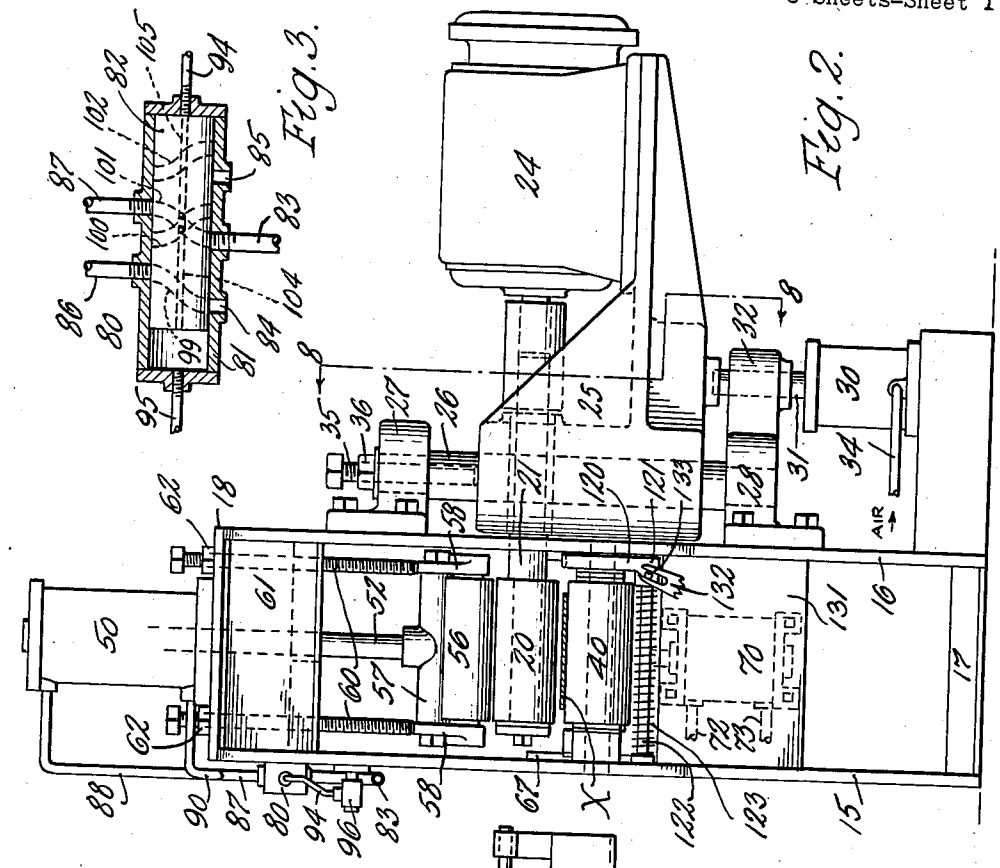
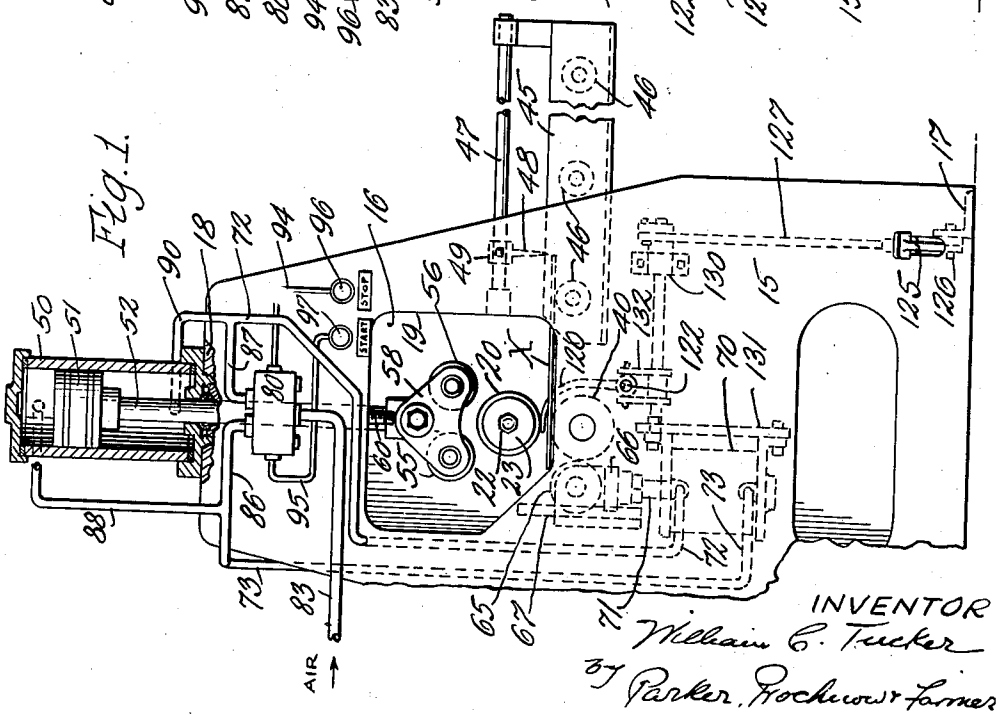
April 23, 1940. W. C. TUCKER 2,197,906

METHOD AND MACHINE FOR FORMING METAL

Filed May 1, 1939 3 Sheets-Sheet 1





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METHOD AND MACHINE FOR FORMING METAL

Filed May 1, 1939 3 Sheets-Sheet 2

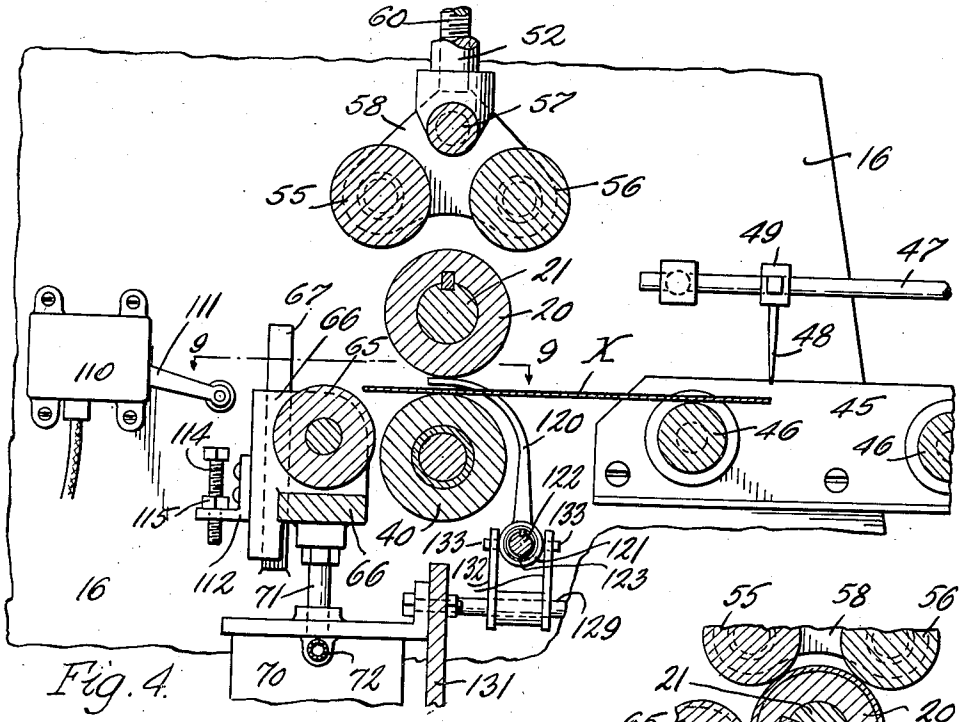


Fig. 4.

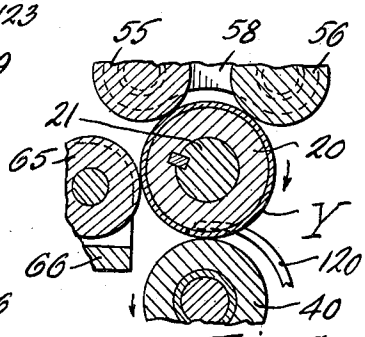


Fig. 6.

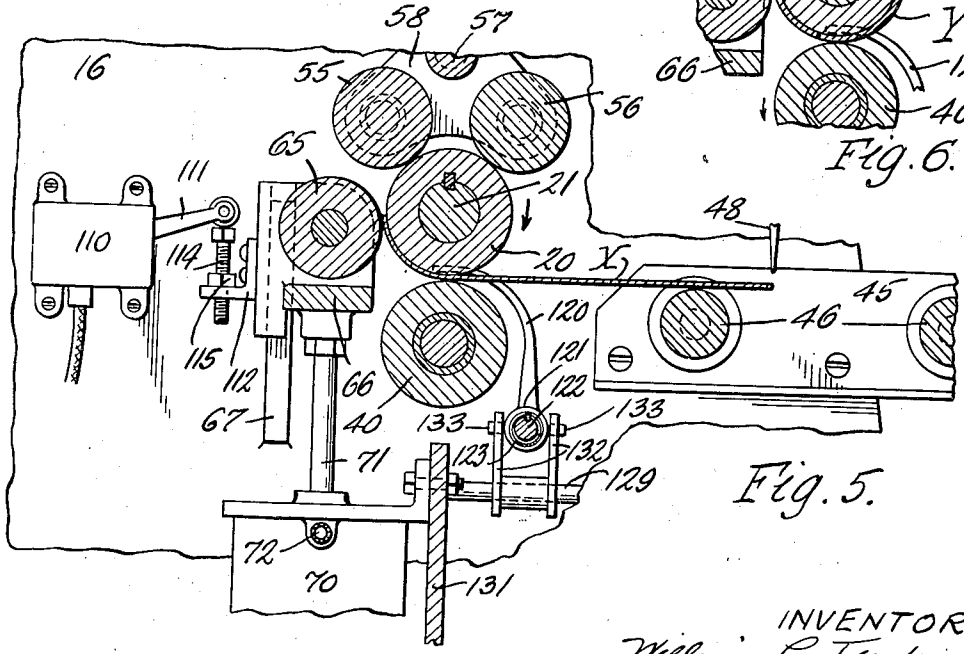


Fig. 5.

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METHOD AND MACHINE FOR FORMING METAL

Filed May 1, 1939 3 Sheets-Sheet 3

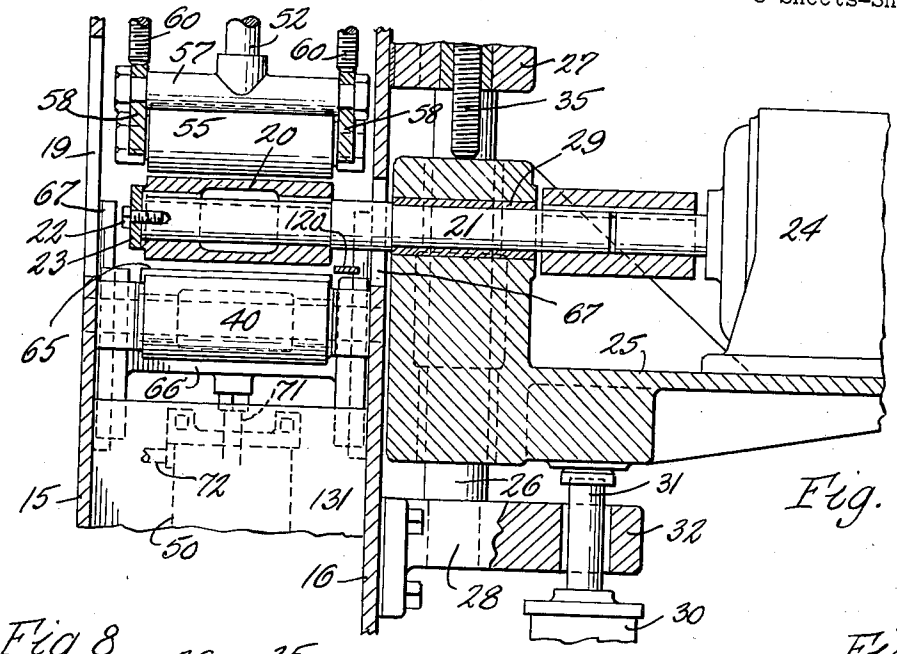


Fig. 7.

Fig. 8.

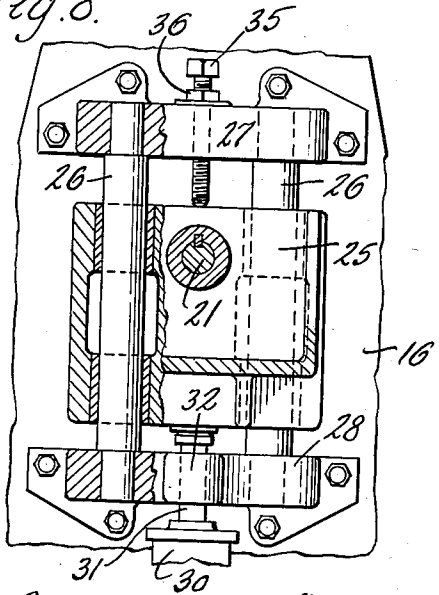


Fig. 10.

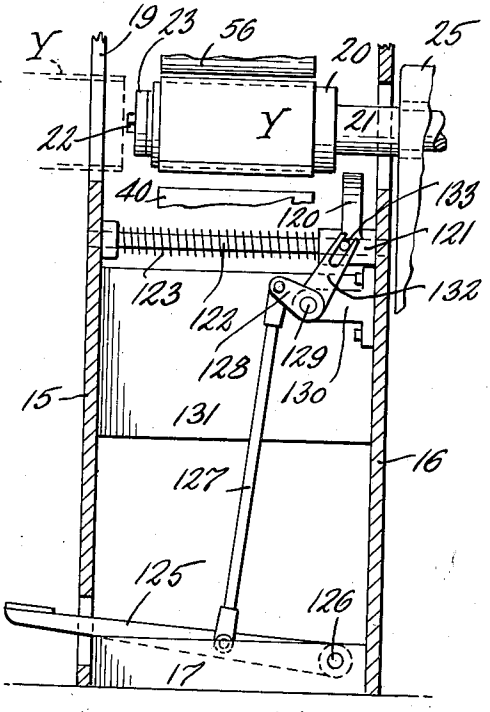
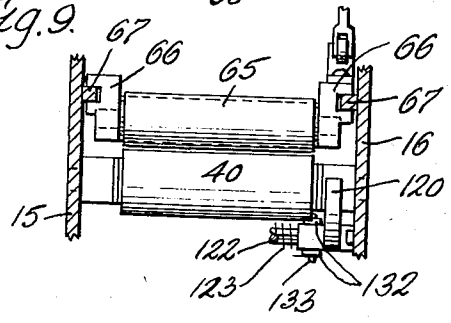


Fig. 9.



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UNITED STATES PATENT OFFICE

2,197,906

METHOD AND MACHINE FOR FORMING METAL

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Application May 1, 1939, Serial No. 271,100

18 Claims. (Cl. 153—54)

This invention relates to improvements in the forming of metal in such a manner that the same is wrapped about a roll.

One of the objects of this invention is to provide an improved method and machine for forming metal by wrapping the same about a roll. A further object is to provide an improved method and machine by means of which rings or shells may be formed from straight metal and in which all of the metal is bent into substantially uniform curvature, thus avoiding flat end portions frequently found on work heretofore produced by other methods and machines. Another object is to provide a method and a machine of this kind in accordance with which the work is formed about a roll partly while the roll is stationary or non-rotating, and partly while the roll is rotating.

It is also an object of this invention to provide a machine of this kind by means of which the preliminary forming of the metal about a roll, and the final forming of the metal are carried on automatically in succession without requiring any attention on the part of the operator. Another object of this invention is to provide a machine of this kind which will be accurate and rapid in operation and safe for an operator to use. Another object is to provide a machine of this kind from which the work can be easily stripped.

A further object of the invention is to provide a machine of this kind in which the roll about which the material is to be wrapped and the several wrapping rolls are normally spaced from each other, and in which the several rolls are moved into work engaging relation to each other in a novel manner. A further object is to provide a machine of this kind in which the roll about which the work is to be wrapped, together with a source of power for driving the same are yieldingly mounted in such a manner that this roll may be moved into operative relation to another roll.

Other objects of this invention will appear from the following description and claims.

In the accompanying drawings:

Fig. 1 is a fragmentary side view of a metal forming machine embodying this invention and by means of which my improved method may be carried out.

Fig. 2 is a front view thereof.

Fig. 3 is a fragmentary sectional view, on an enlarged scale, of a control valve by means of which the machine is started and stopped.

Fig. 4 is a fragmentary longitudinal sectional elevation, on an enlarged scale, of the middle portion of the machine.

Fig. 5 is a view similar to that shown in Fig. 4, but showing the parts in different positions.

Fig. 6 is a fragmentary sectional view of the rolls showing the work thereon completed.

Fig. 7 is a fragmentary transverse sectional view of the middle portion of the machine as seen from the front of the machine.

Fig. 8 is a fragmentary sectional elevation thereof, approximately on line 8—8, Fig. 2.

Fig. 9 is a fragmentary sectional plan view thereof, approximately on line 9—9, Fig. 4.

Fig. 10 is a fragmentary sectional elevation showing the mechanism for stripping the work from the machine.

I have shown in the drawings one embodiment of this invention, and it will be understood that it is not intended to limit the invention to the particular embodiment shown, since it is obvious that the invention may be embodied in machines of different forms. In the particular construction shown, the frame or housing of the machine includes two upright plates or frame members 15 and 16 connected at their lower ends by means of a transverse frame member 17, and at their upper ends by means of a top plate 18, thus forming a box-like frame within which most of the parts of the machine are arranged. The various rolls of the machine are all mounted between the two upright plates 15 and 16, the frame 15 having a relatively large opening 19 formed therein through which the work may be removed from the machine.

20 represents one of the rolls of my metal forming machine, this roll being the one about which the metal is formed or wrapped during the operation of the machine. This roll must, of course, have a periphery approximating the inside face of the work to be produced, and consequently, this roll is removably mounted on the machine so that it can readily be replaced by another roll. In the construction illustrated, the roll 20 is secured on a shaft 21 which is driven by any suitable means. The roll 20 is preferably keyed to the shaft 21 and is removably secured thereon by means of a screw 22 engaging in the end of the shaft 21 and cooperating with a disk 23, which engages the end of the removable roll 20. The particular machine illustrated is provided with rolls adapted to wrap a strip or plate X of metal about the roll 20 to form the same into cylindrical shape Y as shown in Fig. 6, but it will be obvious that metal of any

other form or shape may be wrapped or formed about a roll by means of my machine.

The roll 20 may be driven in any suitable or desired manner. By way of example, I have illustrated in the accompanying drawings a motor 24 which constitutes a source of power, and which preferably includes suitable reducing gears (not shown), and which is coupled to the driven shaft 21 of the machine. The motor or other driving means, together with the roll 20 and shaft 21 are movably mounted on the machine so that the roll can be moved toward and from the work. This may be accomplished in any desired manner and in the construction illustrated, the roll, shaft and motor are mounted on a bracket 25 which is slidably mounted on the frame member 16 of the machine in any suitable or desired manner. In the construction illustrated the bracket 25 has suitable upright bearings formed therein through which shafts or columns 26 extend, two such columns being shown in the construction illustrated which are secured in spaced relation to the side plate 16 of the frame of the machine, for example, by means of upper and lower fixed brackets 27 and 28 which are bolted to the side plate 16 of the machine and extend outwardly therefrom and to which the columns or guide members 26 are secured. The bracket 25 is also provided with a bearing 29 for the shaft 21, the bearing being of such proportions as to form the sole bearing support for the roll 20.

The bracket 25 carrying the roll 20, its shaft 21 and the driving means therefor, such for example as the motor 24 is resiliently mounted so as to be yieldingly held in a position out of engagement with the work X, which in the construction illustrated is the upper position, the yielding means permitting the bracket 25 to slide downwardly lengthwise of the guide columns 26. Any suitable means for accomplishing this purpose may be employed, and in the construction illustrated, I have for this purpose provided a cylinder 30 containing a piston connected with a piston rod 31, which extends through an opening in an extension 32 formed on the lower guide bracket 28. The upper end of the piston rod 31 bears against the slidable bracket 25 and when fluid pressure, such for example as compressed air, is admitted through a supply pipe 34 to the cylinder 30 below the piston therein, the piston rod 31 will be urged upwardly so as to hold the bracket 25 and the parts mounted thereon in their upper position. This position may be varied, depending upon the size of the roll 20 mounted on the shaft 21. Any suitable means for limiting the upward movement of the bracket 25 may be employed, and in the construction illustrated for this purpose, I have provided on the upper bracket 27 an adjusting screw 35, extending through a threaded hole in the bracket 27 and having a lock nut 36 for locking the adjusting screw 35 in the desired position. The lower end of the adjusting screw engages the slidable bracket 25 to limit the upward movement thereof. By means of this construction, it will be obvious that the slidable bracket 25 and the parts mounted thereon will be yieldingly moved into and held in their upper position determined by the adjusting screw 35, and when downward pressure is exerted on the roll or on the slidable bracket 25, this roll and bracket are moved downwardly against the fluid pressure in the cylinder 30, fluid in the cylinder 30 being forced out of the same back through the supply pipe 34 into a storage container (not shown) for the fluid under pressure. Other means may, of course, be provided for yieldingly holding the roll 20 in an upper position and for permitting the same to move downwardly against the yielding force.

40 represents a forming roll which, in the particular construction shown, is arranged below the roll 20. The roll 40 is an idler roll which is suitably journalled on the frame of the machine and arranged to cooperate with the movable roll 20. The metal member X to be formed is positioned in the machine by placing the same upon the roll 40, and any suitable means may be provided as additional supports for the metal member. In the construction shown by way of example, the machine is provided with a suitable work support including a pair of arms 45 secured to the frame plates 15 and 16 and extending outwardly toward the front of the machine. On these arms is journalled a plurality of work supporting rollers 46 upon which the work may be placed for positioning the same in operative relation to the roll 20 and the forming roll 40. Any suitable gauge may be provided to assist the operator in correctly positioning the work, and by way of example, there is shown in the drawing a gauge bar 47 suitably supported above the work support and provided thereon with an adjustable finger 48 including a sleeve 49 which may be locked by means of a set screw in any desired position on the gauge bar 47. This finger is so positioned on the rod that the lower end thereof indicates the position which the rear end of the work X should occupy when being placed into the machine, see particularly Figs. 1 and 4. When in this position, the work X should project somewhat beyond the rolls 20 and 40, as clearly shown in Figs. 1 and 4.

When the work X has been positioned between the rolls 20 and 40, suitable means are actuated to move the roll 20 toward the roll 40 so that the work X will be gripped between the rolls, it being understood that the rolls 20 and 40 are not rotating at this time. Any suitable or desired means for moving the roll 20 toward the roll 40 may be provided, and by way of example, I have shown in Figs. 1 and 2 a cylinder 50 arranged at the top of the machine, for example, on the top plate 18 thereof. This cylinder contains a piston 51 secured to a piston rod 52 which extends downwardly out of the cylinder 50 and through the top plate 18 toward the roll 20. On the lower end of the piston rod 52 are mounted one or more forming rolls, two such rolls 55 and 56 being shown in the construction illustrated. These two rolls may be secured to the lower end of the piston rod 52 in any suitable or desired manner. In the construction shown, the lower end of the piston rod 52 is provided with a cross member or bar 57 rigidly secured thereto and bearing brackets 58 are suitably journalled on the ends of the cross member 57, the bearing brackets each pivotally supporting the upper forming rolls 55 and 56, so that these rolls are free to rotate independently of each other on the bearing brackets 58 and the bearing brackets in turn may swing or oscillate about the cross member 57. When fluid pressure is admitted to the upper end of the cylinder 50, the piston 51 therein will be forced downwardly so that the forming rolls 55 and 56 will contact with the roll 20 and because of the pressure in the upper portion of the cylinder 50, these rolls 55 and 56 will move the roll 20 downwardly toward the roll 40,

the downward movement of the roll being accompanied by the downward movement of the slidable bracket 25 and the parts mounted thereon. When fluid pressure in the upper part of the cylinder 50 is reduced and pressure is admitted into the lower part of the cylinder, the piston 51 will move in the reverse direction, thus moving the forming rolls 55 and 56 into an upper position above the roll 20, as shown in Figs. 1 to 4 and 7, and holding them in this position until pressure is reduced in the lower part of the cylinder 50 and fluid under pressure is admitted to the upper part of the cylinder.

Means are preferably provided for limiting the upward movement of the forming rolls 55 and 56 and by way of example, I have shown for this purpose a pair of stop screws 60 which extend downwardly through the top plate 18 of the frame of the machine, and which engage in correspondingly threaded holes in the top frame plate 18 or in a transverse frame member 61. The lower ends of the stop screws 60 shown engage the pivoted bearing brackets 58 when the rolls 55 and 56 are in their upper position. 62 represents lock nuts which lock the stop screws 60 in any positions in which they may be set to limit the upward movement of the forming rolls 55 and 56.

I prefer to effect the preliminary forming of the work about the roll 20 while the rolls are stationary or non-rotating, and this is preferably accomplished by bending the portion of the work X extending rearwardly beyond the rolls 20 and 40 upwardly about a portion of the roll 20. This preliminary forming of the work may be accomplished in any suitable manner. I prefer to accomplish this by means of a forming roll 65 which is movable from a position shown in Fig. 4 to that shown in Fig. 5. Any suitable means may be provided for accomplishing this movement, and in the construction shown, the forming roll 65 is journalled in a slidable roll supporting member 66. This slidable member is provided at opposite sides thereof with suitable grooves in which guide members or bars 67, secured to the side frames 15 and 16 of the machine, engage.

Any suitable means may be provided for moving the roll supporting member 66 along the guide bars 67, and in the construction illustrated for this purpose, I have provided a cylinder 70 for this purpose. This cylinder contains a piston (not shown) having a piston rod 71 extending out of the cylinder and suitably secured to the roll supporting member 66. This cylinder is provided with suitable supply pipes or conduits 72 and 73 for conducting fluid under pressure to and from the upper and lower portions respectively of the cylinder 70.

In the operation of my machine as thus far described, the work X to be formed is first positioned in the machine in correct relation to the rolls 20 and 40, so that a portion of the work extends rearwardly beyond these two rolls. The piston 51 is then actuated to cause the forming rolls 55 and 56 to move downwardly into engagement with the roll 20 and to move this roll downwardly so that the work X will be securely gripped between the rolls 20 and 40. Fluid pressure is then admitted to the lower portion of the cylinder 70, thus raising the supporting member for the forming roll 65 from the position shown in Fig. 4 to that shown in Fig. 5. During this movement of the forming roll 65, it will be noted that the portion of the work extending rearwardly beyond the rolls 20 and 40 will be bent upwardly to conform with a portion of the periphery of the roll 20. When the parts are in this position, the rotation of the roll 20 in the direction indicated by the arrow in Fig. 5 is started. The work will, consequently, be fed or advanced by the roll 20 and will follow along the periphery of the roll 20 because of the action of the forming roll 65. The leading end of the work will then encounter the forming roll 55. Because of the yielding pressure exerted downwardly upon the rolls 55 and 56 by the fluid operated piston 51 and because of the pivotal connection between the roll carrying bracket 58 and the cross member 57, the forming roll 55 will yield to permit the work to pass between this roll and the roll 20. The forming roll 55 will, consequently, exert a yielding pressure against the work to further urge the same to conform to the contour of the roll 20. As the work advances, it also passes between the roll 56 and the roll 20 and finally if the work X is of the correct length, a completed cylinder or ring Y is formed as shown in Fig. 6. The rotation of the roll 20 is then stopped and the work removed from the roll 20. If a number of similar cylinders or annular forms are to be rolled, the gauge 48 is very useful in determining the correct initial position of the work before the forming of the same in the machine is started.

I preferably provide means whereby the various operations may be performed automatically and this may be done in any suitable or desired manner. The operation of the pistons in the cylinders 50 and 70 can be readily controlled by means of a control valve 80. This valve may be of any suitable or usual construction, that shown, see particularly Fig. 3, including a suitable housing 81 having a slide valve or plunger 82 mounted therein, the slide valve 82 being provided with suitable passages for directing fluid under pressure into either of the two ends of the cylinders 50 and 70. The cylinders may be operated by any suitable fluid, and by way of example, the valve 80 is shown as operating on compressed air, which may be conducted to the machine by means of a pipe or conduit 83 which terminates in a port in the housing 81. The housing also has discharge ports or openings 84 and 85 therein through which compressed air may be discharged to the atmosphere. The valve 80 has also openings connecting with tubes or ducts 86 and 87, the duct 86, as shown in Fig. 1 having a branch 88 leading to the upper end of the cylinder 50, and the pipe 73 leading to the lower end of the cylinder 70 is also connected with the pipe 86. The other duct 87 has a branch 90 leading to the lower end of the cylinder 50 and this ductor pipe 87 also connects with the pipe 72 leading to the upper end of the cylinder 70. The valve housing 81 preferably also has small openings in the opposite ends thereof which connect with ducts 94 and 95 to a stop valve 96 and a start valve 97 respectively. The slide valve member 82 is suitably held against rotating within its housing 81 and is provided with ducts or passages 99, 100, 101, and 102 extending transversely through the slide valve member 82. The valve is shown in Fig. 3 in the stop position, and consequently, air under pressure from the supply pipe 83 will pass through the passage 101 in the valve to the pipe 87 and through branch pipes 90 and 72 respectively to the lower and upper parts of the cylinders 50 and 70, so that the forming rolls will all occupy the positions

shown in Figs. 1, 2 and 4. At the same time, the pipe 86 is connected through the passage 99 in the slide valve to the exhaust port 84, so that air is discharged to the atmosphere from the upper and lower portions respectively of the pistons 50 and 70 through the branch pipes 88 and 73 and main pipe 86.

When the start button 97 is pressed, a small bleeder valve (not shown) is actuated which discharges compressed air from the left side of the valve housing 81 through the pipe 95, thus causing the slide valve or plunger 82 to move to the left. When in this position, the air supply pipe 83 will be connected through the passage 100 in the slide valve 82 with the pipe 86 and its branch pipes 88 and 73, thus admitting air under pressure to the upper and lower portions respectively of the pistons 50 and 70, and at the same time, the passage 102 in the slide valve 82 will connect the pipe 87 with the discharge port 85 of the valve housing, thus discharging air from the lower and upper portions respectively of the pistons 50 and 70.

The slide valve 82 is also provided with the usual small bleeder passages 104 and 105. The passage 104 extends from the left end of the slide valve 82 to the valve passage 101, and the bleeder passage 105 extends from the right end of the valve 82 to the valve passage 100.

From the foregoing description, it will be obvious that when air is discharged from the pipe 95 by having the operator actuate the bleeder valve or start button 97, then compressed air from the left side of the valve will be discharged so that the valve will move to the left end of the cylinder 81, and during this movement, the passage 101 will move out of registration with the air supply pipe 83 while the passage 100 of the slide valve moves into position to receive air from the supply pipe 83, so that air under pressure will flow through the bleeder passage 105 to the right side of the valve 82, thus helping to move this slide valve to the left. The slide valve will remain in this position until the stop valve or button 96 is actuated, in which case, the reverse movement of the plunger or slide valve 82 takes place. This valve is substantially identical with the one shown in Fig. 8 of my Patent No. 2,132,136 of October 4, 1938, and the bleeder valves 96 and 97 which are not shown in detail in the accompanying drawings, may be similar in construction to the one shown in Fig. 9 of my above mentioned patent.

When the bleeder valve 97 is actuated to move the slide valve 82 to the left in Figs. 1 and 3, the flow of compressed air to the upper portion of the cylinder 50 and the discharge of air from the lower portion of this cylinder will take place much more rapidly than the corresponding flow of air to and from the cylinder 70 because of the greater length of the branch pipes 72 and 73 as compared with the branch pipes 88 and 90. Consequently, the piston 51 in the cylinder 50 will be actuated before the piston in the cylinder 70 is actuated. The more rapid action of the piston 51 is probably also brought about to some extent by the fact that the weight of the piston 51, its piston rod 52 and the rolls 55 and 56 and other parts attached thereto helps to expedite the downward movement of these parts, while the air acting on the lower part of the cylinder 70 is required to lift the combined weight of the piston in this cylinder and the parts carried thereby. This results in the movement of the forming rolls 55 and 56 into engagement with the roll 20, and the corresponding movement of the roll 20 toward the roll 40 to clamp the work X, before the forming roll 65 begins its upward movement. In the case of machines in which a difference in the length of the branch pipes does not exist, the delayed action of the forming roll 65 can be readily effected by providing smaller pipes leading to the cylinder 70, or by otherwise introducing a resistance into the flow of air to and from the cylinders 70, so that the work X will be securely clamped between the rolls 20 and 40 by the action of the piston 51 before the forming roll 65 begins its movement.

When, as a result of the operation thus far described, the parts move into the positions shown in Fig. 5, resulting in the bending or forming of the portion of the work which extends rearwardly of the rolls 20 and 40, partly around the periphery of the roll 20, the further forming of the metal is then effected by starting the rotation of the roll 20 in the direction indicated by the arrow in Fig. 5. The rotation of the roll 20 in timed relation to the movement of other parts of the machine may be effected in any suitable manner, but is preferably also effected automatically. In the construction shown for this purpose, I have provided on the machine an electrical switch 110 which may be of any suitable and desired construction, and which connects and disconnects the motor 24 with any suitable source of electricity. The details of construction of the switch and its connection with the motor may be of conventional type and are not herein shown. This switch is actuated by means of a movable switch arm 111, which is so positioned with relation to the support 66 of the forming roll 65 that as the forming roll reaches its upper position, the switch arm 101 is moved from its lower or open circuit position shown in Fig. 4 to its upper or closed circuit position shown in Fig. 5, in which position, electricity is supplied to the motor to operate the same. By way of example, I have shown a bracket 112 on the supporting member 66 of the forming roll 65, and this bracket has an adjustable switch arm engaging member, such as a bolt or screw 114, the upper end of which is adapted to engage the switch arm 111 to move the same from its lower to its upper position. A lock nut 115 serves to lock the adjustable switch arm engaging screw or bolt in the desired relation to the bracket 112. The switch 110 is so formed that the switch arm 111 normally occupies the lower position, this being accomplished either by gravity or a suitable spring (not shown), so that when the roll 65 descends after the operator has actuated the stop valve 96, the switch arm 111 will again move into its lower or open circuit position, thus stopping the motor 24.

From the foregoing, it will be clear that when the forming roll 65 has moved into its upper position, the switch 110 will be closed and the motor 24 will start, thus wrapping the work X about the roll 20 as has been described. As soon as the wrapping is completed, which requires merely one revolution of the roll 20, the operator actuates the stop button or valve 96, which causes the actuation of the rolls as has been described, including the downward movement of the forming roll 65. This downward movement permits the switch arm 111 to move downwardly into an open circuit position in which the motor 24 is stopped. The rolls will then again occupy the positions shown in Figs.

1, 2 and 4, in which they are spaced from each other, and the finished work Y will be wrapped around the roll 20. When the rolls are in this position, the finished work Y can be readily removed or stripped from the roll 20. This may be done manually or by automatic mechanism of any suitable or desired kind, or if desired, a foot operated mechanism such as is shown by way of example in the drawings may be used. This mechanism includes a stripper finger or arm 120 which normally extends into a position adjacent to but beyond that end of the roll 20 which is adjacent to the plate 16 of the housing of the machine. This stripper finger or arm has a hub portion 121 which is arranged to slide on a bar or rod 122 extending crosswise of the machine and having its ends secured on the frame plates 15 and 16. A spring 123 may be employed for normally holding this stripper finger in its inoperative position to the right of the roll 20, in Figs. 2 and 10. The stripper finger is so positioned that when moved to the left in Figs. 2 and 10, it will engage an end of the finished work Y on the roll 20 and upon further movement to the left will strip this work from the roll 20.

Any suitable means for moving the stripper finger along its supporting rod 122 may be employed, and in the particular construction illustrated, I have shown a foot operated lever 125, Figs. 1 and 10 pivoted at 126 on the lower frame member 17 or other suitable part of the machine. A link 127 connects the foot lever 125 with a crank arm 128 secured on a rock shaft 129 pivoted on a bracket 130 mounted on the frame plate 16, and on a transverse frame member or plate 131, which connects the frame plates 15 and 16 and also forms a support for the cylinder 10. A pair of bifurcated fingers 132 are also secured on the rock shaft 129 and the bifurcated ends of these fingers engage pins or projections 133 extending outwardly from opposite sides of the hub portion 121 of the stripper finger or arm 120. Consequently, when the foot lever 125 is depressed, the fingers 132 will be swung with the rock shaft 129 to the left in Fig. 10, and will move the stripper finger 120 to the left into engagement with the work X. If the foot lever 125 is given a rapid downward movement, the stripper finger 120 will impart sufficient movement to the work Y to discharge the same through the opening 19 in the frame plate 15, or if desired, the work Y after being partly pushed through the opening 19 may be removed from the machine by hand.

The machine described has the advantage that it is rapid and reliable in its operation and safe for an operator to use in that at no time is there any necessity for the operator to place his hands in danger of injury by moving parts of the machine. Furthermore, the work turned out by the machine is more perfect than has heretofore been produced. This is partly due to the fact that the portion of the work extending beyond the rolls 20 and 40 is bent by the roll 65 into a form which conforms very closely to the contour of the roll 20 and the work, consequently, has no flat end portions. In bending machines or wrapping rolls as heretofore constructed, in which all of the rolls rotated only about fixed axes, these flat ends on the work were unavoidable.

Another advantage of this machine is that the rolls are yieldingly held in their operative positions relatively to each other. Consequently, if a piece of metal larger than the required size is fed into the machine, so that the opposite ends thereof will overlap, no damage to the machine will result, since the rolls will move apart sufficiently to compensate for the added thickness of the overlapping ends.

I claim as my invention:

1. In a metal forming machine, the combination of an idler roll, a driven roll normally in spaced relation to said idler roll, means for yieldingly holding said driven roll in spaced relation to said idler roll to permit work to be positioned between said rolls, and yielding means for moving said driven roll toward said idler roll against said first mentioned yielding means for engaging work placed between said rolls.

2. In a metal forming machine, the combination of an idler roll, a driven roll normally in spaced relation to said idler roll, means for yieldingly holding said driven roll in spaced relation to said idler roll, and a forming roll movable yieldingly into work engaging relation with said driven roll for moving said driven roll toward said idler roll into engagement with work placed between said driven and idler rolls and for forming work passing between said driven roll and said forming roll.

3. In a metal forming machine, the combination of a roll about which a piece of metal is to be wrapped, a pair of forming rolls arranged adjacent to said first mentioned roll and located on opposite sides of said first roll, all of said rolls being normally spaced apart, and means for yieldingly urging one of said forming rolls against said first roll for moving said first roll toward the other forming roll into position to engage the work.

4. In a metal forming machine, the combination of a roll about which a piece of metal is to be wrapped, a pair of forming rolls arranged adjacent to said first mentioned roll and located on opposite sides of said first roll, all of said rolls being normally spaced apart, means for yieldingly moving said rolls toward each other for clamping a piece of metal between said first roll and one of said forming rolls, and means for rotating said first roll to advance said piece between said rolls.

5. In a metal forming machine, the combination of a roll about which a piece of metal is to be wrapped, a pair of forming rolls arranged adjacent to said first mentioned roll and located on opposite sides of said first roll, all of said rolls being normally spaced apart, means for yieldingly moving said rolls toward each other for clamping a piece of metal between said first roll and one of said forming rolls, a third forming roll arranged to move bodily substantially tangentially with reference to said first roll to bend a portion of said piece of metal about a portion of said first roll, and means for rotating said first roll to advance said piece of metal between said rolls.

6. In a metal forming machine, the combination of a pair of rolls arranged to receive work between them, means for pressing said rolls into gripping engagement with the work while said rolls are non-rotating, with the leading end of the work extending beyond said rolls, a third roll movable at an angle to the work to form said leading end into engagement with the periphery of one of said first mentioned rolls while the same are non-rotating, and means for rotating one of said rolls after forming said leading end,

to continue the forming of said work about said one of said first mentioned rolls.

7. In a metal forming machine, the combination of a pair of rolls arranged to receive work between them, means for pressing said rolls into gripping engagement with the work while said rolls are non-rotating, with the leading end of the work extending beyond said rolls, a third roll movable at an angle to the work to form said leading end into engagement with the periphery of one of said first mentioned rolls while the same are non-rotating, means for rotating one of said rolls after forming said leading end, to continue the forming of said work about said one of said first mentioned rolls, and an additional roll cooperating with said one of said pair of rolls to form the work about the same.

8. In a metal forming machine, the combination of a pair of normally non-rotating rolls between which the work may be arranged with the leading end of the work extending beyond said rolls, a third roll arranged in a position to engage the leading end of the work, means for producing relative movement of said pair of rolls and said third roll to cause the work to be formed about one of the rolls of said pair and to be held in engagement therewith by said third roll while the same are non-rotating, and means for imparting rotation to one of said rolls to complete the forming of said work after said leading end of the work has been formed about said one roll.

9. In a metal forming machine, the combination of an idler roll, a driven roll normally in spaced relation to said idler roll to permit work to be positioned between said rolls with the leading end thereof extending beyond said rolls, means for moving said driven roll toward said idler roll while said rolls are non-rotating, to clamp the work between said rolls, a forming roll movable relatively to said driven and idler rolls in a direction to engage the work and form the same about a portion of said driven roll while said driven roll is non-rotating, and means for rotating said driven roll while said forming roll is in position to press said work against said driven roll, to complete the forming of the work.

10. In a metal forming machine, the combination of an idler roll, a driven roll normally in spaced relation to said idler roll to permit work to be positioned between said rolls with the leading end thereof extending beyond said rolls, a forming roll movable into engagement with said driven roll, yielding means for urging said forming roll toward said driven roll and for moving said driven roll into a position to clamp the work between said driven and idler rolls while said rolls are non-rotating, and a second forming roll movable relatively to said other rolls while the same are non-rotating, to engage the leading end of the work and form the same about a portion of said driven roll, and means for rotating said driven roll for completing the forming of the work about the same.

11. In a metal forming machine, the combination of an idler roll, a driven roll normally in spaced relation to said idler roll to permit work to be positioned between said rolls with the leading end thereof extending beyond said rolls, a pair of forming rolls movable into engagement with said driven roll for moving said driven roll into clamping engagement with the work, a member for imparting said movement to said forming rolls and which is yieldingly urged to move said forming rolls toward and from said driven roll, another forming roll for engaging the leading end of the work and movable for forming said end of the work about the portion of said driven roll while said driven roll is non-rotating, and means for rotating said rolls to complete the forming of the work about said driven roll.

12. A metal forming machine in accordance with claim 11 and including bracket members on which said pair of forming rolls are mounted and which bracket members are pivotally mounted on said movement imparting member.

13. In a metal forming machine, the combination of an idler roll rotatable about a fixed axis, a driven roll arranged with its axis substantially parallel to the axis of said idler roll and movable toward and from said idler roll, means for yieldingly holding said driven roll in spaced relation to said idler roll to permit work to be inserted between said rolls with the leading end thereof extending beyond said rolls, a forming roll arranged with its axis substantially parallel to the axes of said idler and driven rolls, fluid pressure operated means for moving said forming roll into engagement with said driven roll, and for moving said driven roll against the action of said yielding means toward said idler roll for gripping the work between said driven and idler rolls, a third forming roll located adjacent to said leading end of the work, fluid pressure operated means for moving said last mentioned forming roll into engagement with said leading end of said work for forming said leading end about a portion of said driven roll, and means for rotating said driven roll after forming of said leading end about the same to advance the work past said forming rolls to complete the forming thereof about said driven roll.

14. In a metal forming machine, the combination of an idler roll rotatable about a fixed axis, a driven roll arranged with its axis substantially parallel to the axis of said idler roll and movable toward and from said idler roll, means for yieldingly holding said driven roll in spaced relation to said idler roll to permit work to be inserted between said rolls with the leading end thereof extending beyond said rolls, a forming roll arranged with its axis substantially parallel to the axes of said idler and driven rolls, fluid pressure operated means for moving said forming roll into engagement with said driven roll, and for moving said driven roll against the action of said yielding means toward said idler roll for gripping the work between said driven and idler rolls, a third forming roll located adjacent to said leading end of the work, fluid pressure operated means for moving said last mentioned forming roll into engagement with said leading end of said work for forming said leading end about a portion of said driven roll, and means actuated by the movement of said last mentioned forming roll to effect the rotation of said driven roll to complete the forming of the work about the same.

15. In a metal forming machine, the combination of an idler roll rotatable about a fixed axis, a driven roll arranged with its axis substantially parallel to the axis of said idler roll and movable toward and from said idler roll, means for yieldingly holding said driven roll in spaced relation to said idler roll to permit work to be inserted between said rolls with the leading end thereof extending beyond said rolls, a forming roll arranged with its axis substantially parallel to the axes of said idler and driven rolls, fluid pressure operated means for moving said forming roll into engagement with said driven roll, and for moving said

driven roll against the action of said yielding means toward said idler roll for gripping the work between said driven and idler rolls, a third forming roll located adjacent to said leading end of the work, fluid pressure operated means for moving said last mentioned forming roll into engagement with said leading end of said work for forming said leading end about a portion of said driven roll, means for rotating said driven roll after forming of said leading end about the same to advance the work past said forming rolls to complete the forming thereof about said driven roll, means for actuating both of said fluid pressure operated means after completion of the work to move said forming rolls out of engagement with said driven roll, and a stripper including a part movable lengthwise adjacent to the surface of said driven roll for removing the work endwise therefrom.

16. A method of wrapping a metal member about a roll, comprising clamping said metal member between said roll and another roll while the same are non-rotating, with a portion of the metal member extending beyond said rolls, bending said portion of said metal member against the periphery of one of said rolls, then rotating said rolls and completing the wrapping of said metal member about said roll.

17. In a method of forming a metal member about a roll, the steps of clamping the metal member between said roll and another roll while said rolls are non-rotating, with the leading end of said metal member projecting beyond said rolls, forming said leading end of the metal member about a portion of said first roll by pressing the same against said first roll by means of a forming roll, and then rotating said rolls to complete the forming of said member about said first roll, while said forming roll is in position to hold said metal member against said first roll.

18. In a metal forming machine, the combination of a roll about which a piece of metal is to be wrapped, bearings in which said roll is journalled and which are located at one end only of said roll, a pair of forming rolls arranged adjacent to said first mentioned roll and located on opposite sides of said first roll, all of said rolls being normally spaced apart, means for yieldingly urging one of said forming rolls against said first roll for moving said first roll toward the other forming roll into position to engage the work, and means movable endwise of said first roll when said rolls are spaced apart for stripping the work from said first roll lengthwise toward the end thereof opposite to that which is journalled in bearings.

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