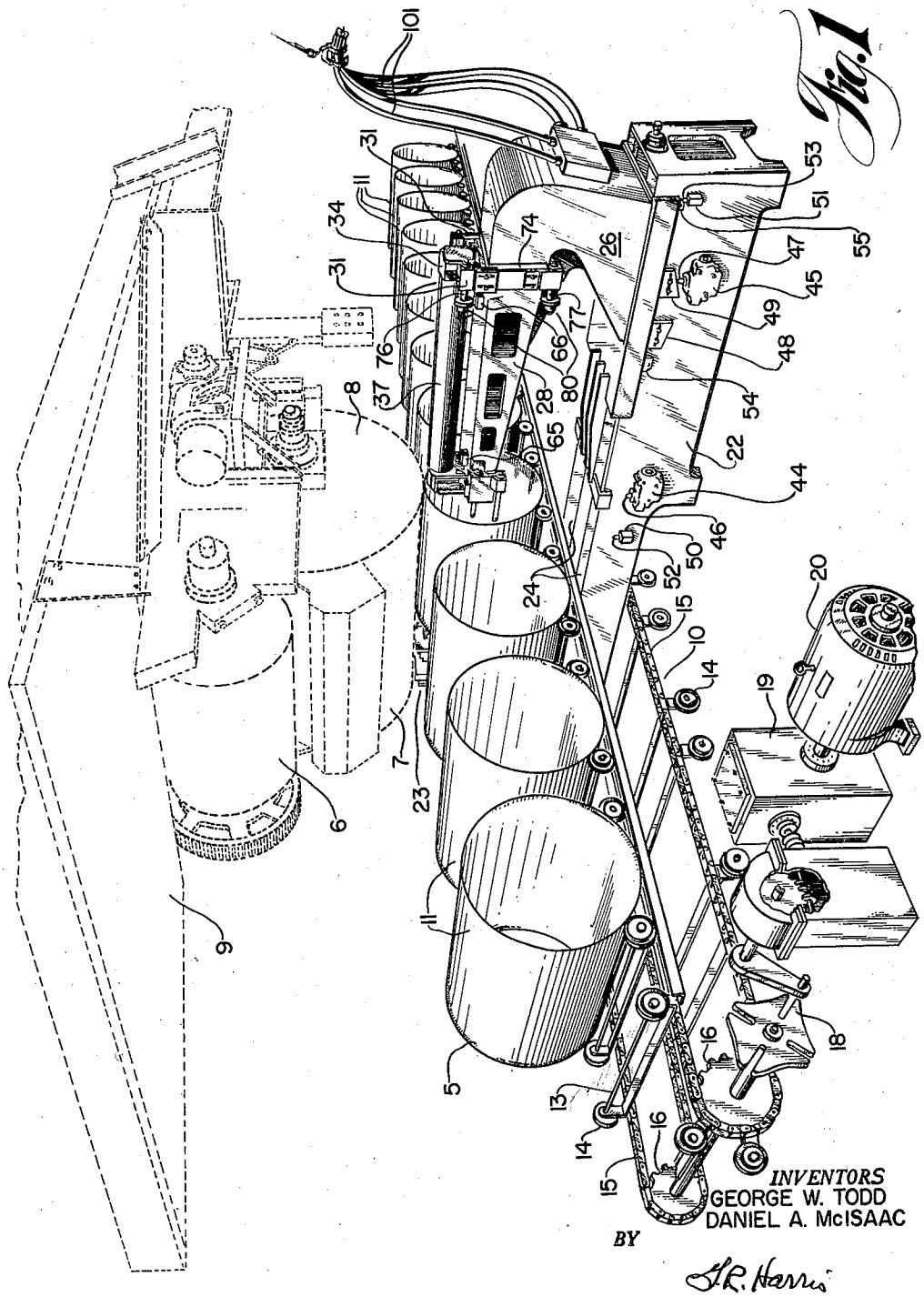
Oct. 14, 1958 G. W. TODD ET AL 2,856,058

POSITIONING APPARATUS

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Fig. 1



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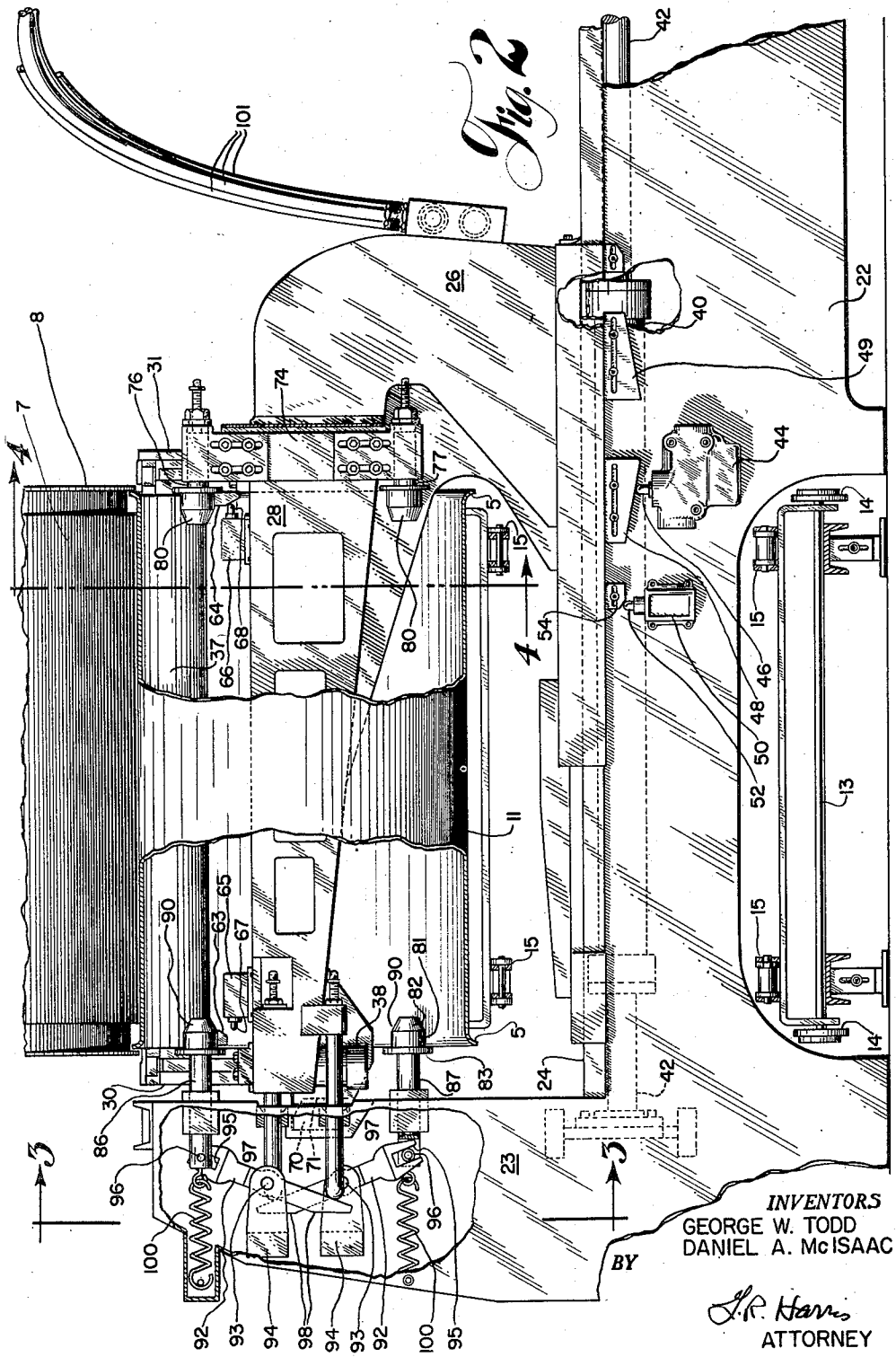
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Fig. 2



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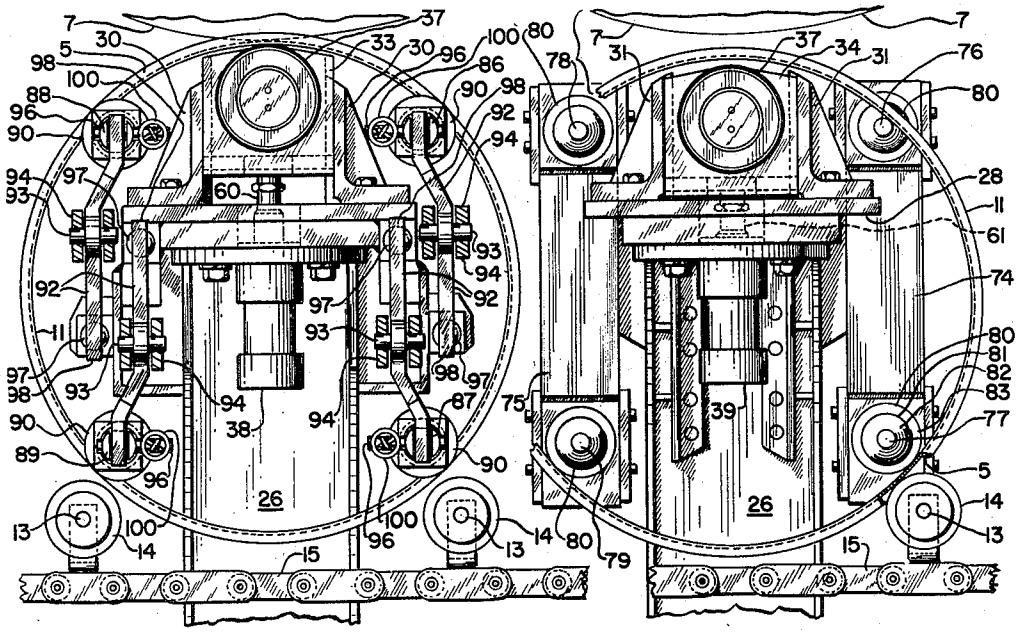


Fig. 3

Fig. 4

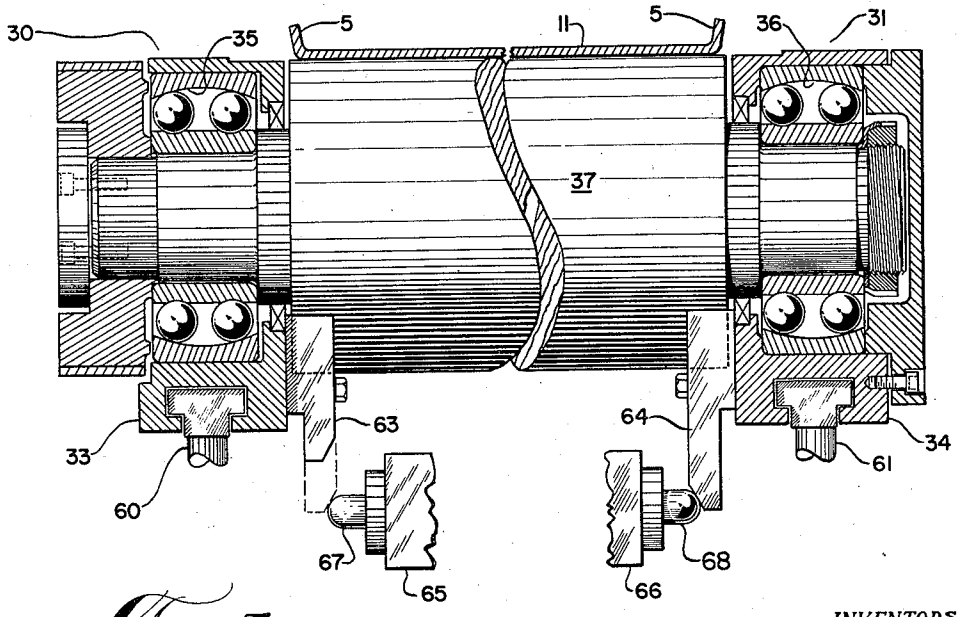


Fig. 5

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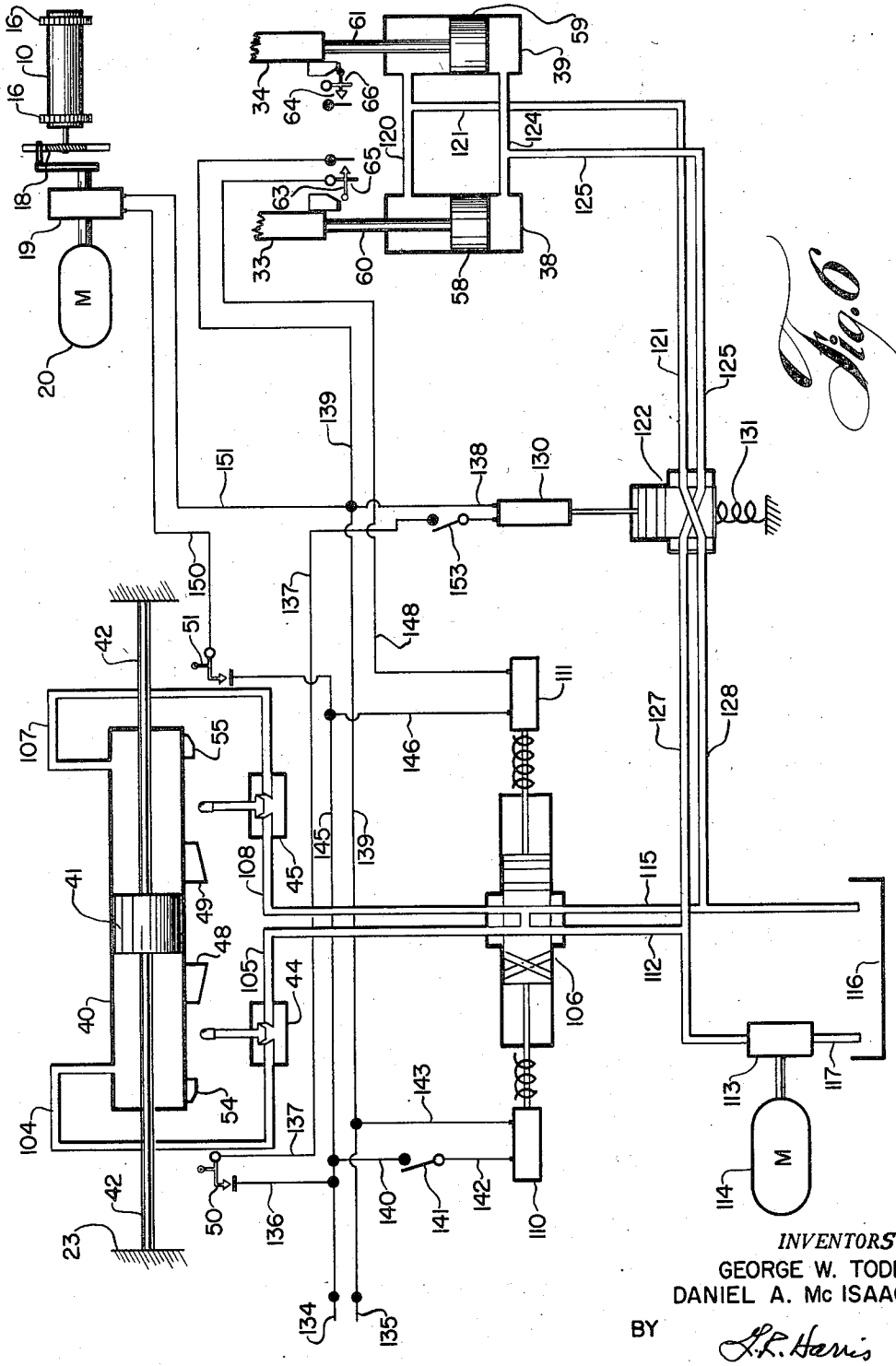


Fig. 6

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2,856,058

POSITIONING APPARATUS

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Application March 4, 1957, Serial No. 643,688

15 Claims. (Cl. 198—33)

This invention relates to apparatus for successively positioning cylindrical shells for an operation upon the shell surface. The invention is more particularly concerned with apparatus for successively positioning cylindrical barrel shells for decoration of their surfaces by a rotary press or the like.

It is an object of our invention to provide apparatus adapted to position relatively flexible cylindrical shells, such as the shells of steel drums, one after another for an operation such as rotary printing of the exterior shell surface. It is another object of our invention to provide apparatus adapted to position a shell so that it may be freely rotated without misalignment. It is another object of our invention to provide apparatus adapted to lift successive shells from a conveyer and hold each shell so lifted so that it may be freely rotated by the mechanism acting upon it. It is another object of our invention to provide positioning apparatus for relatively flexible cylindrical shells which firmly supports each shell internally against pressures incident to the operation being conducted on its surface. Other objects of our invention will appear in the course of the following description thereof.

Users of steel drums or barrels in many cases wish to have these containers decorated with a design which covers the entire exterior surface of the drum. Such a decoration can only be applied to the article after it has been formed into a cylindrical shell and, of course, it is most convenient to apply such decoration by rotary apparatus which causes the shell to rotate as it is being decorated. A conventional form of apparatus for so decorating drum shells is a rotary offset press employing a large drum or roll carrying a resilient blanket, which may be made of rubber, onto which the desired design is transferred from a number of rolls carrying inked plates and which offsets the decoration upon a drum shell brought in contact with the blanket. Drum printing apparatus of this type can be made to operate quite rapidly if the successive drum shells to be decorated can be positioned rapidly and precisely for decoration. Such positioning apparatus has not to our knowledge been available prior to our invention, to be described.

A present preferred embodiment of our invention is illustrated in the attached figures to which reference is now made.

Fig. 1 is a view in perspective of apparatus of our invention together with a representation of a portion of a rotary offset press of the type with which our invention may be used.

Fig. 2 is an elevation broken away in portions to show the internal construction of apparatus of our invention.

Fig. 3 is a cross section through the apparatus of Fig. 2 taken on the plane indicated by the line 3—3, showing the back-up roll of our apparatus in its raised position.

Fig. 4 is another cross section of the apparatus of Fig. 2 taken on the plane indicated by the line 4—4 showing the back-up roll of our apparatus in its lowered position.

Fig. 5 is a longitudinal section through the mounting of the back-up roll of the apparatus of our invention.

Fig. 6 is a schematic representation of the hydraulic and electric circuits of our apparatus.

Our apparatus includes a conveyer 10 which carries a succession of cylindrical drum shells 11—11 beneath an offset printing apparatus 9. Each shell 11 is a smooth surfaced cylindrical shell formed with an outturned flange 5 at each end. The offset printing apparatus 9 in itself forms no part of our invention and is shown only in sufficient detail to provide a clear understanding of the structure and operation of the apparatus of our invention. The printing apparatus includes a large diameter rotating roll 8 provided around its outer surface with an offset blanket 7. Printing apparatus 9 is also provided with one or more smaller rotating rolls 6, each of which carries on its surface a curved plate or die formed in the pattern of the design to be applied to the drum shells 11. Printing apparatus 9 is also provided with means, not shown, for inking the plate carried by roll 6. It will be understood that the printing apparatus may be provided with several such rolls 6 each provided with a different color of ink and carrying only that portion of the design appearing in that color on the decorated barrel. The plate-carrying roll 6 transfers its inked impression to the offset blanket 7 of rotating roll 8, which in turn applies it to the surface of a drum shell 11 positioned beneath it by the apparatus of our invention.

Conveyer 10 is provided with a succession of transverse rods or axles 13, each such axle carrying a flanged roller 14 at each end thereof. Successive axles 13 are spaced apart along the conveyer a distance such that two adjacent pairs of rollers 14 support a drum shell 11 by its flanged ends. Conveyer 10 has a pair of endless chains 15—15 each extending over a sprocket wheel 16 at either end of the conveyer to form an upper and a lower flight. The transverse axles 13 are attached at each end to chains 15. Our conveyer 10 is driven by an indexing drive which may conveniently be a Geneva movement device 18 driven through a magnetic clutch 19 by an electric motor 20. The drum shells 11 are positioned on conveyer 10 with their axes parallel to each other and to the axis of rotating roll 8 of the press 9, as may be observed from Fig. 1.

An elongated bed structure 22 is positioned parallel to the axes of the drum shells 11 between the upper and lower flights of conveyer 10. This bed structure 22 extends beyond the conveyer 10 on both sides. On one side of the conveyer 10 bed structure 22 terminates in an upright abutment 23. The upper surface of bed structure 22 is formed into parallel ways 24 which extend from abutment 23 crosswise of conveyer 10 and beyond it on the side opposite abutment 23. Slidably mounted on ways 24 is an upright member 26 carrying a ram 28 which is elongated parallel to ways 24 and extends toward abutment 23. The upper surface of ram 28 is provided at its unsupported end with a pair of upright housings 30—30 and with a like pair of upright housings 31—31 near its supported end. In housings 30—30 a block 33 is mounted so as to allow vertical sliding movement, and in housings 31—31 is mounted a like block 34 which is also capable of sliding movement in a vertical direction. Block 33 is provided with a bearing 35, preferably of antifriction type, and block 34 is provided with a like bearing 36 so disposed that a cylindrical roll 37 may be journaled therein with its axis parallel to ways 24. Roll 37 rotates freely in bearings 35 and 36. Beneath block 33 is positioned a hydraulic cylinder 38 which is affixed to ram 28 and beneath block 34 is positioned a second hydraulic cylinder 39 identical to hydraulic cylinder 38 and also affixed to ram 28.

Upright element 26 is rigidly attached to a horizontally disposed hydraulic cylinder 40 which is positioned between ways 24—24. Cylinder 40 is provided with a

piston 41 which is attached to a double-ended piston rod 42. Rod 42 runs the full length of ways 24—24 and is fastened at each end to bed structure 22. Upon bed structure 22 are mounted hydraulic valve mechanisms 44 and 45. Valve 44 has an upwardly projecting pin 46 movable in the direction of its axis to operate the valve mechanism. Valve 45 is provided with a like pin 47. A cam 48 is attached to upright member 26 so as to depress pin 46 and a cam 49 is likewise mounted on member 26 to depress pin 47 of valve 45 in a manner to be described. Bed structure 22 also carries limit switches 50 and 51. Limit switch 50 is provided with a movable pin 52 which actuates its mechanism and limit switch 51 is provided with a like pin 53. Upright structure 26 carries a cam 54 adapted to move pin 52 of limit switch 50 and also a cam 55 adapted to move pin 53 of limit switch 51 in a manner to be described.

Hydraulic cylinder 38 is provided with a piston 58 and hydraulic cylinder 39 with a piston 59. Piston 58 is attached to piston rod 60 and piston 59 is likewise attached to piston rod 61. Piston rod 60 is attached to block 33 and piston rod 61 is attached to block 34. Block 33 carries on its lower portion a downwardly projecting cam 63 and block 34 carries a somewhat similar downwardly projecting cam 64. Ram 28 carries limit switch 65 positioned adjacent to block 33 and limit switch 66 positioned adjacent to block 34. Limit switch 65 is operated by plunger 67 and limit switch 66 is operated by plunger 68. Cam 63 is positioned so that when block 33 is lowered it pushes in plunger 67 of limit switch 65. Cam 64 is positioned so that it pushes plunger 68 of limit switch 66 inwardly except when block 34 is raised to its upper position when cam 64 permits plunger 68 of limit switch 66 to move outwardly.

The inner face of abutment 23 opposite ram 28 is provided with a projection 70 which mates with a recess 71 in the end of ram 28 so that when ram 28 is moved against abutment 23 its otherwise unsupported end is supported by projection 70.

Ram 28 at its junction with element 26 is provided with outwardly projecting shoulders 74 and 75, one on each side thereof. Shoulder 74 carries near its upper end shaft 76 which projects toward abutment 23 parallel to ways 24—24 and the axis of roll 37 and a like shaft 77 near its lower end. Shoulder 75 also carries similar projecting shafts 78 near its upper end and 79 near its lower end. Upon each of these shafts is mounted a freely rotating roller 80. Each roller 80 is formed with a cylindrical surface 81, a tapered nose portion 82, which tapers to a smaller diameter than cylindrical portion 81, and a flange 83 on the opposite end of cylindrical portion 81.

In the face of abutment 23 adjoining ram 28 are mounted four shafts 86, 87, 88 and 89, the axes of these shafts being prolongations of the axes of shafts 76, 77, 78 and 79, respectively. Each of shafts 86, 87, 88 and 89 carries on its end extending toward ram 28 a freely rotating roller 90, which is identical in construction with the freely rotating rollers 80 carried by ram 28. Each of the shafts 86, 87, 88 and 89 is free to move axially in abutment 23. Within abutment 23 is provided a lever arm 92 pivoted for free rotation about a horizontal shaft 93 intermediate its ends. Shaft 93 is carried by bracket 94 affixed to abutment 23. One end of lever 92 is formed with a slot 95 adapted to fit around a pin 96 mounted at the inner end of shaft 86 transverse to the long axis of the shaft. Ram 28 carries a pin 97 which projects beyond the end of ram 28 in a direction parallel to ways 24 and the axis of roll 37. A hole is provided in the inner face of abutment 23 to admit pin 97 which is so positioned that when it enters abutment 23 its end strikes end 98 of lever 92 opposite the slot end 95. A tension spring 100 is connected at one end to pin 96 and at the other end to abutment 23 so as to urge roller 90 carried by shaft 86 toward abutment 23. Shafts 87, 88 and 89 are provided with lever mechanisms identical to that described for shaft 86 and ram 28 is provided with pins identical to pin 97 but positioned to engage the lever mechanisms for shafts 87, 88 and 89 so that all four rollers 90 carried by the four shafts retract or extend in unison.

Hydraulic and electrical connections to the parts of our mechanism carried by ram 28 are lead off through flexible conductors 101 in a manner well understood to those familiar with the art.

The end of hydraulic cylinder 40 adjacent to abutment 23 is connected through pipe 104 to valve 44 and from this valve through pipe 105 to a three-way valve 106, to be described. The end of hydraulic cylinder 40 remote from abutment 23 is connected through pipe 107 to valve 45 and from this valve through pipe 108 also to valve 106. Valve 106 is operated by a pair of solenoids 110 and 111. The valve has three positions, as is clearly shown in Fig. 6. From valve 106 pipe 112 leads to hydraulic pump 113 driven by electric motor 114. Also from valve 106 pipe 115 leads to a sump 116. Pump 113 is provided with an intake pipe 117 which also communicates with sump 116. When neither solenoid 110 nor 111 of valve 106 is energized, the valve connects pipes 105, 108, 112, and 115. When solenoid 111 is energized, the valve slide is moved to the right in Fig. 6 so that pipe 108 is connected to pipe 112 and pipe 105 is connected to pipe 115. When solenoid 110 is energized, the valve slide is moved to the left in Fig. 6 so that pipe 105 is connected to pipe 112 and pipe 108 to pipe 115.

The upper ends of hydraulic cylinders 38 and 39 are connected together by a pipe 120 which is connected by pipe 121 to valve 122. The lower ends of hydraulic cylinders 38 and 39 are likewise connected together by pipe 124 which is connected by pipe 125 to valve 122. Pipe 127 connects valve 122 with pipe 112 coming from pump 113. Pipe 128 connects valve 122 with the sump 116. Valve 122 is operated by solenoid 130 and has two positions, as may be seen from Fig. 6. When solenoid 130 is energized, the valve slide is pulled up so that pipe 125 is connected to pipe 127 and pipe 121 is connected to pipe 128. When solenoid 130 is de-energized, the valve slide is pulled down by a spring 131 as well as gravity so that pipe 121 is connected to pipe 127 and pipe 125 is connected to pipe 128.

One side 134 of an electric power source is connected through conductor 136 to limit switch 50 and from thence through conductor 137 to solenoid 130. The other end of the solenoid 130 is connected through conductors 138 and 139 to the other side 135 of the power source. One side 134 of the power source is connected through conductor 140 to a switch 141 and then through conductor 142 to solenoid 110. The other end of solenoid 110 is connected through conductor 143 to conductor 139 to the other side 135 of the power source. Side 134 of the power source is connected through conductor 145 and conductor 146 with solenoid 111. The other end of solenoid 111 is connected through conductor 148 with limit switch 65 and from there through conductor 139 to the other side 135 of the power source. Side 134 of the power source is connected through conductor 145 to limit switch 51 and thence through conductor 150 to the magnetic clutch 19. The other lead from magnetic clutch 19 is connected through conductors 151 and 139 to the other side 135 of the power source.

It will be understood that although we have described and illustrated electrical control circuits in which the power line voltage is also the control circuit voltage, we may employ relays and a low-voltage control circuit of conventional type.

We shall now describe the operation of our apparatus, again with reference to the present preferred embodiment illustrated in the figures. Let it be assumed that the apparatus initially is in the position illustrated in Fig. 1 in

which ram 28 is retracted from abutment 23 to its fullest extent and a shell 11 is positioned by conveyor 10 beneath roll 8 of the printing apparatus 9. Hydraulic cylinders 38 and 39 are in a position such that roll 37 is in its lower position and in this position it clears the inside surface of drum shell 11. Roll 8 of the press 9 is positioned so that a blank area of offset blanket 7 is directly above ram 28. Member 26 carrying ram 28 is caused to move along ways 24 by hydraulic cylinder 40 carrying ram 28 and the apparatus mounted thereon within drum shell 11.

Rollers 80 are so proportioned and positioned that their tapered ends 82 enter shell 11 as it is supported on conveyor 10, and the two upper rollers 80 lift the end of shell 11 clear of the conveyer and against offset blanket 7 as their cylindrical surfaces 81 enter the shell. The four rollers 80 are disposed so that their cylindrical surfaces 81 are tangent internally to a common circle equal in diameter to that of shell 11.

Rollers 90 carried by abutment 23 are normally held against the face of this abutment by springs 100. As ram 28 approaches abutment 23 pin 97 which projects beyond the end of the ram 28 enters abutment 23 and makes contact with end 98 of pivoted lever 92. As pin 97 pushes on end 98 of lever 92 it causes lever 92 to pivot about shaft 93 so that its slotted end 95 which bears against pin 96 affixed to shaft 86 causes shaft 86 to move outwardly and away from abutment 23 carrying roller 90 with it. Shafts 87, 88 and 89 are caused to move in the same manner and carry their rollers 90 into drum shell 11. The four rollers 90 are disposed in the same manner as the rollers 80 and act in the same way to lift their end of shell 11 clear of the conveyer 10. Our apparatus is adjusted so that the maximum travel of rollers 90 is sufficient to bring their cylindrical portions 81 within and in contact with the iner surface of drum shell 11 and their flanges 83 against the outturned flange 5 of shell 11. Likewise, rollers 80 carried by ram 28 are moved into the other end of drum shell 11 until their flanges 83 engage outturned flange 5 of drum shell 11 and their cylindrical portions 81 make contact with the inner surface of drum shell 11.

Hydraulic cylinders 38 and 39 are then actuated so as to raise roll 37 until it makes contact with the underside of the upper portion of drum shell 11 and hold it against offset blanket 7 carried by rotating roll 8. As roll 8 rotates it transfers its decoration to the outer surface of drum shell 11, which rotates freely on roll 37. The relatively flexible drum shell 11 is firmly supported by roll 37 so that the decoration is transferred from offset blanket 7 uniformly across the surface of drum shell 11 and drum shell 11 is kept in alignment with roll 8 by rollers 80—80 at one end and 90—90 at the other end. When drum shell 11 has made a full revolution and is completely decorated, hydraulic cylinders 38 and 39 are caused to drop roll 37 until it clears the inner surface of drum shell 11 and hydraulic cylinder 40 is operated to cause ram 28 to retract until it is entirely clear of drum shell 11. As ram 28 retracts rollers 90 carried by abutment 23 are also retracted by springs 100—100 and drum shell 11 is set down upon rollers 14—14 of conveyer 10. The indexing drive 18 of conveyer 10 is then actuated and the conveyer moved one position so that decorated drum shell 11 is carried away from press 9 and an undecorated drum shell 11 is positioned beneath press 9 and the cycle above described is then repeated.

The operation of our apparatus is rendered largely automatic by the electrical and hydraulic controls illustrated in Fig. 6 and previously described. The closing of switch 141 energizes solenoid 110 and causes valve 106 to move so that hydraulic fluid from pump 113 passes through pipes 112, 105, valve 44, and pipe 104 into the end of hydraulic cylinder 40 adjoining abutment 23. The pressure of hydraulic fluid on piston 41 which is immovable causes cylinder 40 together with element 26 and ram 28 to move toward abutment 23. As the ram 28 moves

toward the abutment 23 at full speed, cam 48 begins to engage plunger 46 of valve 44. Valve 44 is a throttling valve and cam 48 is tapered so that it gradually depresses plunger 46 thereby reducing the flow of hydraulic fluid to cylinder 40 and slowing down ram 28 as it nears the end of its stroke. Pin 97 carried by ram 28 engages lever 92 to cause rollers 90 to move outwardly after this throttling action just described has begun so that rollers 90 will enter drum shell 11 at a slower speed and raise it smoothly from conveyer 10. When ram 28 has completed its travel toward abutment 23, cam 54 depresses plunger 52 of limit switch 50 which completes the circuit through normally closed switch 153 and solenoid 130 of solenoid valve 122. The solenoid moves the valve into the position shown in Fig. 6 in which it admits hydraulic fluid into the lower ends of hydraulic cylinders 38 and 39. The cylinders then lift back-up roll 37 against the underside of the drum shell 11 to be decorated. Switch 153 is opened after decoration of the shell is completed, de-energizing solenoid 130 and moving valve 122 into the position admitting hydraulic fluid into the upper ends of cylinders 38 and 39, thus lowering back-up roll 37. When roll 37 is at the bottom of its travel and is clear of shell 11, cam 63 closes switch 65, which permits solenoid 111 of valve 106 to be energized so as to move valve 106 into the position which admits hydraulic fluid into the end of cylinder 40 remote from abutment 23. The movement of cylinder 40 carries ram 28 out of drum shell 11 allowing the shell to drop to conveyer 10, and when ram 28 has reached the end of its stroke, cam 55 carried by it closes switch 51 which operates magnetic clutch 19 long enough to permit the indexing drive 18 to move conveyer 10 one shell position. Switches 141 and 153 can be positioned to be operated by the rotation of printer roll 8 if desired.

We claim:

1. Positioning apparatus comprising longitudinally extending ways, an abutment at one end of the ways, a ram slidably mounted on said ways elongated toward said abutment, means to reciprocate the ram along the ways, a roll positioned lengthwise of the ram and journaled therein for free rotation, means carried by the ram for raising and lowering the roll, a plurality of cantilevered freely rotatable rollers carried by the ram, the axes of said rollers being parallel to each other and that of the roll, the rollers extending toward the abutment, a plurality of cantilevered freely rotatable rollers mounted on the abutment, the axes of said rollers being parallel to each other and that of the roll, the rollers extending toward the ram, and means to reciprocate the rollers mounted on the abutment along their axes.

2. Apparatus of claim 1 in which the roll in its raised position and the rollers carried by the ram are positioned so that they are internally tangent to a common circle.

3. Apparatus of claim 1 in which the roll in its raised position and the rollers mounted on the abutment are positioned so that they are internally tangent to a common circle.

4. Apparatus of claim 1 in which the axes of the rollers mounted on the abutment are prolongations of the axes of the rollers carried by the ram.

5. Apparatus of claim 1 having four rollers carried by the ram and four rollers mounted on the abutment.

6. Apparatus of claim 1 in which the facing ends of the rollers carried by the ram and the rollers mounted on the abutment are tapered to a reduced diameter and the other ends of those rollers are flanged.

7. Apparatus of claim 1 having four rollers carried by the ram positioned so that they are internally tangent to a common circle and in which the roll in its lowered position is within said circle and not tangent thereto.

8. Positioning aparatus comprising longitudinally extending ways, an abutment at one end of the ways, a ram slidably mounted on said ways elongated toward said abutment, means to reciprocate the ram along the ways,

a pin mounted in the abutment for sliding movement therein parallel to the ways, one end of said pin extending out of the abutment toward the ram, a freely rotatable roller axially mounted on said end, a lever pivotally mounted in the abutment about a pivot intermediate the ends of the lever, a slidable pivotal connection between one end of the lever and the end of the pin opposite that carrying the roller, a second pin carried by the ram positioned to push the other end of the lever when the ram approaches the abutment, thereby causing the lever to rotate about its pivot and move the roller away from the abutment, and means connected between the abutment and the first pin urging the roller toward the abutment.

9. Apparatus of claim 8 including a throttling control for the means to reciprocate the ram, and a tapered cam carried by the ram adjusted to engage and operate the throttling control gradually as the ram approaches the abutment, the cam being positioned so that it engages and begins to operate the throttling control before the second pin begins to push the lever.

10. Apparatus of claim 8 including a roll positioned lengthwise of the ram and journaled therein for free rotation, means at each end of the roll for raising and lowering it with respect to the ram, control means for said raising and lowering means having a first position in which the raising and lowering means raises the roll and a second position in which the raising and lowering means lowers the roll, and a cam carried by the ram adjusted to move the control means from said second to said first position by contact therewith, said cam being positioned to make contact with said control means when the roller has been moved away from the abutment.

11. Positioning apparatus comprising longitudinally extending ways, an abutment at one end of the ways, a ram slidably mounted on said ways elongated toward said abutment, means to reciprocate the ram along the ways, a roll positioned lengthwise of the ram journaled at each end for free rotation in a block, a housing for each block carried by the ram, each housing permitting vertical sliding movement of the block, means for raising and lowering both blocks simultaneously between upper and lower positions, control means for the ram reciprocating means movable from a first position in which the ram reciprocating means are deactivated to a second position in which the ram reciprocating means are activated to move the ram away from the abutment, and a cam mounted on a block and positioned to move said control means from its first to its second position when said block is lowered to its lower position.

12. Apparatus for positioning hollow cylindrical shells comprising conveyer means adapted and arranged to convey a succession of said shells along a predetermined path of travel at right angles to the axes of the shells, a ram adapted to enter an open end of a shell, means for imparting reciprocating motion to the ram along a predetermined path of travel at right angles to the path of travel of the shells between a position in which the ram is entirely outside the path of travel of the shells and a position in which it extends across said path, a roll positioned lengthwise of the ram and journaled therein for free rotation, and means at each end of the roll for raising and lowering it with respect to the ram, the roll in its raised position being adapted and adjusted so that its uppermost surface clears the ram and supports a shell thereon clear of the conveyer by contact with the internal surface of said shell.

13. Apparatus of claim 12 in which the path of travel of the ram comprises ways extending beneath the shell conveyer and the ram is slidably mounted on said ways, the ram extending toward the path of travel of the shells.

14. Apparatus of claim 12 including a plurality of freely rotatable rollers carried by the ram, the axes of said rollers being parallel to each other and that of the roll, and positioned so that the roll in its raised position and the rollers are internally tangent to a common circle which is clear of the conveyer means.

15. Apparatus for positioning hollow cylindrical shells comprising conveyer means adapted and arranged to carry a succession of said shells along a predetermined path of travel at right angles to the axes of the shells, a ram adapted to enter the open end of a shell, means for imparting reciprocating motion to the ram along a predetermined path of travel at right angles to the path of travel of the shells between a position in which the ram is entirely outside the path of travel of the shells, and a position in which it extends across said path, a roll positioned lengthwise of the ram and journaled therein for free rotation, indexing drive means for the conveyer means, control means for the indexing drive means movable from a first position in which the indexing drive means is deactivated to a second position in which the indexing drive means is activated, and a cam mounted on the ram and positioned to move said control means from its first to its second position when the ram is reciprocated to its position entirely outside the path of travel of the shells.

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