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[54] **MANDREL ASSEMBLY FOR CONTINUOUS CAN PRINTING**
8 Claims, 7 Drawing Figs.

[52] U.S. Cl. **101/40,**
198/22, 198/25, 198/211; 248/295

[51] Int. Cl. **B41f 17/20**

[50] Field of Search **101/35,**
38—40; 248/295, 296, 298; 198/22, 25, 211,
(Cursory)

ABSTRACT: A continuously rotatable mandrel assembly for sequentially carrying a plurality of cans to the blanket of a continuously rotatable printing cylinder wherein, during the printing operation, the can is pressed into engagement with the blanket and is caused to follow the path of the blanket while permitting rotation of the can about its longitudinal axis.

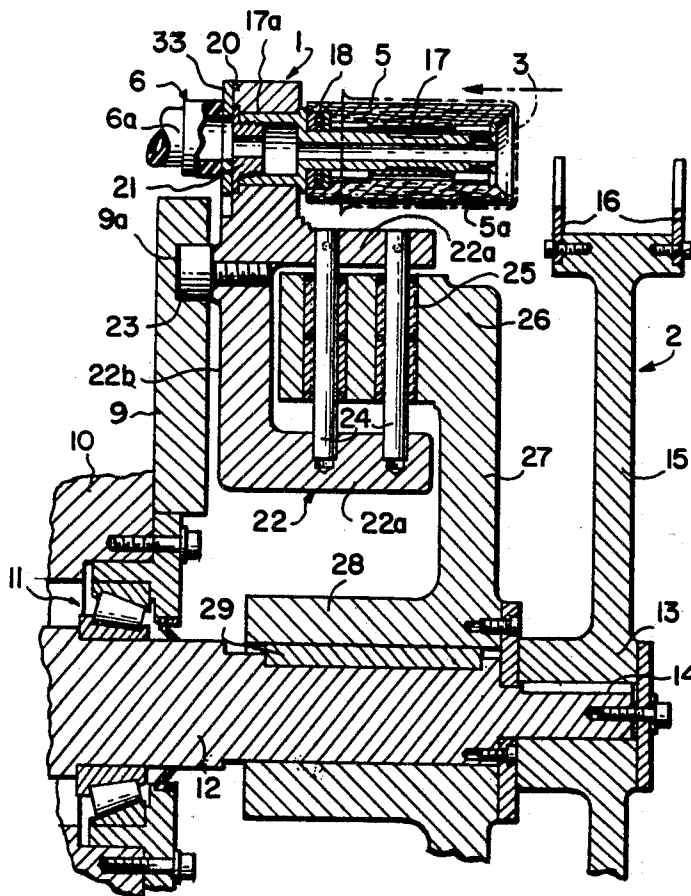


Fig. 1.

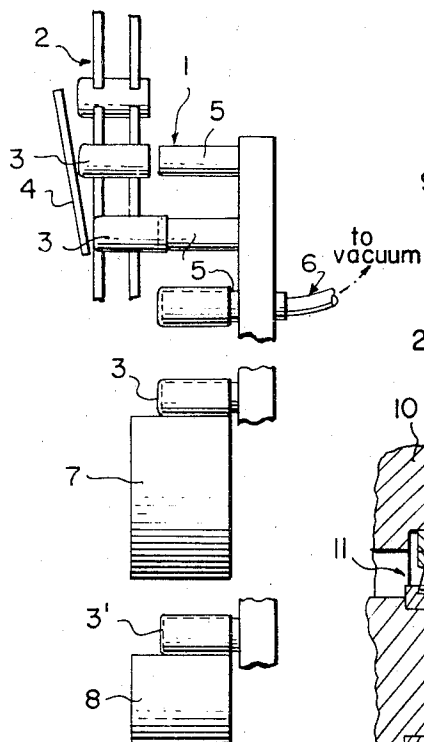


Fig. 3.

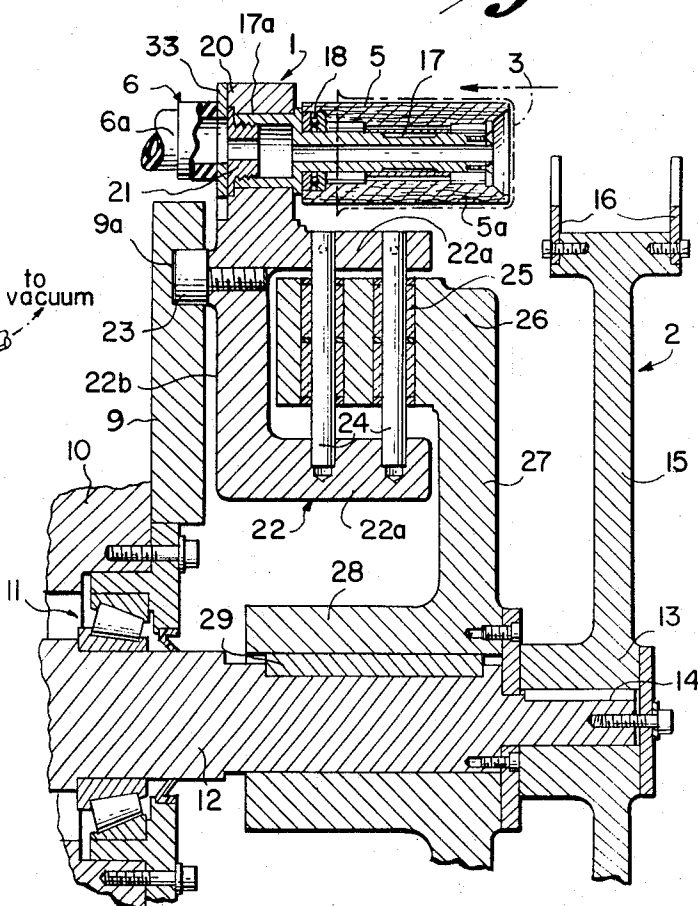


Fig. 6.

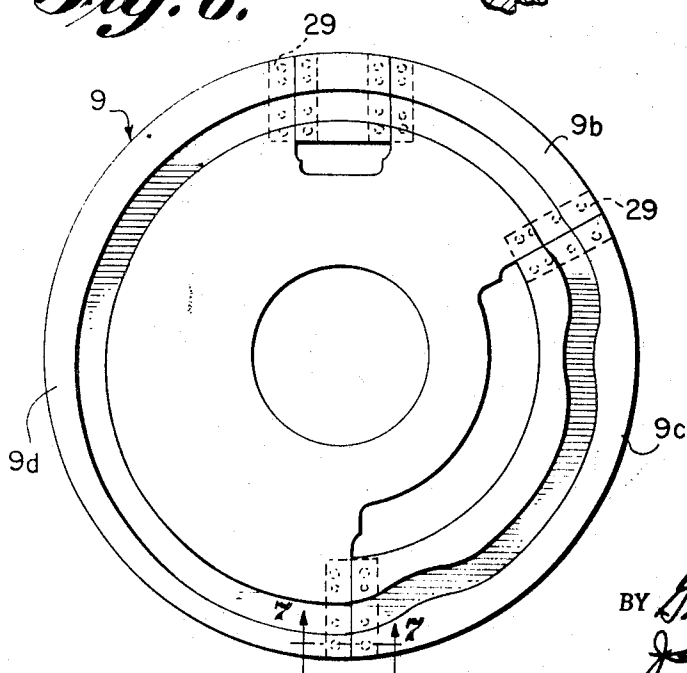
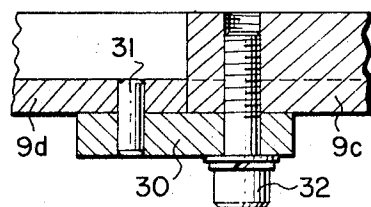


Fig. 7.



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Fig. 2.

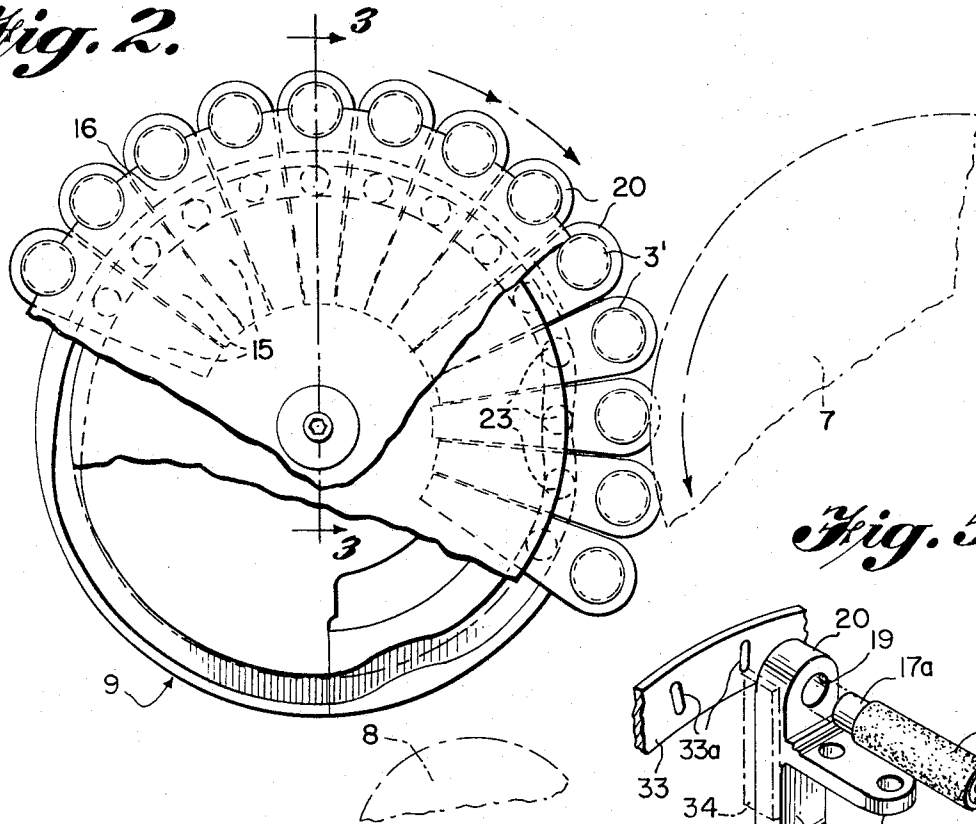


Fig. 5.

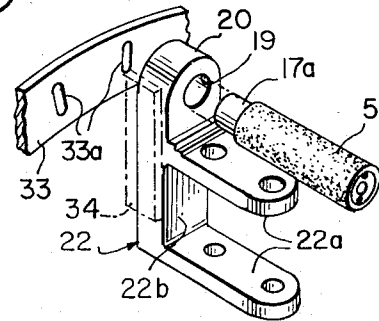
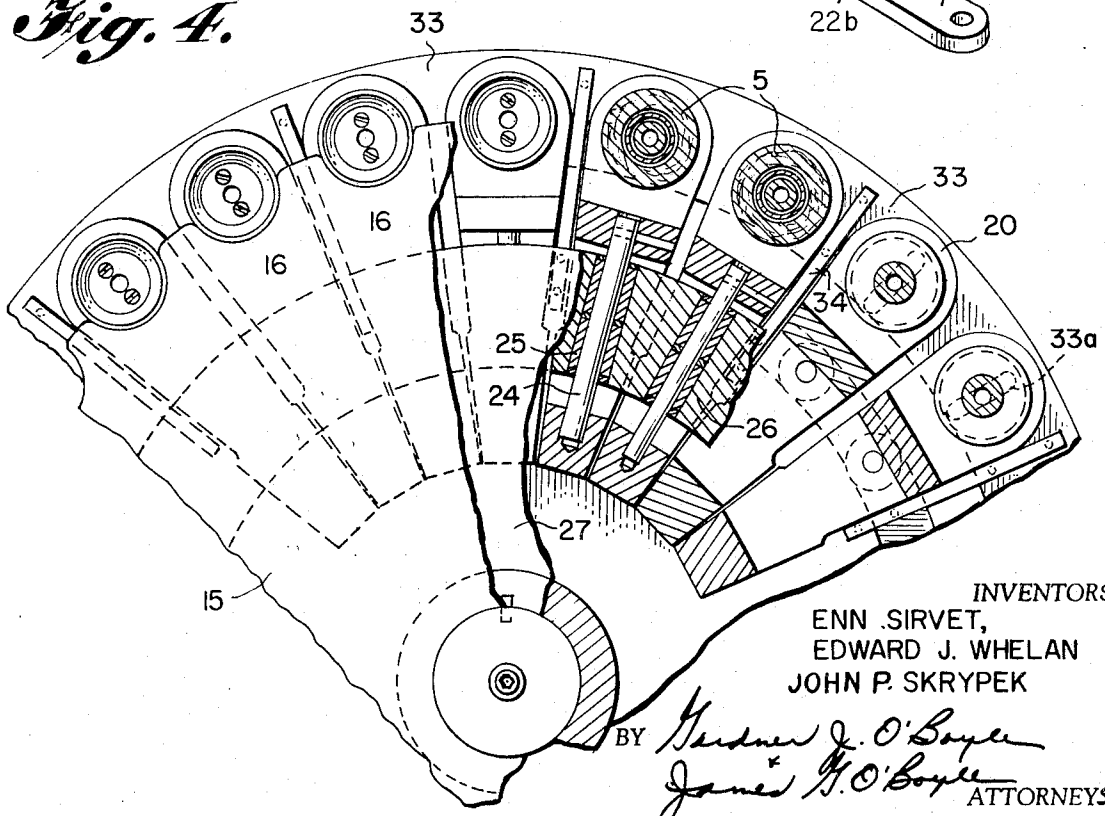


Fig. 4.



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MANDREL ASSEMBLY FOR CONTINUOUS CAN PRINTING

Heretofore, printing on the exterior surface of hollow preformed containers, such as tubes and cans, has been effected by a continuously rotatable printing cylinder having an impression blanket which picks up ink from inking units and applies the impression to the can being supported by a mandrel or spindle freely rotatable about its longitudinal axis and carried by an intermittently rotatable carrier. During the printing operation the can, carried by the mandrel, is rotated about its longitudinal axis due to friction between the can and the blanket, while the mandrel carrier remains stationary for an increment of time to allow the can to complete one revolution about its longitudinal axis to ensure that the entire outer surface of the can is properly printed. It will be appreciated by those skilled in the art that such intermittent rotation of the mandrel carrier greatly limits the number of cans which can be decorated during a given period of time.

To overcome the disadvantages experienced with can printing machines requiring the intermittent rotation of the mandrel carrier, various apparatus have been proposed to permit continuous rotation of the mandrel carrier during the printing operation. In one arrangement, a plurality of spring-biased arms are pivotally connected to a carrier, each arm supporting a can-holding mandrel having a cam follower mounted on one end thereof for engaging a suitably configured cam, whereby upon rotation of the carrier relative to the cam, the cam follower on each arm is spring biased against the cam to ensure that the follower is maintained in engagement with the contour of the cam to thereby cause the can-holding mandrels to follow a path parallel to the surface of the impression blanket of the printing cylinder.

In another proposed arrangement, the can-holding mandrels are mounted on the carrier through an eccentric shaft mechanism to which pivotal motion is transmitted from a cam follower through a linkage assembly. In this arrangement, the printing pressure developed during engagement between the can and the impression blanket is transmitted back through the pivot point of the eccentric shaft mechanism and linkage assembly urging the cam follower into engagement with the cam. In order to prevent the cam follower from moving away from the cam during the nonprinting portion of the cycle, a spring and rod mechanism is employed for urging the follower to follow the cam profile.

While these proposed arrangements have been satisfactory for their intended purpose, that is, the continuous rotation of the carrier during the printing operation, they have been subject to certain disadvantages in that the springs employed for urging the cam follower against the cam have a tendency to lose their biasing force and must be frequently adjusted and/or replaced. Furthermore, the pivotal arms or linkage for connecting each mandrel to its respective cam follower require a number of moving parts, which in turn require constant maintenance.

After considerable research and experimentation, the mandrel assembly of the present invention has been devised to overcome the disadvantages experienced in hitherto employed mandrel assemblies and comprises, essentially, a hub portion having a plurality of radially movable mandrel support arms slidably mounted thereon. Each arm is provided with a cam follower adapted to be mounted within a suitably configured groove formed in a stationary plate cam whereby each of the mandrel support arms is moved in a radial direction during rotation of the hub. By this construction and arrangement, each can-carrying mandrel is caused to follow a path parallel to the surface of the impression blanket of the printing cylinder, whereby the printing of the cans is effected by the continuous movement of the mandrel and printing assemblies.

The direct structural relationship between the cam and each of the cam followers controls the movement of the mandrel support arms during the printing and nonprinting portions of the cycle; accordingly, the necessity of employing springs to bias the cam followers against the cam is precluded. Furthermore, the cam includes removable segments having suitably

configured grooves whereby various sizes of cans to be printed may be accommodated to thereby preclude the necessity of changing each of the cam followers as required in hitherto employed assemblies.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic view showing cans to be printed being transferred to the mandrel assembly of the present invention;

FIG. 2 is a fragmentary, side elevational view of the control cam and associated mandrel support arms;

FIG. 3 is a sectional view taken along line 3-3 of FIG. 2;

FIG. 4 is an enlarged fragmentary sectional view of the mandrel support arms;

FIG. 5 is an exploded perspective view of one of the mandrels and associated support arm;

FIG. 6 is a side elevational view of the control cam employed in the assembly of the present invention; and

FIG. 7 is a view taken along line 7-7 of FIG. 6.

Referring to the drawings and more particularly to FIG. 1, the mandrel assembly 1 of the present invention comprises, essentially, a rotary feed wheel 2 adapted to receive undecorated cans 3 from a supply source, it being understood that each can has a closed bottom but an open top. A stationary, convergent wiper blade 4 is positioned adjacent one side of the rotary wheel and is adapted to sequentially engage the bottom of each can to thereby push the open end thereof onto the end portion of a respective mandrel 5, each can then being completely drawn onto its respective mandrel by means of a vacuum source 6 communicating with the mandrel, to be described more fully hereinafter. After each undecorated can has been sequentially deposited in a respective mandrel, it is carried to the blanket of a continuously rotatable printing cylinder 7 where it is decorated, after which the decorated can 3' is carried to a varnish cylinder 8. After the cans have been decorated and varnished, they are transferred to a suitable conveyor, not shown, and transported through a drying oven.

Each of the mandrels employed in the assembly of the present invention is adapted to follow the path of the blanket of the printing cylinder and varnish cylinder during the decorating cycle whereby the mandrel assembly can be continuously rotated rather than intermittently rotated as heretofore. The details of the mandrel assembly for accomplishing the continuous rotation thereof are illustrated in FIGS. 3 and 4, wherein a disc or plate cam 9 having a suitably configured groove 9a is secured to a stationary frame member 10, the frame member also supporting a bearing and seal assembly 11 through which a rotary drive shaft 12 extends.

The shaft 12 drives the rotary feed wheel 2 which comprises a hub portion 13 keyed as at 14 to the drive shaft, the hub portion having a disc 15 integral therewith, the peripheral edge of said disc having a pair of spaced bifurcated does arms 16 forming a cradle for receiving each undecorated can 3 as it is received from the supply source. Each of the cradles carried by the rotary feed wheel 2 is disposed in alignment with a respective mandrel 5 whereby the undecorated can may be slid from its respective cradle onto a respective mandrel by means of the wiper blade 4 and vacuum source 6 as noted hereinabove.

Each mandrel 5 includes a cylindrical resilient sleeve 5a rotatably mounted on a spindle 17 by means of suitable bearings 18. The resilient sleeves receive the cans in snug fitting relationship as they are moved in the direction of the arrow shown in FIG. 2; however, the snug fit of the can on the resilient sleeve does not prevent the can from sliding longitudinally thereon when being transferred to or from the mandrel.

As will be seen in FIGS. 3 and 5, each spindle 17 is provided with an enlarged portion 17a, one end thereof being secured within a bore 19 of an ear portion 20 by means of a nut 21. The ear portion 20 is integrally formed on a bifurcated arm or bracket 22 formed by spaced, parallel legs 22a integrally con-

nected to a base portion 22b. A cam follower 23 is secured to the base portion of the bracket and is adapted to ride within the cam groove 9a. A pair of parallel rods 24 extend between and are secured to the bracket legs 22a, and are slidably received within suitable bearings 25 mounted within an annular rim or carrier 26 positioned within the bight portion of the bracket 22, the carrier being integrally connected to one end of a web portion 27, the opposite end of the web portion being integrally connected to a hub 28 keyed as at 29 to the drive shaft 12.

By the construction and arrangement of the mandrel assembly thus far described, it will be readily apparent that when the drive shaft 12 is rotated, the radial arms 27 carrying the brackets 22 will be similarly rotated. During this rotation, the cam follower 23 will follow the profile of the cam groove 9a causing the pins 24 to slide within the bearings 25, whereby the bracket 22 and associated mandrel 5 are caused to move in a vertical plane.

The particular cam employed in the mandrel of the present invention is illustrated in FIGS. 6 and 7, and comprises a plurality of segments 9b, 9c and 9d each having a portion of the complete cam groove 9a formed therein, each of the segments being interconnected by an overlapping plate 30 connected to one segment through a dowel pin 31 and the adjacent segment by bolt 32. While the cam illustrated employs three segments, it will be appreciated by those skilled in the art that any number of segments having grooves of predetermined configuration may be assembled, whereby the desired movement may be imparted to each bracket 22 and associated mandrel 5 during the rotation of drive shaft 12. The desired reciprocatory movement imparted to the mandrels 5 by the control cam 9 in the present invention is illustrated in FIG. 2, wherein it will be seen that the configuration of the cam groove causes each can-carrying mandrel to follow a path parallel to the surface of the impression blanket of the printing cylinder 7 and varnish cylinder 8, while each can is being pressed into engagement with the respective cylinders during the printing cycle. By this construction and arrangement, the mandrel assembly may be continuously rotated which thereby obviates the necessity of intermittently stopping the mandrels during the printing cycle as required heretofore. Furthermore, by employing interchangeable cam segments, the assembly of the present invention can be readily adapted to handle cans of various sizes, the main requirement being that the configuration of the cam groove be such that the can-carrying mandrels follow a path parallel to the surfaces of the printing and varnish cylinders during the decorating cycle.

The changing of the configuration of the cam groove to accommodate a particular can size will also cause a corresponding change in the amount of reciprocatory movement imparted to the mandrels. While the amount of reciprocatory movement of the mandrels may be changed, it is still important when each mandrel is moved past the vacuum source that it be aligned with the nozzle 6a thereof for drawing the undecorated can onto the mandrel. It is also important that the mandrel be aligned with the pressure source (not shown) as it moves past its nozzle for blowing the decorated can from the mandrel onto the drying oven conveyor. To facilitate this alignment an annular ring 33 (FIGS. 3, 4 and 5) having a plurality of spaced, radially extending slots 33a is mounted in abutting relationship against the outer face of the ear portion 20 and nut 21, each slot 33a communicating with coincident bores formed in the nut 21 and spindle 17, the annular ring being held in operative position by a plurality of radial fingers 34 each of which has one end secured to the ring 33 and the other end secured to the rim 26. It will thus be seen that the radial slots 33a in the ring 33 maintain communication between the bores of the spindles and the vacuum and air pressure nozzles in spite of any vertical displacement of the mandrel relative to the nozzles caused by a change in cam configuration.

In the operation of the mandrel assembly of the present invention, the undecorated cans 3, being fed from a supply

source, are sequentially deposited on a respective cradle 16 carried by the rotary wheel 2. As the rotary wheel passes the blade 4, each can is pushed onto the outer end portion of the mandrel which is aligned with a respective cradle on the rotary wheel. The mandrels are then sequentially rotated past the nozzle 6a of the vacuum source, whereby each can is drawn completely onto its respective mandrel. During this portion of the cycle, the cam 23 riding in cam groove 9a is in a dwell position; therefore, no reciprocatory movement is imparted to the brackets 22 and associated mandrels. The can-carrying mandrels, being driven in a clockwise direction as indicated by the arrows in FIG. 2, then approach the decorating cycle where the cans are printed by the printing cylinder 7 and varnished by the varnish cylinder 8. During this portion of the operation, each cam follower 23 follows the profile of the cam groove to cause each bracket 22 and its respective can-carrying mandrel to follow a path parallel to the surfaces of the impression blankets of the printing and varnishing cylinders, while simultaneously causing each can to be pressed into engagement with the blankets. During the engagement of each can with the impression blankets, the mandrel bearings 18 allow the respective mandrel to rotate about its longitudinal axis, the rotation of which is effected by the frictional engagement between the can and the impression blanket due to the fact that drive shaft 12 and impression blankets are being rotated at different linear speeds. The length of the cam profile is so selected to ensure that each can-carrying mandrel completes at least one revolution about its longitudinal axis before the can is moved out of contact with the impression blankets.

After the cans have been suitably printed and varnished, the cam followers ride once again into the dwell portion of the cam where each decorated can is blown from its respected mandrel onto an oven-drying conveyor.

From the above description, it will be appreciated by those skilled in the art that the assembly of the present invention provides an improved mandrel assembly for the continuous printing of cylindrical containers and that the construction and arrangement of the cam 9 and the mandrels 5 affords a direct control of the mandrels to impart the desired movement thereto during the printing and nonprinting portions of the operation, whereby the necessity of employing numerous springs, pivot joints, and pivotal arms is precluded; thus resulting in an assembly having relatively few moving parts and therefore not likely to get out of order even after long and continued use.

We claim:

1. A mandrel assembly of the character described for use with a can-decorating machine of the type having a rotatable impression member, said mandrel assembly comprising a hub secured to a rotatable drive shaft, an annular rim, and a web portion connecting the annular rim to said hub; a plurality of circumferentially spaced bifurcated brackets, each bracket including a pair of spaced, parallel legs integrally connected to a base portion, said annular rim being positioned within the bight portion of each bifurcated bracket; means supporting each bracket on said rim for reciprocatory movement relative thereto along an axis perpendicular to the axis of rotation of said rim, can-receiving mandrel means mounted on each bracket, and cam means operatively connected to the brackets for imparting the reciprocatory movement thereto thereby constrain the brackets and associated mandrel means to follow a path parallel to the impression-imparting surface of the impression member, whereby a can carried by the mandrel is caused to be pressed into engagement with said surface and to follow the path thereof during the transfer of an impression to the can.

2. A mandrel assembly in accordance with claim 1, wherein the means for supporting each bracket on the rim comprises, bearing means mounted within said annular rim, and pin means extending between and secured to the legs of said bifurcated bracket, said pin means being slidably mounted within said bearing means.

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3. A mandrel assembly according to claim 1, wherein the cam means comprises, a stationary, grooved plate cam mounted adjacent the circumferentially spaced bifurcated brackets, and a cam follower secured to each bracket and adapted to travel within the groove of said plate cam.

4. A mandrel assembly according to claim 1, wherein a rotary feed wheel is secured to said drive shaft, said feed wheel including a plurality of spaced, bifurcated arms forming cradles for receiving undecorated cans from a supply source, said cradles being aligned with said can-receiving mandrels.

5. A mandrel assembly according to claim 4, wherein a convergent wiper blade is positioned adjacent one side of the rotary feed wheel for sequentially engaging the bottom of each undecorated can carried in the cradles to thereby push the open end thereof onto the can-receiving mandrels.

6. A mandrel assembly according to claim 2, wherein the can-receiving mandrel means comprises, a spindle secured to each bifurcated bracket, and a resilient sleeve rotatably

mounted on each spindle, whereby the resilient sleeve is rotatable about an axis parallel to the axis of rotation of said rim during the transfer of an impression from the impression-imparting surface of the impression member to a can supported on said sleeve.

7. A mandrel assembly according to claim 6, wherein an annular ring is positioned adjacent said brackets, said annular ring having a plurality of radial slots formed therein communicating with a coincident bore formed in each spindle, whereby the bores of the spindles are sequentially aligned with a vacuum source during rotation of the rim to thereby draw an undecorated can onto each mandrel.

8. A mandrel assembly according to claim 3, wherein the plate cam comprises a plurality of interconnected segments, each segment having a portion of the complete cam groove formed therein, whereby the segments are interchangeable to provide a cam groove of variable configurations.

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