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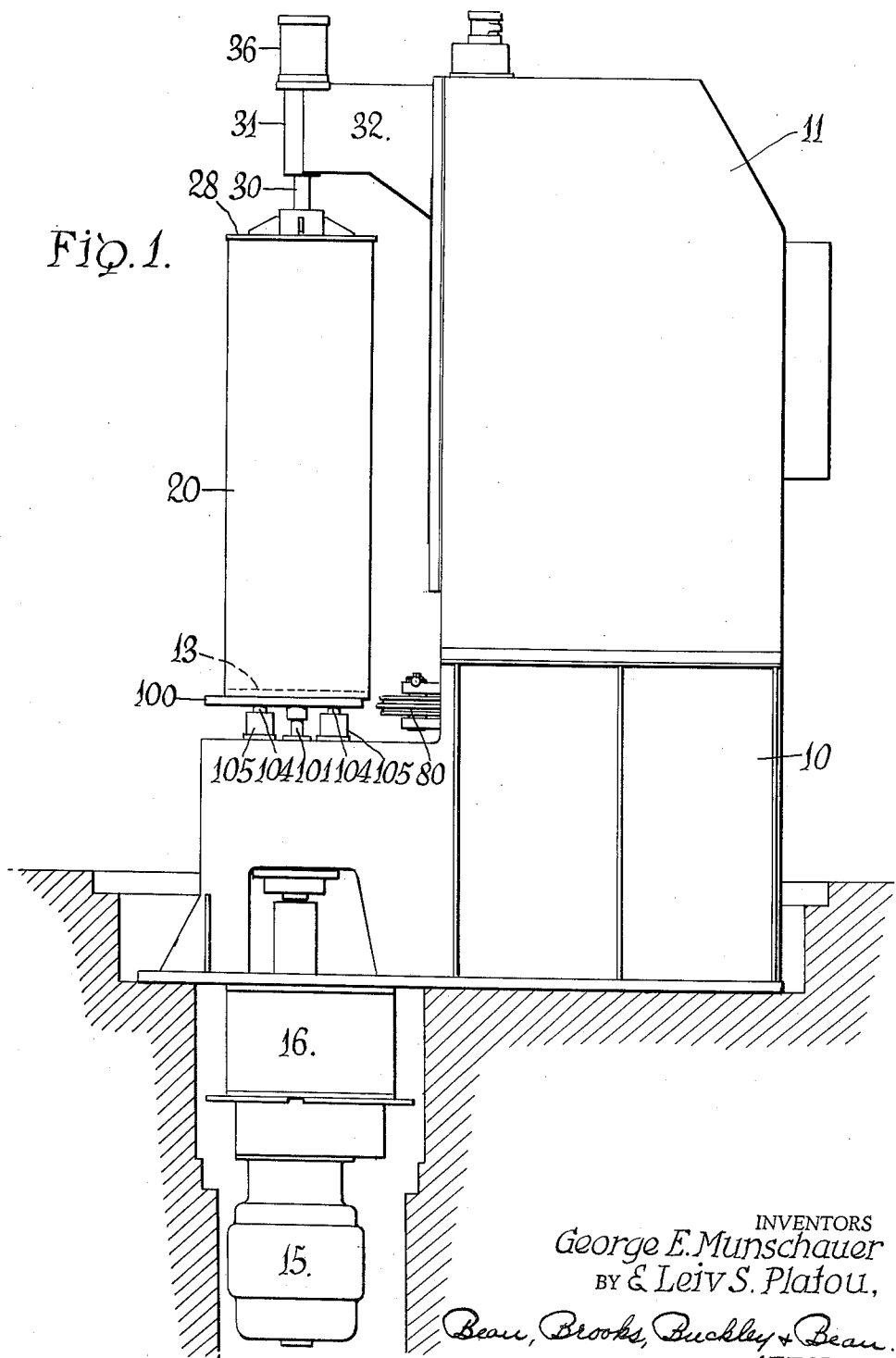
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HYDRAULIC SEAMER

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6 Sheets-Sheet 1

FIG. 1.



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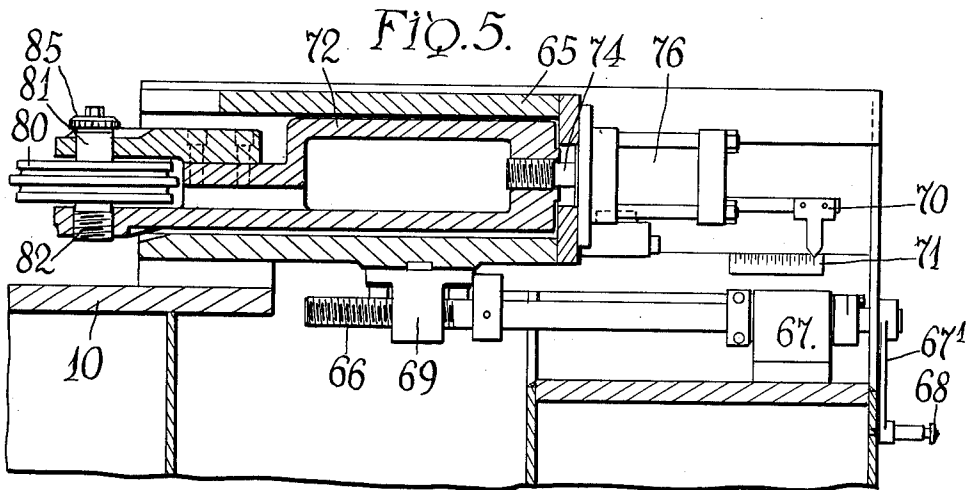
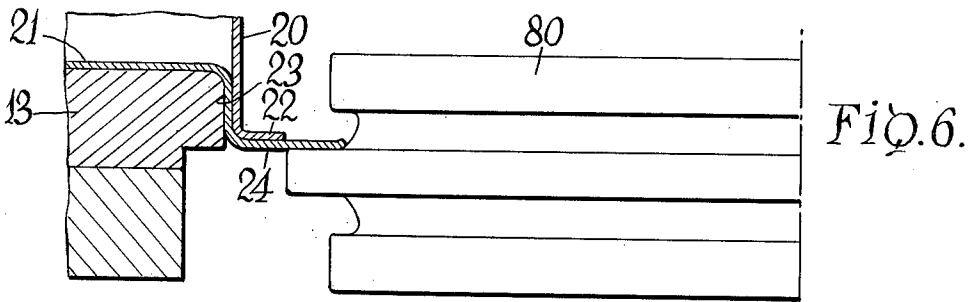
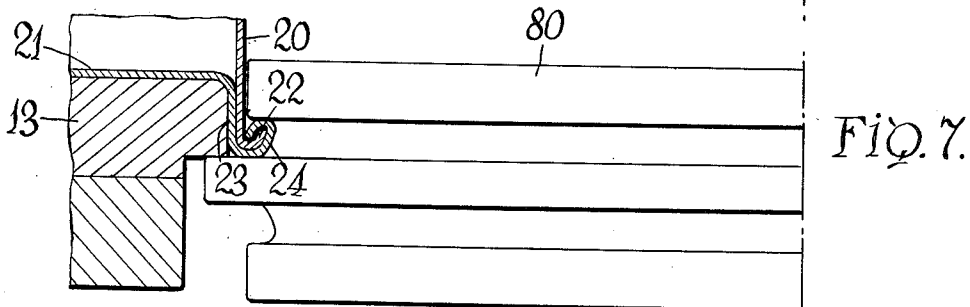
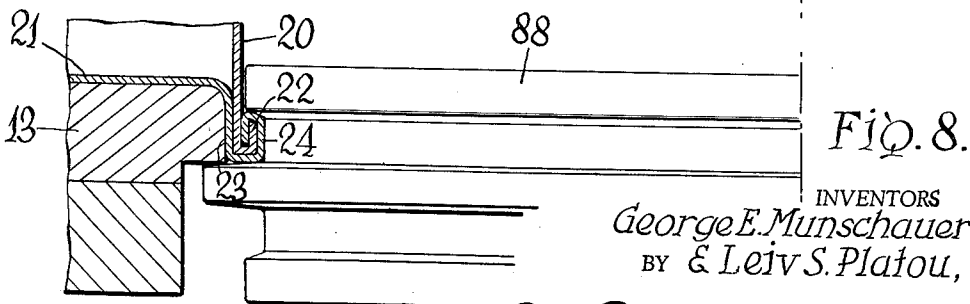
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6 Sheets-Sheet 4



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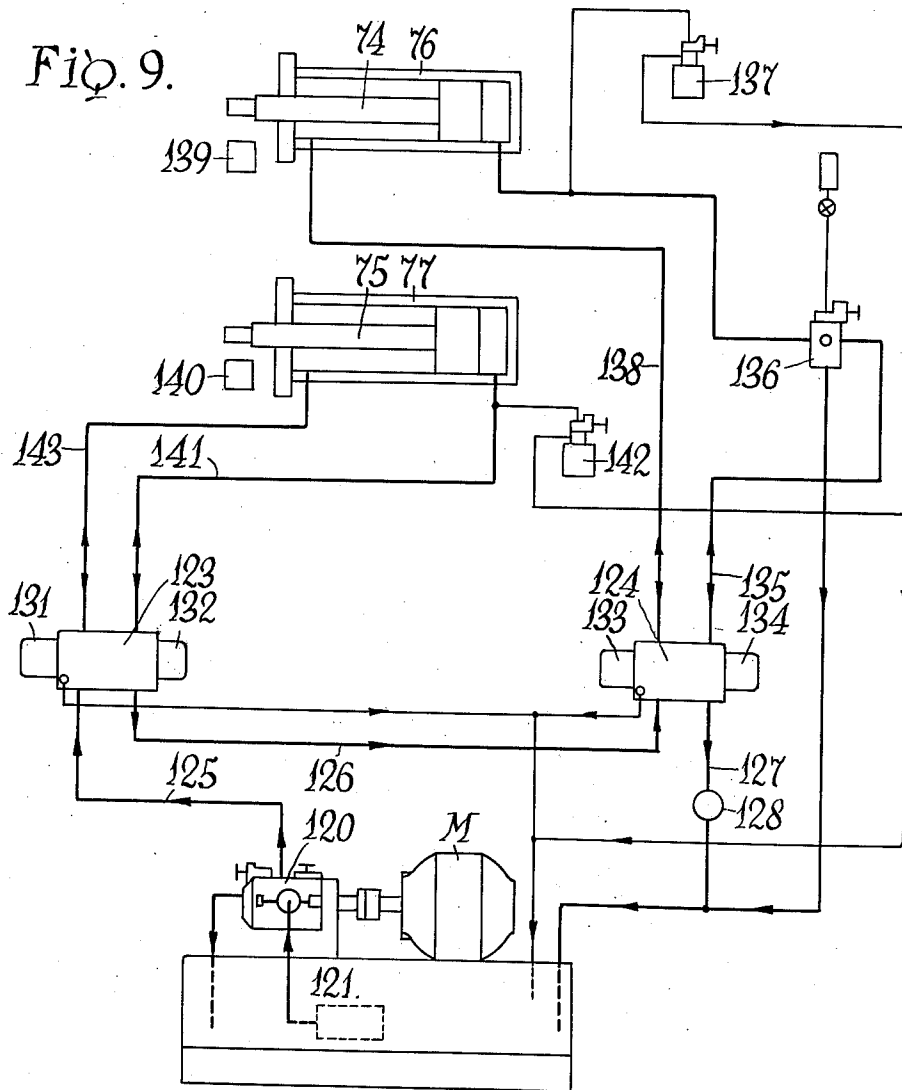
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HYDRAULIC SEAMER

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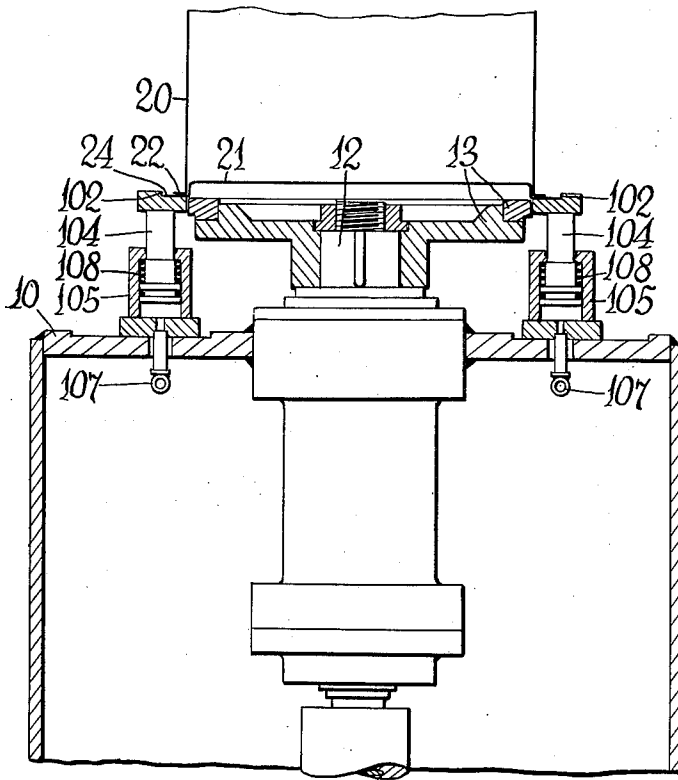
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HYDRAULIC SEAMER

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6 Sheets-Sheet 6

FIG. 10.



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HYDRAULIC SEAMER

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5 Claims. (Cl. 113—23)

This invention relates to sheet metal working machines and particularly to what is known in the art as a seamer of the type employed in forming double seams for attaching heads to the ends of sheet metal barrels or drums.

Machines for this general purpose are well known in the metal working art and comprise generally means for holding and rotating a barrel or drum body and an end member to be joined thereto while forming rolls engage tangentially against the peripheries of the body and end member to form and flatten the desired double seam. Preliminary to this seam-forming procedure the edge of the circular end member and the edge of the cylindrical body member are provided with seam-forming flanges in a manner and according to practices well known in this art.

Heretofore the forming rolls in machines of this class have been controlled and moved progressively toward the work as the forming proceeds by mechanical means such as cams or the like. Accordingly, the rolls have been advanced toward the work by predetermined increments as the work is rotated; that is, the forming rolls, each in its turn, move inwardly toward the work a predetermined distance during each rotation of the work. Since the metal of the drum body and the end member varies in thickness within certain limits and since the conventional double seam involves five layers of this metal, such distance controlled rolling produces loose joints when the metal runs thin and results in undesirable strain on the working parts and an undesired cold forming or cold rolling of the metal when it runs thicker than normal.

A primary object of the present invention is to provide rolling means wherein the feeding arrangement automatically compensates for variations in the gauge of the metal so that the seams are properly and fully formed, but without undue strain on the apparatus, regardless of metal thickness variations. Generally speaking, this is accomplished by providing roll feeding means wherein predetermined pressures are exerted against the work by reason of which the forming rolls move against the work during the actual forming and flattening at a greater or less rate with metals of varying thickness. Since the final pressure of the flattening rolls is constant, uniformly flattened seams are produced even though the final position of the flattening roll with respect to the axis of the work varies in accordance with variations in gauge of the metal of the work pieces.

The movement of the forming rolls to the work under hydraulic pressure control avoids the necessity for accurate radial positioning of the rolls relative to the work axis.

A further object of the invention is to provide novel work stripping means for lifting assembled and seamed drum bodies and heads from the circular chuck against which the seam is rolled and flattened and for centering the drum head with respect to the seaming chuck by initially locating the drum head in a recess in the stripper plate. The present apparatus provides an arrangement whereby stripper members for different diameters of drums may be employed interchangeably by merely lifting one stripper from its operating position and substituting the stripper for a different drum diameter. Furthermore, the lifting operation of the stripper member for effecting its stripping function is correlated in a novel manner with a work clamping member which holds the drum body

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downwardly in proper position for the rolling operation. Again speaking generally, a single fluid pressure source is alternatively and successively applied to the clamping means and to the stripping means, whereby operation of a valve to unclamp the work automatically energizes the stripper operating means to effect the stripping function.

A further object of the present invention is the provision of two-stage hydraulic means whereby each forming roll moves from a withdrawn position to a position in engagement with the work at a rapid rate and under relatively low hydraulic pressure and progresses through the actual forming movement at a reduced rate and under a substantially greater hydraulic pressure, the transition being effected automatically by pressure responsive means. The withdrawing movement of each forming roll is effected rapidly under the relatively low hydraulic pressure employed in the approach movement. This rapid approach of the forming rolls, in addition to promoting the general efficiency of the machine, avoids scraping or skidding of the rolls against the raw metal edges of the work pieces during the approach movement.

In a preferred form of the present invention the flattening roll approaches the work as the curling roll starts its withdrawing movement and the completion of the dwell period of the flattening roll shuts off the main motor so that rotation of the work slows and stops while the flattening roll withdraws.

Other objects and advantages of the apparatus of the present invention will appear to those skilled in the art from a consideration of the following detailed specification and the accompanying drawing, wherein a complete embodiment of the principles of the present invention is set forth by way of example. However, it is to be understood that such embodiment merely exemplifies the principles of the invention and the teachings thereof are not limited thereto or otherwise than as defined in the appended claims.

In the drawings:

FIG. 1 is a general side elevational view of one form of the hydraulic seaming machine of the present invention viewed from the right-hand side thereof;

FIG. 2 is a vertical cross-sectional view taken centrally through the upper portion of the structure illustrated in FIG. 1 and viewed from the opposite side of the machine from FIG. 1;

FIG. 3 is a top plan view showing the work receiving bed of the machine and the forming rolls, with the superstructure of the machine removed for added illustration;

FIG. 4 is a fragmentary cross-sectional view of the structure of FIG. 3 taken approximately on the line IV—IV of FIG. 3;

FIG. 5 is a cross-sectional view somewhat similar to FIG. 4 but viewed from the opposite side of the machine and taken through the first forming roll and its mounting means, approximately as indicated by the line V—V of FIG. 3;

FIG. 6 is an enlarged fragmentary detailed view of the first forming roll and the work members at the beginning of a forming operation;

FIG. 7 is a view similar to FIG. 6 but showing the completion of the first forming operation;

FIG. 8 is a view similar to FIGS. 6 and 7 but showing the second forming roll at the completion of a squeezing or seam flattening operation;

FIG. 9 is a schematic circuit diagram of the hydraulic system for controlling operating movements of the forming rolls; and

FIG. 10 is a view somewhat similar to the right hand portion of FIG. 4 but taken obliquely on the line X—X of FIG. 3 and on a somewhat larger scale and showing the stripper plate in the elevated position which it occupies

at the beginning and end of a cycle of operation and between operations.

Like characters of reference denote like parts throughout the several figures of the drawings and, referring particularly to FIG. 1, the numeral 10 designates the bed of the machine and the numeral 11 designates a column structure or superstructure which is disposed upon and extends upwardly from the rear side of the bed 10.

A vertical power driven spindle 12 extends upwardly through the bed and carries at its upper end a work receiving circular chuck member 13 which will be referred to in greater detail later herein. In the form of the present invention illustrated herein the drive means for spindle 12 is disposed beneath the floor level and comprises an electric driving motor 15 and a speed reducing gear mechanism 16, the output shaft of the latter extending upwardly for driving connection with the spindle 12 in any desired manner.

The work pieces comprise a sheet metal cylindrical drum body 20 and a circular head or bottom member 21, these parts being shown particularly in FIGS. 4, 6, 7 and 8. The present apparatus shows a head or bottom member 21 being secured to one end of a cylindrical drum 20, it being understood however that heads 21 may be secured to both ends of drum 20 by successive operations if that be desired.

Referring particularly to FIG. 6, drum 20 is provided with an outward annular flange 22 and head member 21 is provided with a downward annular flange 23 and an outward terminal flange 24, the flanges 22, 23 and 24 being preliminarily formed on the parts 20 and 21 in any desired manner.

As shown in FIG. 4, spindle 12 has anti-friction bearing in bed 10 as at 25 and 26 and carries at its upper end a chuck member 13 referred to previously herein which comprises merely a circular structure of such diameter that the flanged head member 21 may be placed thereover and located centrally thereby as shown in FIGS. 4 and 6. Following such placement of the head member 21 on chuck member 13 the cylindrical drum body member 20 is placed thereover likewise as shown in FIGS. 4 and 6 and a clamp plate 28 is brought downwardly against the upper end of drum 20 to hold the same against axial displacement from the position shown in FIGS. 4 and 6.

The clamp member 28 and its supporting and operating instrumentalities are illustrated in detail in FIG. 2, to which reference will now be had.

Clamp plate 28 is carried for free relative rotation at the lower end of a spindle 30 which in turn is carried for free vertical movement in a bearing 31 fixed to the outer end of an outboard bearing support structure 32 which is mounted against the front face of column 11 for relative vertical adjusting movement. Axial thrust anti-friction bearing means 34 is provided to mount the clamp plate 28 for free rotation relative to spindle 30 and vertical movements of spindle 30 relative to bearing 31 are effected and controlled by a fluid pressure cylinder and piston arrangement 36, the operating piston rod of which is designated 37 in FIG. 2.

Outboard bearing support structure 32 includes a mounting plate portion 40 which is guided for vertical movement by ways or guides 41 fixed to the front of column member 11. A nut member 42 is fixed to the rear face of plate 40 and engages a screw 44 which is rotatably mounted at its upper and lower ends in bearings 45 and 46 carried by column 11.

The upper end of screw 44 has gear connection with power drive means in the form of an air motor designated generally by the numeral 47 and driving operation of the motor 47 in opposite directions raises and lowers support 32 and the clamp plate structure carried thereby, such adjustments being made to establish a proper working height of the bearing support structure for drums of various lengths. Secondary vertical movement of clamp

plate 28 by operation of the piston and cylinder mechanism 36 is used to clamp and unclamp plate 28 with respect to a given drum workpiece between successive seaming operations.

Operating air pressure is directed to the upper and lower ends of cylinder 36 by conduits 48 and 49 fixed to bearing support 32 which in turn receive air pressure from a conduit junction block 51 fixed to column 11. The numeral 50 in FIG. 2 designates a flow control valve in conduit 49 which determines the speed of operation of the clamping mechanism. Communication between block 51 and the conduits 48 and 49 is by way of a pair of flexible conduits 52 which extends over pulleys 53 rotatably mounted upon a block 54 fixed to column 11. A pair of slack take-up pulleys 55 engage the conduits 52 between block 51 and pulleys 53 and are weighted as at 56 to take up the varying slack of the conduits occasioned by up and down movements of the outboard bearing support 32.

Control of operating air pressure to opposite ends of the cylinder 36 by way of conduits 48 and 49 is effected manually by means of a four-way valve 60 which is operable alternatively to supply operating air pressure to either of the conduits 48 or 49. When operating air pressure is applied to conduit 49 for raising or unclamping movement of plate 28 the same valve setting applies operating air pressure, by means of a conduit indicated schematically at 57 in FIG. 2, to a work stripper operating mechanism, presently to be described.

Reference will now be had to the forming rolls, which form and secure the double seam which joins the drum 20 with the head or bottom member 21, and the supporting and positioning means for such forming rolls. Referring particularly to FIG. 5, a generally flat box-like member 65 is mounted between the upper portions of the side walls of base 10 for guided horizontal movement from left to right as viewed in FIGS. 3, 4 and 5. Such guided horizontal movement of the box-like member 65 is for the purpose of variably positioning the entire forming roll structure as a unit to accommodate the same to the forming of seams on drums and heads of varying diameters.

Securely adjusted positioning of the member 65 is effected by means of a screw 66 which is journaled in a bearing 67 fixed to base 10 and held against axial movement. Rotation of screw 66 is by means of a handle 67' including a detent pin 68 for locking the screw 66 in various positions of adjustment. Screw 66 passes through an internally threaded nut member 69 which is fixed to the underside of box-like member 65. A pointer 70 carried by the box-like member moves relative to a scale 71 fixed to base 10 to indicate directly the drum diameter for which the box-like member 65 is positioned.

A pair of forming roll carriers 72 and 73 are positioned within the box-like member 65 in side-by-side relation, each being guided for independent horizontal movement in the box-like member 65, also from left to right as viewed in FIGS. 3, 4 and 5. The carriers 72 and 73 are attached at one end of each to piston rods 74 and 75 which project from pistons contained in fluid pressure operating cylinders 76 and 77 and in the present instance the operation is by means of hydraulic fluid.

At its opposite end each of the carriers 72 and 73 gives rotatable support to one of the forming rolls. In FIG. 5 carrier 72 supports a forming roll 80 which curls the flanges into interlocking relationship prior to the final flattening of the seam formed thereby. Forming roll 80 is mounted upon a shaft 81, preferably by means of anti-friction bearings (not shown) contained within the roll, so that the roll 80 rotates freely on supporting shaft 81.

Shaft 81 is threaded at its lower end into a portion of carrier 72 as clearly shown at 82 in FIG. 5 and roll 80 is held against relative axial movement on shaft 81. Accordingly, shaft 81 may be adjusted upwardly and downwardly by the threaded connection of its lower end to position the roll 80 accurately in a vertical direction. As

shown in FIG. 3, such vertical adjustment of roll 80 is maintained by a spring biased locking or detent pin 84 which engages notches formed about the periphery of a locking wheel 85 which is fixed to shaft 81.

A flattening roll 88 is similarly mounted upon the other carrier 73, the same reference characters being applied to the various supporting, adjusting and operating parts thereof as in the case of the forming roll 80.

It is to be understood that the forming rolls, that is the curl forming roll 80 and the flattening roll 88, are entirely conventional in their peripheral formations and that the novelty herein resides, insofar as the forming rolls are concerned, in the manner in which they are operated, positioned, adjusted and controlled. It is accordingly sufficient to state that roll 80 contains two curl forming grooves, one of which is shown at the beginning of a curling operation in FIG. 6 and at the conclusion of a curling operation in FIG. 7. The double groove arrangement permits the rolls to be reversed, top to bottom, to present a new groove when the first groove becomes worn, thus doubling the life of each forming roll.

Flattening roll 88 is similarly provided with two flattening grooves, one of which is shown at the conclusion of a flattening operation in FIG. 8. It is further to be understood that rolls 80 and 88 move progressively toward the work as their forming and flattening operations proceed, such movements in prior art devices having generally been by way of mechanical cams which produce predetermined increments of feeding movement toward the work for each rotation of the drum and head members.

Reference will now be had to novel stripping means for lifting the seamed drum and head or bottom member from the chuck member 13 at the conclusion of a seam-forming and flattening sequence of operations. It will be understood that these operations, particularly the final flattening operation, causes the drum head or bottom member 21 to fit quite closely about the chuck member 13 so that lifting of the finished assembly from the chuck member requires a substantial upward force.

The present apparatus provides stripper members and mounting means which are so arranged that the stripper members are readily interchangeable to accommodate the manufacture of drums of various diameters and also provides for correlated operation with the air-pressure-operated top clamp member 28 so that the work is automatically stripped from the chuck member in conjunction with the unclamping movement of member 28. Furthermore, in the present apparatus the stripper member initially positions the drum head and locates the same centrally with respect to the chuck member 13.

Having reference particularly to FIG. 3, the stripper element itself, in the present instance, comprises a generally C-shaped flat plate member designated 100. The inside diameter of plate member 100 is such that it just clears the outer diameter of chuck member 13 and the upper surface of the plate member 100 is recessed at its inner portion to form an arcuate ledge designated 102 in FIGS. 3, 4 and 10. Stripper member 100 is bored to receive a pair of guide pins 101 which are secured at their lower ends to the work surface of bed 10 and project upwardly therefrom as clearly shown in FIG. 3.

Stripper member 100 rests upon the upper ends of four piston rods 104 which project upwardly from fluid pressure operating cylinders 105 which are likewise attached to the work surface of base 10. In FIG. 4 the piston rods are in their lower positions wherein they support stripper member 100 at a position slightly below the flanges 22 and 24 of the work pieces to permit unobstructed operation of the forming rolls 80 and 88.

When valve 60 is operated to reverse the application of pressure to cylinder 36 and raise piston rod 37 and clamp plate 38, operating pressure is automatically and simultaneously applied beneath the pistons of piston rods 104 to project the latter upwardly and raise stripper 100 to force the lower end of the finished work members from chuck

member 13. The air pressure conduit from valve 60 to the cylinders 105 is indicated schematically at 107 in FIG. 2 and in FIG. 10. In the absence of air pressure piston rods 104 are urged to a lower withdrawn position by springs 108 in the cylinders 105 as shown in FIG. 10.

Referring more particularly to FIG. 10, after a stripping operation and until a succeeding clamping operation the stripper member 100 remains in the elevated position shown in FIG. 10. At the beginning of a cycle of operation a flanged head member 21 is placed on stripper member 100 and its peripheral flange 24 is located by ledge 102. Application of clamping pressure lowers the stripper member 100 and the head member is moved down over chuck member 13.

Reference will now be had to the hydraulic system for operating and controlling the movements of the forming rolls 80 and 88 and in this connection reference will be had particularly to the hydraulic circuit diagram, FIG. 9. Hydraulic pressure is supplied by a conventional double pump mechanism 120 which is of a known type, wherein the combined delivery of a large pump and a small pump is delivered to the output line below specified pressures and the large pump bypasses to the reservoir 121 above certain pressures whereupon the small pump continues to deliver fluid at a substantially less quantity but at a relatively high pressure.

A pair of four-way valves 123 and 124 are of the spring centered type and thus normally fluid from the pump mechanism 120 flows through the conduit 125 through valve 123, through a conduit 126, through valve 124, and back to the pump reservoir through a conduit 127. The numeral 128 designates a check valve which imposes a back pressure of sufficient degree to actuate the internal pilot operation which is conventional in four-way valves of the type employed in the case of valves 123 and 124.

The four-way valves 123 and 124 are each adapted to be operated in opposite directions by pairs of solenoids 131 and 132 and 133 and 134, respectively. At the beginning of the cycle solenoid 134 is energized. This directs the combined delivery of both pumps into the head end of cylinder 76 through a line 135. The forming roll 80 thus moves to the work at a relatively rapid speed. As soon as pressure in line 135 builds up in excess of the unloading valve of pump mechanism 120, the low pressure pump thereof unloads and the balance of the forward movement of forming roll 80 is accomplished at high pressure by the small pump only. A relief valve 136 in line 135 determines the maximum pressure to cylinder 76.

A pressure switch 137 is in communication with line 135 and when pressure has built up to the setting of this pressure switch a timer (not shown) is started for a dwell period. When this dwell expires solenoid 134 is de-energized and solenoid 133 is energized. This reverses the setting of four-way valve 124 and pump delivery is thence to the line 138 leading to the opposite end of cylinder 76, whereupon the forming roll 80 is returned under the combined operation of both pumps and at a relatively rapid speed.

In FIG. 9 the numerals 139 and 140 designate a pair of limit switches which are arranged to be contacted by the respective roll carriers as the latter move to their return positions. When forming roll 80 is fully retracted limit switch 139 is engaged and this de-energizes solenoid 133. When the dwell period established by timer 137 expires, solenoid 132 becomes energized and the combined delivery of both pumps is now directed into the head end of the cylinder 77 of the flattening roll 88 through line 141 to effect rapid advance of roll 88. When the work is contacted pressure will build up in line 141 as previously described and the balance of the flattening work will be accomplished by the small high pressure pump only.

A further pressure actuated switch 142 is in communication with line 141 and when pressure builds up in

the latter to a predetermined point a further timer (not shown) begins a dwell period. When the dwell expires solenoid 132 is de-energized and solenoid 131 is energized. Combined pump delivery is now directed to the left-hand end of cylinder 77 by way of a line 143 to effect rapid return of forming roll 88. Upon full return limit switch 140 is contacted which de-energizes solenoid 131 to put the hydraulic system in neutral with both of the valves 123 and 124 centered as before. When the dwell period of the timer expires, the main motor 15 is de-energized, so that it slows down and stops while the forming roll 88 is withdrawing.

In a full cycle of operation the operator loads the work pieces into the machine and operates valve 60 to cause clamping operation of cylinder 36. After the work is clamped the operator actuates a start button for main motor 15 which rotates the clamped workpiece. A timing relay (not shown) operates from the start button of the main motor to energize solenoid 134 and institute a cycle of hydraulic operation as previously described. Following the stopping of the main motor at the conclusion of a hydraulic cycle of operation and with the hydraulic system in neutral, the operator reverses valve 60 to release the clamp and strip the work as described previously herein.

We claim:

1. Sheet metal forming apparatus for joining an end member to a drum body comprising, a bed and means thereon for supporting such end member and for rotating the same on its axis, clamp means engageable against an end of a drum body to hold the opposite end thereof in coaxial abutting engagement with said end member, forming rollers movable peripherally against the abutting portions of the end member and the drum body to form a seam therebetween, vertical guide means extending upwardly from said bed, and a plurality of push rods projecting upwardly from said bed, interchangeable stripping means generally surrounding said support means, said stripping means having vertical sliding engagement with said guide means and being adapted to rest upon said push rods, reciprocating fluid motor means for moving said clamp means to and from clamping position, and fluid motor means operable jointly with movement of said reciprocating fluid means to unclamping position for raising said push rods and thus moving said stripping means against the end member and drum body to strip the same from said support means.

2. Sheet metal forming apparatus for joining an end member to a drum body comprising, a bed and means thereon for supporting such end member and drum body and for rotating the same on the axis of the drum body, forming rollers movable peripherally against the abutting portions of the end member and the drum body to form a seam therebetween, vertical guide means extending upwardly from said bed, and a plurality of push rods spaced laterally from said guide means and projecting upwardly from said bed, interchangeable stripping means having vertical sliding engagement with said guide means and being adapted to rest upon said push rods and fluid motor means for raising said push rods to move said stripping means against the end member and drum body to strip the same from said support means.

3. Sheet metal forming apparatus for joining an end member to a drum body comprising, a bed and means

thereon for supporting such end member and for rotating the same on its axis, clamp means engageable against an end of a drum body to hold the opposite end thereof in coaxial abutting engagement with said end member, forming rollers movable peripherally against the abutting portions of the end member and the drum body to form a seam therebetween, vertical guide means extending upwardly from said bed, and a plurality of push rods projecting upwardly from said bed, interchangeable stripping means generally surrounding said support means, said stripping means having vertical sliding engagement with said guide means and being adapted to rest upon said push rods, and reciprocating fluid motor means raising said push rods to move said stripping means against the end member and drum body to strip the same from said support means.

4. Sheet metal forming apparatus for joining an end member to a drum body comprising, a bed and means thereon for supporting such end member and for rotating the same on its axis, clamp means engageable against an end of a drum body to hold the opposite end thereof in coaxial abutting engagement with said end member, forming rollers movable peripherally against the abutting portions of the end member and the drum body to form a seam therebetween, vertical guide means extending upwardly from said bed, and a plurality of push rods projecting upwardly from said bed, interchangeable stripping means generally surrounding said support means, said stripping means having vertical sliding engagement with said guide means and being adapted to rest upon said push rods, and reciprocating fluid motor means for raising said push rods to move said stripping means against the end member and drum body to strip the same from said support means, said stripping means having an arcuate recess concentric with the axis of drum rotation adapted to receive and locate an end member when the stripping means is in raised position.

5. Sheet metal forming apparatus for joining an end member to a drum body comprising, a bed and means thereon for supporting such end member and for rotating the same on its axis, clamp means engageable against an end of a drum body to hold the opposite end thereof in coaxial abutting engagement with said end member, means engaging the abutting portions of the end member and the drum body to form a seam therebetween, stripping means generally surrounding said support means, and means raising said stripping means against the end member and drum body to strip the same from said support means, said stripping means having an arcuate recess concentric with the axis of drum rotation adapted to receive and locate an end member when the stripping means is in raised position.

References Cited in the file of this patent

UNITED STATES PATENTS

1,275,867	Davis	Aug. 13, 1918
1,982,711	Vickers	Dec. 4, 1934
2,228,651	Buck	Jan. 14, 1941
2,307,544	Robinson	Jan. 5, 1943
2,516,322	Jacokes	July 25, 1950
2,559,125	Lee	July 3, 1951
2,779,301	Grotnes	Jan. 29, 1957
2,805,635	Hale	Sept. 10, 1957
2,845,887	Kradoska	Aug. 5, 1958