METHOD FOR ASSEMBLING UNITS WITH CONNECTOR CLIP

FIG. 29

FIG. 30

FIG. 51

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FIG. 53

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METHOD FOR ASSEMBLING UNITS WITH CONNECTOR CLIP

FIG. 65

FIG. 66
| TS | Contact Description                                      | 0° | 30° | 60° | 90° | 120° | 150° | 180° | 210° | 240° | 270° | 300° | 330° | 360° |
|----|--------------------------------------------------------|----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|
| TS1| LS3 BY-PASS CONTACT                                    |    |     |     |     |      |      |      |      |      |      |      |      |      |
| TS2| PROPER STARTING SEQUENCE CONTACT                      |    |     |     |     |      |      |      |      |      |      |      |      |      |
| TS3| CAN TRANSFER & SIDE GUIDE CONTACT                     |    |     |     |     |      |      |      |      |      |      |      |      |      |
| TS4| PROGRESSION CONVEYOR CONTACT                           |    |     |     |     |      |      |      |      |      |      |      |      |      |
| TS5| ROT. MAG. PICK-UP VOLTAGE CONTACT                      |    |     |     |     |      |      |      |      |      |      |      |      |      |
| TS6| ROT. MAG. HOLDING VOLTAGE CONTACT                      |    |     |     |     |      |      |      |      |      |      |      |      |      |
| TS7| SENSING HEAD CONTACT #1                                |    |     |     |     |      |      |      |      |      |      |      |      |      |
| TS8| RELAY CONTACT                                          |    |     |     |     |      |      |      |      |      |      |      |      |      |
| TS9| SENSING HEAD CONTACT #2                                |    |     |     |     |      |      |      |      |      |      |      |      |      |
| TS10| CLIP APPLICATION & ORIENT PLATE CONTACT                |    |     |     |     |      |      |      |      |      |      |      |      |      |
| TS11| CLIP FEED CONTACT                                      |    |     |     |     |      |      |      |      |      |      |      |      |      |
| TS12| CAN COUNTER BY-PASS CONTACT                            |    |     |     |     |      |      |      |      |      |      |      |      |      |

FIG. 86

DEGREES

0° 30° 60° 90° 120° 150° 180° 210° 240° 270° 300° 330° 360°

CLOSE 180°
OPEN 0°

CLOSE 0°
OPEN 10°

CLOSE 0°
OPEN 120°

CLOSE 180°
OPEN 210°

CLOSE 30°
OPEN 60°

CLOSE 65°
OPEN 150°

CLOSE 66°
OPEN 145°

CLOSE 68°
OPEN 142°

CLOSE 70°
OPEN 140°

CLOSE 30°
OPEN 150°

CLOSE 15
OPEN 300°

CLOSE 0°
OPEN 330°

BASED ON 50 CYCLES PER MINUTE
METHOD FOR ASSEMBLING UNITS WITH CONNECTOR CLIP

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Filed Apr. 3, 1963, Ser. No. 270,341
10 Claims. (Cl. 53—14)

This is a continuation-in-part of application Serial No. 100,618, filed April 4, 1961, and now abandoned, and application Serial No. 174,655, filed February 12, 1962.

This invention is directed to a connector clip, and methods and apparatus for assembling multiple units into a package form with the connector clip, and is particularly adapted to assembling containers such as conventional cans into multiple unit packages.

In recent years emphasis has been placed on selling multiple unit packages such as the standard six-pack of beer cans, two or more connected cans of fruit juice or soup and the like. It has been found that a substantial sales increase in this items is achieved by this multiple unit packaging concept. Typically, the cans are formed into a multiple unit package by a paper or plastic wrap or carton.

Recent innovations in the multiple packaging field include the use of a metal or plastic clip detachably connected to a plurality of cans to form a multiple unit package. Typical of these plastic clips are those shown in my United States patent applications Serial Number 174,655, filed February 12, 1962 and Serial Number 100,618, filed April 4, 1961.

Various sheet metal clips have been devised for connecting cans, however, none of these metal clips have enjoyed wide-spread usage due to the sharp edges on the clip which may injure a clip user or cut through the protective coatings on the connected metal cans, thereby permitting subsequent unconnected cans to become detached.

The invention avoids these disadvantages by providing a molded plastic clip having unique configuration features. The sharp edges of a plastic clip cannot gouge or otherwise damage the protective coatings of cans. A feature of the invention, moreover, is the concept of providing guard projections adjacent the sharp edges to reduce the likelihood of anyone being injured by the sharp edges after the clip is removed by a purchaser from a group of cans.

Another teaching of the invention is that a plastic clip molded for this purpose may be formed to any desired configuration and may be thickened in various parts of the configuration for strength or for ornamental appearance. A sheet stamping cannot be formed with locally thickened portions and, therefore, cannot have the structural and ornamental advantages of a clip molded of plastic.

Another advantage is found in a carrier clip that has a central finger hole to facilitate the carrying of a multiple-unit package by a purchaser. If the clip is made of sheet metal, the finger hole has a metal edge that may be a source of discomfort to a person carrying the package. Flanging or rolling the sheet metal edge is not a satisfactory solution. If the clip is made of plastic, however, the finger hole may be formed with a relatively wide rounded edge that cannot cause discomfort.

Another difficulty with many of the prior art can clips, especially those which were formed for metal stampings and the like, relates to the problem of ease of assembly and disassembly of the cans. It will be apparent that metal stamping per se provides relatively rigid structure and, accordingly, special bending operations and the like were required to assemble the clip to the cans. Additionally, after assembly, the relatively rigid clip made it difficult for the ultimate user to disassemble the cans from each other. As noted above, the metal clips frequently had relatively sharp edges and the disassembly operation by the user presented potential hazard in re-assembly and personal injury. Further, the general flexibility of the disclosed arrangement contributes to safety in carrying the cans arrangements. That is, for example, when a group of six cans are associated with one of the herein disclosed clips, it will be seen that opposed finger holes are provided whereby the user may grasp the associated cans by using his thumb and the middle finger. In the carrying action, of course, the thumb and finger direct pressure toward each other and against the associated clip. Thus, the natural carrying action and the flexibility of the clip tend to bias the cans together tightly in a group which avoids accidental disassociation during user transport.

Further features of the disclosed invention relate to appropriate camming structure in the design of the clip per se which, when combined with the inherent flexibility of the clip, provide easy assembly of the clip to the cans. In effect, the head associated with the can end is naturally guided into assembled and locking relationship with the clip. Of course, the inherent flexibility of the arrangement also accommodates ready disassembly by the user in view of the fact that the cooperating parts of the clip which provide can retention may be easily biased away from each other and without the use of excessive pressure or a hand tool whereby the can simply and easily demounts from the clip. For this purpose, certain disclosed embodiments of the invention provide readily accessible tabs. These and other features of the disclosed invention will be readily appreciated from a careful review of the specification and drawings.

A further feature of the invention is the provision of marginal tongue portions shaped to facilitate disengagement of the clip from the cans of a group. The flexible tongues are tapered on their undersides to facilitate manual lifting of the tongues by the purchaser. The features and advantages of the invention may be understood from the following detailed description and the accompanying drawing.

The novel method according to the present invention permits a simple application of the plastic clip to a minimum of two containers up to an unlimited number dependent only on the size package desired. The containers are positioned below a clip positioning device and relative axial movement is effected between the containers and device until the clip engages the head of the containers to form a multiple container package. This relative axial movement is a single motion, easily achieved mechanically and minimizing shock damage to the containers and contents.

The method also permits the production of multiple container packages wherein the individual containers in the package may be oriented into any desired position. Particularly it is desirable to orient the containers so that the predominant printing or decoration on the containers, such as the trade mark or brand name, is displayed outwardly at the sides of the package and any vertical seam on the can is positioned inside the package where it may not be observed by the purchaser of the package.

The orientation method of the present invention permits orientation of all known types of containers including: flat and non-flat top cans; steel cans; aluminum cans; cans with a steel body and aluminum ends; impaction-extruded cans; non-circular cans; plastic cans and plastic-metal cans. The method adapts readily to changes in the amount of orientation desired in the containers or the type of container being oriented. The simplicity with which the method adapts to various types and sizes of containers is extremely important since some canning plants have only short runs of many types and sizes of cans dependent upon the customers' desire. Even can-
ning plants having long runs on a given size of cans require some adaptability in the method of orientation, since normally the canning plant operator utilizes at least two sources of supply of cans and the cans vary in seam types, etc., from the two supply sources.

The method according to the present invention minimizes cycle time, thereby maximizing output per machine invested dollar, by simultaneously performing the feeding, orienting and clipping steps on segregated groups of cans.

The apparatus according to the present invention performs the functions described above with respect to the method of the present invention and further provides a machine having high operating speeds, maintenance-free dependable operation, versatility for handling various types and sizes of cans, low operating cost and operational simplicity, thereby permitting use of operating personnel with minimum training.

In the drawings I have shown the present preferred embodiments of my invention in which:

FIGURE 1 is a perspective view of a group of six cans interconnected by two plastic clips in accord with the teachings of the invention;

FIGURE 2 is an enlarged plan view of one of the plastic clips of FIGURE 1 showing how the plastic clip interconnects a group of four cans;

FIGURE 3 is an enlarged transverse section taken as indicated by the line 3—3 of FIGURE 2 and showing the cross-sectional configuration of hook elements of the clip;

FIGURE 4 is a similar cross-sectional view taken along the line 4—4 of FIGURE 2;

FIGURE 5 is a fragmentary plan view similar to FIGURE 2 showing how the clip may be constructed to interconnect only two cans;

FIGURE 6 is a similar view of a third embodiment of the clip for interconnecting three cans;

FIGURE 7 is a fragmentary plan view on a reduced scale of a case of metal cans with the first embodiment of the invention in use to interconnect cans in the case;

FIGURE 8 is an enlarged fragmentary section taken as indicated by the line 8—8 of FIGURE 5 and showing a projecting guard rib adjacent a tooth;

FIGURE 9 is a plan view of an alternate embodiment of the invention and illustrating a multiple clip unit;

FIGURE 10 is a partially sectional view taken along line 10—10 of FIGURE 9;

FIGURE 11 is a fragmentary sectional view taken along line 11—11 of FIGURE 9;

FIGURE 12 is a fragmentary sectional view taken along line 12—12 of FIGURE 9;

FIGURE 13 is an enlarged, fragmentary sectional view taken along line 13—13 of FIGURE 9; and

FIGURE 14 is a fragmentary sectional view taken along line 14—14 of FIGURE 9.

FIGURE 15 is a perspective of an apparatus made according to the present invention, with parts removed for clarity;

FIGURE 16 is a perspective of the main frame used to support various operating elements of the present apparatus;

FIGURE 17 is a perspective of the front side of the present apparatus with parts removed for clarity;

FIGURE 18 is a perspective similar to FIGURE 17 with additional parts added to show the relationship between the operating elements;

FIGURE 19 is a perspective of the rear side of the present apparatus with parts removed for clarity;

FIGURE 20 is a side elevation view of an infeed conveyor unit made according to the present invention;

FIGURE 21 is a plan view of the infeed conveyor;

FIGURE 22 is an end elevation view of the infeed conveyor, taken from the right hand end of FIGURE 20;

FIGURE 23 is an enlarged perspective of the infeed counter and control mechanism;

FIGURE 24 is a cross section taken along line 24—24 of FIGURE 20;

FIGURE 25 is a side elevation view of a can transfer and control assembly;

FIGURE 26 is a front elevation view of the can transfer and control assembly;

FIGURE 27 is a perspective of a modified form of the can transfer and control assembly;

FIGURE 28 is a side elevation view of the assembly as shown in FIGURE 27 with the transfer assembly in advanced position;

FIGURE 29 is a perspective of a first form of an orientation assembly;

FIGURE 30 is a perspective of a second form of the orientation assembly;

FIGURE 31 is a perspective of a third form of the orientation assembly;

FIGURE 32 is a perspective of a fourth form of the orientation assembly;

FIGURE 33 is a perspective of a fifth form of the orientation assembly;

FIGURE 34 is a plan view of the assembly shown in FIGURE 33;

FIGURE 35 is a cross section taken on line 35—35 of FIGURE 34;

FIGURE 36 is a perspective of a sixth form of the orientation assembly;

FIGURE 37 is a plan view of the assembly shown in FIGURE 36;

FIGURE 38 is a cross section of a vacuum chuck, taken on line 38—38 of FIGURE 32;

FIGURE 39 is a side elevation view, partly in cross section, of a seventh form of the orientation assembly;

FIGURE 40 is a perspective of a mechanical chuck used to pick up and rotate the containers;

FIGURE 41 is a cross section of the mechanical chuck, taken on line 41—41 of FIGURE 40;

FIGURE 42 is a top plan view, partly in cross section, of a gear box for rotating the chucks of the orientation assembly;

FIGURE 43 is a cross section through the gear box and electromagnetic chucks forming part of the orientation assembly, taken on line 43—43 of FIGURE 42;

FIGURE 44 is a top plan view, partly in cross section, of a modified gear box for rotating the chucks of the orientation assembly;

FIGURE 45 is a top plan view of a lift plate forming part of the mechanical orientation assembly;

FIGURE 46 is a cross section of the lift plate, taken on line 46—46 of FIGURE 45;

FIGURE 47 is a cross section of the lift plate, taken on line 47—47 of FIGURE 45;

FIGURE 48 is a perspective of a modified form of orientation stop forming part of the orientation assembly, with the stop finger in the extended position;

FIGURE 49 is a cross section of the modified form of orientation stop, taken on line 49—49 of FIGURE 48;

FIGURE 50 is a cross section similar to FIGURE 49, but showing the stop finger in withdrawn position;

FIGURE 51 is a vertical cross section through a transducer sensing head, taken on line 51—51 of FIGURE 50, forming part of the modified orientation assembly;

FIGURE 52 is a side elevation view of a top and bottom clip application station;

FIGURE 53 is an end elevation view of the clip application station, taken from the right hand side of FIGURE 52;

FIGURE 54 is a perspective of a container engaging side guide;

FIGURE 55 is an enlarged perspective, partly in cross section, of the side guide;

FIGURE 56 is a bottom plan view of a pressure pad for applying clips to the top of the containers at the clip application station;
FIGURE 57 is a cross section of the pressure pad shown in FIGURE 56, taken on line 57—57 of FIGURE 56; FIGURE 58 is a cross section of the pressure pad shown in FIGURE 56, taken on line 58—58 of FIGURE 56; FIGURE 59 is a cross section similar to central portion of FIGURE 57, showing a modified form of pressure pad; FIGURE 60 is a top plan view of a pressure pad for applying clips to the bottom of the containers at the clip application station; FIGURE 61 is a cross section taken on line 61—61 of FIGURE 60; FIGURE 62 is a cross section taken on line 62—62 of FIGURE 60; FIGURE 63 is a plan view, with parts removed for clarity, of a clip feeding assembly for supplying clips to the top clip pressure pad at the clip application station; FIGURE 64 is a side elevation view of the assembly shown in FIGURE 63; FIGURE 65 is a cross section taken on line 65—65 of FIGURE 64; FIGURE 66 is a cross section taken on line 66—66 of FIGURE 64; FIGURE 67 is an enlarged perspective of part of the assembly shown in FIGURE 63, at the start of the clip feeding cycle; FIGURE 68 is an enlarged perspective of part of the assembly shown in FIGURE 63, at the end of the clip feeding cycle; FIGURE 69 is an enlarged perspective, with parts removed for clarity, of a clip feeding assembly for supplying clips to the bottom clip pressure pad at the clip application station; FIGURE 70 is a side elevation view, with parts removed for clarity, of the assembly shown in FIGURE 69, at the start of the clip feeding cycle; FIGURE 71 is similar to FIGURE 70, showing the clip feeding cycle at a point just prior to deposition of the clip on the bottom pressure pad; FIGURE 72 is similar to FIGURE 70, showing the clip feeding cycle at the point when the chip has been deposited on the bottom pressure pad; FIGURE 73 is similar to FIGURE 70, showing the clip feeding cycle at point midway in the return stroke preparatory to receiving another clip for the next clip feeding cycle; FIGURE 74 is a perspective of a portion of a clip supplying assembly which provides clip to the clip feed assembly; FIGURE 75 is a side elevation view of the clip supplying assembly; FIGURE 76 is a front elevation view of the clip supplying assembly; FIGURE 77 is a plan view of the clip supplying assembly; FIGURE 78 is an enlarged cross section taken on line 78—78 of FIGURE 75; FIGURE 79 is an enlarged cross section taken on line 79—79 of FIGURE 75; FIGURE 80 is a perspective of a clip transfer assembly; FIGURE 81 is an end elevation view, partly in cross section, of the clip transfer assembly; FIGURE 81A is a view taken on line 81A—81A of FIGURE 81; FIGURE 81B is a perspective of the lower end of the clip tube; FIGURE 82 is a side elevation view, with parts removed for clarity, of a modified form of the present invention; FIGURE 83 is a schematic of the pneumatic system for my apparatus; FIGURE 84 is a schematic of the electrical system for my apparatus; FIGURE 85 is a schematic of the electrical orientation system for my apparatus; and FIGURE 86 is a schematic of a timer cam profile.

Briefly, the clip constructed according to the present invention comprises a single body of plastic, having suitable strength and flexibility, for connection with two or more containers to form an interlocked multiple container package. My clip invention is particularly constructed to interlock two, three, four or six symmetrically arranged, tangentially abutting cans having a peripheral bead at either or both the top and bottom ends of the cans. The present invention is also directed to a method and apparatus for assembling units into multiple unit packages. Preferably the units are containers, and specifically, conventional cans having a peripheral bead at either or both the top and bottom of the cans. The method according to the present invention includes the steps of feeding a succession of units along a predetermined path to a transfer station, preferably segregating a predetermined number of the units from the succession of units at the transfer station, transferring the predetermined number from the transfer station to an assembling station, feeding a connector clip to the position immediately adjacent the segregated articles at the assembling station, releasably engaging a connector clip to one or more ends of each of the segregated units to form a multiple unit package, and removing the package from the assembling station. These method steps are performed simultaneously and are being performed simultaneously on isolated increments of the supply of units, thus, the limiting speed factor in the overall operation of the method is the slowest step being performed.

An additional and important step in my method is the orientation of the units at an orienting station prior to connecting the units together to form a package. Here again it is important that this orientation of the articles be accomplished simultaneously with the other method steps to minimize the total cycle time of the method. Specifically, the orientation step involves individually engaging each of the units, rotating each unit about its vertical axis and stopping the rotation when each unit is in its desired oriented position.

Specifically, my methods are applicable to wholly or partly metallic plastic or fibre cans normally having cylindrical side walls and circular upper and/or lower end walls with an outstanding peripheral bead or chime forming the connection between the end walls and the cylindrical sides.

My invention also includes apparatus for assembling a plurality of units with a connector clip to form a multiple unit package. The apparatus includes: means for feeding a succession of the units along a predetermined path, optional means operatively related to the path to segregate a predetermined number of the units from the succession of units, means to receive the segregated units and transfer them to an assembling station, an assembling station to receive the segregated units, means at the assembling station to releasably engage a connector clip with each of the segregated units to form a package, and means to remove the package from the assembling station. An additional and important part of my apparatus is the inclusion of an orienting station in the path of movement of the units, and which receives a plurality of units (segregated or unsegregated), orienting the units in a desired fashion and positions the oriented units on means to feed the units to the assembling station.

My invention also includes the various sub-combinations of the method and apparatus, including the operational procedure and structural configuration of the sub-combinations: (1) feed mechanism and control mechanism; (2) transfer and control assembly; (3) orientation assembly; (4) top and bottom clip application stations; (5) clip feeding assembly; (6) clip supplying assembly; (7) clip transfer assembly; (8) pneumatics system; (9) electrical system; and (10) timer control arrangement.
The first embodiment of the invention illustrated in FIGURES 1 to 4, inclusive, comprises a single body of plastic of suitable strength and flexibility, for example, an impact-type polystyrene. This particular embodiment of the invention is constructed to interlock four symmetrically arranged, tangentially abutting tin cans, the individual cans being indicated by the letter C. As best shown in FIGURE 3, the top of the can has a peripheral bead 10 which forms a downwardly facing outer circumferential shoulder 12. The plastic body is formed with four radial portions 14 to overlap top portions of the four cans respectively. Each of these radial portions 14 is formed with an arcuate shoulder 15 on its underside, the shoulder being curved to fit snugly against the inner side of the bead 10 of the corresponding can as may be seen in FIGURE 3. Each of the radial portions 14 is further formed with a plurality of downwardly extending, hook-shaped teeth 16 to engage the outer circumferential shoulder of the corresponding bead in the manner shown in FIGURE 3. In the construction shown there are two sets on each of the radial portions 14 comprising two pairs of teeth on opposite sides of the center of the radial portion. As may be seen in FIGURE 3, each tooth 16 has a pointed end or edge 18, the tooth being tapered to provide an inclined face 20 for can action by the bead of a can. Thus, to assemble the plastic body to a can, it is merely necessary to position the plastic body correctly relative to the can and then to force the plastic body or clip downward. As the inclined face 20 of a tooth moves against the bead of a can, the bead flexes the teeth radially outwardly of the can by can action, the teeth subsequently snapping back into engagement under the bead.

A feature of the invention is the concept of providing an aperture 22 in the plastic body adjacent the root of each of the teeth 16, the aperture being on the hook side of the tooth, as may be seen in FIGURE 3. The provision of such an aperture lends flexibility to the corresponding tooth 16 with respect to flexure of the tooth away from the bead of a can. Thus, apertures 22 facilitate the assembling of a plastic clip to a group of cans. In the construction shown, a slit or slot 24 extends from each aperture 22 along each side of the corresponding tooth 16 to provide further freedom for flexure of a tooth. Thus, the deflection of a tooth by a bead of a can in the assembling of the clip to a can is accomplished principally by flexure of the tooth in the root region indicated by numeral 25 in FIGURE 3.

Two of the plastic clips in this first embodiment of the invention may be used to secure together a group of six cans in the manner indicated in FIGURE 1. It is contemplated that the plastic clips employed for this purpose will have relatively large central apertures 26 so that the group of cans shown in FIGURE 1 may be readily picked up by a person inserting a forefinger into the central aperture 26 of one of the two clips and inserting the thumb of the same hand into the central aperture of the other clip. In this embodiment of the invention, the plastic body is further provided with a downwardly extending flange or skirt 28 around the rim of the central aperture 26 and the bottom edge of this flange is suitably rounded as indicated, to avoid discomfort to a person carrying the group of cans. A feature of the invention is that the skirt 28 is closely adjacent the downwardly extending teeth 16 of the plastic clip and extends beyond the pointed ends of the teeth to serve as guards for the pointed ends. Thus, if a plastic clip is removed from the cans by a purchaser and is placed upside down on a support surface with the sharp ends of the teeth upward, the cylindrical flange 28 will minimize the possibility of a person being inadvertently injured by the pointed teeth.

It is desirable to make the central aperture 26 of the plastic clip relatively large. In this regard, a feature of this first embodiment of the invention is that the two pairs of teeth of each of the radial portions 14 are spaced apart with a relatively large gap. It is apparent that with this spacing the central aperture 26 may be made of larger diameter. In this embodiment, the cylindrical flange 28 will minimize the possibility of a person being inadvertently injured by the pointed teeth.

It is to be noted that each of the radial portions 14 forms a marginal tongue 30 that extends beyond the bead 10 of the corresponding can to overhang the top wall 32 of the can. As may be seen in FIGURES 3 and 4, each of these marginal tongues 30 is beveled on its underside as indicated at 34 to facilitate manual removal of the plastic clip from a group of cans. The can may also be separated from the plastic clip by simply swinging the lower ends of the cans away from each other to cause the top walls 32 of the cans to rock against the tongues 30.

An important advantage of the described embodiment of the invention is that it may be assembled to cans that are packed tightly together in a case. FIGURE 7 shows a number of cans in a case 35 and shows the relative positions of the plastic clips for interlocking groups of cans in the case, each group consisting of two rows of three cans each. With the cans thus packed togerher in the case, it is merely necessary to position the plastic clips as shown and then force the clips downward to engage the cans with the previously described snap action. High impact styrene is sufficiently rigid to secure the cans together with such effectiveness as to unite the cans to function as a single package. On the other hand, there is sufficient flexibility in high impact styrene to permit the tooth-shaped teeth 16 to function in the described manner.

FIGURE 5 shows how the invention may be embodied in a plastic clip 26 for interconnecting a pair of cans. The plastic clip 36 has two opposite radial portions 38 which are constructed and function in the same general manner as the radial portions 14 of the first embodiment of the invention. In this instance, each of the radial portions 38 has two sets of three teeth spaced apart on its opposite halves. Each of the radial portions has the usual arcuate shoulder 15 on its underside to engage the inner side or inner circumference of the bead 30 of the corresponding can. Each of the radial portions 38 is formed with a tongue 40 which serves the same purpose as previously described tongue 30, the underside of the tongue or being tapered back to the dotted line 42.

It is contemplated that the plastic clip 36 will project downwardly adjacent the terminal ends of the teeth 36, and be equipped with a V-shaped flange 44. As may be seen in FIGURE 8, the flange 44 is formed with a rounded edge and extends below the pointed ends of the teeth 16.

FIGURE 6 illustrates a plastic clip 50 for interconnecting three symmetrically positioned tangentially abutting cans. The plastic clip 50 has three radial portions 52 that are constructed and function as previously described. Thus, each of the radial portions is provided with a plurality of teeth 16 and is further provided with an arcuate shoulder 15 on its underside to engage the inner circumference of the bead of the corresponding can. In this instance each of the radial portions 52 is provided with three pairs of teeth 16. Each of the radial portions is formed with a tongue 54 of the same configuration as the tongues 40 of the plastic clip 36.

The plastic clip 50 may project downwardly to guard the pointed ends of the teeth 16, and is provided with a flange 56. The plastic clip is provided with three flanges 55 on its underside and is further provided with a central tubular flange 56. Each of these flanges is of the cross-sectional shape and relative depth indicated in FIGURE 8.

FIGURES 9 to 14, inclusive, illustrate an alternate embodiment of the disclosed clip and, considering FIGURE 9, it will be seen that a unitary multiple segment clip is indicated generally at 60. Specifically, the multiple
ment comprises a first clip segment 62 and a second clip segment 64. The clip segments 62 and 64 are integrally joined by collar 66 which is connected at opposed ends to the respective segments. For purposes of the disclosure herein, it will be understood that a base or central planar portion 68 is provided, the upper surface of which will be connected to the base of the tab 112. The lower portion 70 of the container comprises a first clip segment 62 and a second clip segment 64. The clip segments 62 and 64 are integrally associated with the clip segments 62 and 64. As in the earlier described embodiments, the wall 70 may extend downwardly substantially below the tip of the hook-like container gripping segments and thus provide the heretofore mentioned safety feature. Semi-arcuate depressions 76, 76 may be provided in each wall 70 and have a measure of utility as guide cavities for use in automatic packaging of cans as herein described with respect to four combinations and are used as a device to provide axial orientation of the clip. The clip 62 further comprises a plurality of spaced radial portions 78, 78. Each radial portion 78 comprises an upwardly directed segment 80 extending above the planar portion 68 and in the form of an arc, as best seen in FIGURE 9, said arc being provided with a radius equivalent to that of the containers to be packaged. The upwardly directed wall 80 extends outwardly to a terminal point whereas it is bent generally downwardly to form an integral, downwardly extending wall 82, said wall 82 defining, together with a portion of the upwardly directed segment 80, an arcuate internal cavity 86 (FIGURE 14). The cavity 86 is provided with a continuously arced corner 88 which, as in the previous embodiments, serves to firmly engage the arcuate bead of the related carried containers. Returning to the planar section 68, it will be noted that apertures 90, 90 are provided in the planar segment 68 at spaced points and immediately above the internal cavity 86. As is best illustrated in FIGURE 13, the planar section 68 communicates with a downwardly-projecting, hook-like can retractor element 92 by integral formation with the wall 68 and immediately adjacent the respective apertures 90. Again, this construction of each hook-like element being formed immediately adjacent a related aperture 90, adds flexibility to the hook-like structure. As best seen in FIGURE 11, each hook-like segment 99 comprises downwardly tapered sides 94 and 96 which terminate in a relatively sharp point 98. The bottom surface of each hook-like segment 92, and beginning with the terminal point 98, is provided with an upwardly-directed cam surface 100, said cam surface 102 defined on the lower end of the wall 82. It will further be understood that the hook-like segment 92 is biased radially outwardly, in its normal position, while the wall 82 is normally biased inwardly. Thus, the hook-like segment 92 and the wall 82 are biased toward each other and define therebetween an opening 104 which communicates with the cavity 86. Additionally, the cam surfaces 100 and 102 are in angular converging relation to each other and are both directed to the opening 104, the cam surface 100 being located below the cam surface 102, as seen in vertical elevation.

As another feature of the invention, the hook-like segment 92 is provided with a tip 110 which is raised above the adjacent communicating surface, as seen in the elevation, it integrally comprises the tip 110 and contact with the underside of the adjacent bead of the can. Thus, the tip 110 under the flexing action of the hook-like segment 92 is pressured into intimate engagement with the line of juncture between the bead segment of the can lid and the related adjacent wall section of the container. As an additional feature of the disclosed embodiment of the invention, it will be noted that the upwardly directed segment 80 communicates centrally of each radial portion 78 with a pronounced outwardly-extending finger tab 112. The lower surface 114 of the finger tab 112 is preferably located at or slightly above the upper surface of the planar portion 68 when seen in elevational view. Thus, the underside of the tab 112 is readily accessible to the finger of the user, thus facilitating container disassembly, as will be subsequently described.

Certain inherent advantages in use will readily be apparent from the structure just described. For example, the particular location of the cam surfaces 100 and 102 facilitates easy assembly of the clip to the lid 92. For example, when the clip is brought downwardly against the generally arcuate bead of the related can top, the bead initially engages the lower cam surface 100 of the flexible hook-like segments 92. By virtue of the cam action of this engagement, the bead is moved toward the surface 102 of the wall 82. Upon contact with the cam surface 102, the bead is automatically positioned for proper entry into the cavity 86. Additionally, concurrent abutting engagement with the cam surfaces 100 and 102 by the bead of the container tends to bias the downwardly-extending, hook-like segments 92 and the wall 82 away from each other, increasing the aperture opening 104 to provide proper admission of the bead. Thus, both the wall and the hook-like segment flex away from each other to admit the bead into the cavity 86 and, upon complete admission into the cavity 86, they snap back to approximately their original location and maintain a biasing pressure on the inner and outer areas of the bead. The importance of this relatively easy and accurately automatic location of the container bead relative to its receiving cavity 86 will be more clearly understood when consideration is given to the tremendous volume of cans which are currently processed and packaged. Specifically, the relatively automatic location of the bead relative to the rotating hook-like segment 92 and the cavity 86 saves time and importantly improves the efficiency of multiple container packaging.

Additionally, after the packaging operation has been completed, the described form and structure of the hook-like segment 92 as well as the adjacent cooperating portion of the wall 82, being in a flexed condition, tend to pressure-engage the associated bead on opposed sides thereof, thus providing safe and positive can packaging and eliminating the possibility of accidental disassociation during user transport. The additional feature of the pronounced release tabs 112 will become apparent when consideration is given to the fact that upward pressure on the tab 112 and consequent upward motion thereby induces the counter-clockwise or outward bending of the immediately adjacent connected wall 82, thus flexibly biasing the wall 82 out of engagement with the inner surface of the related can bead and enlarging the aperture 104 between the wall 82 and the hook-like segment 92. With this in mind, it will be apparent that convenient and easy disassembly of a given container from the clip is accomplished by this tab action. Further, the normal pressure during transport of the user's fingers located in the apertures 72 and 74 is directed against the wall 70 and toward each other. This pressure tends to buckle or bow the overall clip unit 60, thus biasing the carried containers or cans toward each other into a closely related, composite group.

From the above, it will be understood that the disclosed invention provides an important advancement in the art of container packaging, in that it is readily accessible to the user, only from the standpoint of economy and efficiency in container packaging, but also from the standpoint of increased utility to the ultimate container user.

The present clip was specifically designed to provide a durable connection at both the top and bottom of a plurality of cans forming a package. Plastic clips are known which connect only the top of the cans to form a package,
however, these packages lack stability in shipping and handling since the bottom ends of the cans are free to move relative to each other. This results in breakage of the clip, distortion of the clip such that it will not hold the cans and shock-damage to the contents of the cans.

In designing a clip and application to both the top and bottom of the cans, it is necessary to minimize the quantity of plastic resin used to maintain this packaging method in an economically competitive position with other packaging methods such as the use of paper overwraps. To reach this end, the quantity of plastic resin used in each pair of plastic clips made according to the present invention was less than one-half the quantity used in the known clip which connects only one end of the cans. My clip is structurally designed to utilize the maximum inherent strength of the plastic resin in the molded condition. I obtain an extremely high strength in my clip by injection-molding the clip through a large injection gate, preferably about 0.07"--0.08" wide and 0.03"--0.04" high. The reasons that the use of this large gate results in a stronger clip are: (1) the resin does not burn and degrade significantly when passing through the large gate to the mold in contrast to the substantial burning occurring when a small gate is used; and (2) the molecular structure of the resin and its additives, such as elastomers (rubber) is not oriented significantly in passing through a large gate as contrasted with a small gate, and a product made from oriented resin (and additives) is weaker than a product made from unoriented resin (and additives).

I have also found that it is important to connect the clip to the cans with a minimum stress on the various elements of the clip. If the clip is in a substantially unstressed condition on the cans, its inherent strength is preserved, resulting in a stronger package. The clip can be affixed to the cans in unstressed condition by careful alignment of the clip above the can beads before the clip is attached to the cans.

**General assembly**

Referring specifically to FIGURE 15, the containers are fed into the machine, an infeed conveyor, generally designated 150, to a can transfer and control assembly, generally designated 151, which transfers the containers to a main conveyor, generally designated 152, which in turn sequentially moves the containers to an optional orientation assembly, generally designated 153, to orient the containers to a desired position on the top clip application station, generally designated 154, to apply a clip to the top of the containers, and a bottom clip application station, generally designated 155, to apply a clip to the bottom of the containers, to form a multiple container package.

My preferred embodiment shows a machine for simultaneously packaging twelve cans to form two six-can packages, however, it is understood that this machine can package from two to almost an unlimited number of cans simultaneously to form packages comprising two or more cans each. My preferred embodiment also shows the cans being initially fed transversely in a double row from one side of the machine, however, my invention includes an in-line feed directly from the infeed conveyor to the main conveyor, or the simultaneous transverse feeding of cans from two infeed conveyors (located on opposite sides of the main conveyor) onto the main conveyor, or the transverse or in-line feeding of only a single row of cans to the main conveyor.

**Machine frame**

Referring specifically to FIGURE 16 showing the basic frame construction of the machine: the lower frame portion includes central longitudinally disposed lower channels 156 disposed parallel to the channels 157 of the liquid channels 158 mounted on adjustable flanged pipe legs 159 and shoes 160 which support the middle frame portion. The middle frame portion has two longitudinally extending channels 161 disposed parallel to the channels 156 of the lower frame portion and mounted on cross angle supports 162. A plurality of box beam risers 163 are affixed to the top side of the boxes 164. The bottom side of the upper frame portion which includes a base plate 165 affixed to and spanning the area between the box beam risers 163. Upper box beam risers 165 with flanged upper and lower ends support a top mounting plate 166. Suitable gusset plates are affixed to and between the various channels and risers to rigidify the frame. Arctic iron 167 extend outwardly from the box beam risers 163 and are supported by angularly disposed support bars 168 extending between the outer ends of the angle irons and the base of the box beam risers. Suitable mounting plates and bars are integral with the machine frame to provide mounting means for the various portions of the operational apparatus to be described hereinafter. Specifically this frame was constructed and arranged to permit simple adjustment and modification of the machine to handle any size of can from the conventional tuna can to the 16-oz. can.

**Conveyor system**

FIGURE 17 illustrates the basic machine frame with the main conveyor system mounted thereon. This conveyor system includes a pair of conveyor chains 169, a pair of risers spaced between 0.125" apart and having a top surface with a low coefficient of friction such as steel. Spaced lugs 170 are affixed to the upper surface of each conveyor chain 169 for a purpose to be described hereinafter. The lugs on the spaced chains are transversely aligned to function as a single cross bar. The pairs of lugs are equally spaced along the conveyor chain to provide sufficient space between the lugs on the cross chains to receive the desired number of containers between the lugs. The lugs are spaced such that the containers fit between the pairs of lugs but the containers cannot move appreciably by sliding along the conveyor chains. The conveyor chains 169 are continuous and pass around pairs of sprockets 171 mounted on shafts rotatable in pillow blocks 172 integral with the frame. The pairs of sprockets 171 are four in number and move the conveyor chains in a generally rectangular path in a direction moving from left to right on the top horizontal run as viewed in FIGURE 17. The conveyor chains pass along an upper substantially horizontal run to the exit end of the apparatus shown in the right hand end of FIGURE 17, downwardly in a vertical run over idle sprockets 171 shown in the lower right hand portion of FIGURE 17, along a lower horizontal run and then to a second pair of lower sprockets 171 and upwardly in a vertically inclined run (see FIGURE 19, right hand side) around the top sprockets to the entrance end of the machine.

FIGURE 19 shows the opposite side of the machine from the view in FIGURE 17. A motor and speed control 173, of conventional construction, provides the driving force for the main conveyor chains 169. This motor and speed control drives a "Hilliard" clutch 174, of conventional construction. The "Hilliard" clutch operates for a single revolution and then stops until again actuated to repeat the cycle. The clutch 174 is driven by the motor and speed control 173 by suitable conventional sprockets and chains 175. The clutch drives one of the pairs of sprockets 171 which in turn drive the conveyor chains 169. Preferably this drive mechanism provides an acceleration and deceleration curve in the form of a sine wave thereby minimizing starting and stopping shock to articles on the main conveyor system. The "Hilliard" clutch is normally locked in stopped position by a pneumatic operated progression advance cylinder to be described hereinafter. This cylinder is automatically actuated by the main machine timer control system to release the clutch for a single revolution.
A dogging system 176 is provided on the main drive shaft for the sprockets 171. This dogging system consists of a circular plate rotatable with the main drive shaft and having a single dogging notch 177 in its periphery. A pneumatically operated dog (not shown) is actuated by a stroke connected to the dogging system. This cylinder is automatically actuated by the main machine timer control system to move the dog outwardly to permit the circular dogging plate to move in unison with the main drive shaft. The dog rides on the periphery of the circular plate until the notch 177 is encountered by the dog at some time during the dog enters the notch. The entry of the dog into the notch is simultaneous with the completion of a single revolution by the "Hilliard" clutch. The function of the dogging system is to ensure exact, repetitive positioning of the conveyor chains 169 and the containers on the chain.

Referring to FIGURES 18 and 19, the frame structure is shown with various operating mechanisms including a portion of infeed conveyor 150 shown on the left hand side of FIGURE 18, the can transfer and control assembly 151, the main conveyor system 152, the orientation assembly 153, the top clip application station 154, and the bottom clip application station 155. The top clip feed assembly 178, the bottom clip feed assembly 179, the guide racks for the top clip supply assembly 181 are shown in FIGURE 19.

Infeed conveyor

The infeed conveyor, can counter and control mechanisms are shown in FIGURES 20 to 24, inclusive. The conveyor chain 180 is of conventional construction and includes a plurality of parallel transversely extending metal slats pivoted mounted to each other to form a continuous chain passing around and engaged with a drive sprocket 181 at the infeed end of the conveyor chain and idler sprocket 182 at the exit end of the conveyor chain. Preferably the conveyor chain is of the type sold under the name "Rex Chains X815." The drive sprocket 181 is mounted on a shaft driven by variable speed motor 183 through a conventional arrangement by sprockets and a sprocket chain. The driven shaft is mounted in bearings 184 affixed to spaced side mounting plates 185 supported by base mounting plate 186 affixed to the main frame of the machine. The idler sprocket 182 is mounted on an idler shaft which in turn is rotatably mounted in pillow blocks 187 rigidly positioned on the mounting plate 186. The conveyor chain 180 is driven from right to left as viewed in FIGURES 20 and 21 and the containers to be packaged in the machine are fed initially to the right hand end of the conveyor chain in any known manner.

The upper run of the conveyor is supported by a chain support plate 188 which extends the entire length of the top run of the conveyor chain and is maintained in rigid supporting position beneath the upper run by several supporting plates, not shown. A pair of spaced can guide brackets 189 are mounted on each side of the conveyor chain and extend upwardly above the upper run of the chain to provide support for a can guide side rail 190 extending along each side of the chain 180. A pair of support plates 191 for a can separator are fixed to the can guide side rail 190 and extend upwardly and across the conveyor chain. A brace plate 192 is affixed to the support plates 191, the top plate 193 extends downwardly from the brace plate and extends longitudinally along a path equidistant between the two can guide side rails 190. The can guide side rail 190 shown in the right hand side of FIGURE 22 and the can separator plate 193 are adjustable transversely of the chain 180 to adjust various diameters of containers being packaged on the machine.

A star wheel 194 is mounted for free rotation in a bracket 195 affixed to the lower conveyor support bar on each side of the conveyor chain 180. The points of the star wheel are rotatably positioned such that the cans can engage the star wheel as they move between the can guide side rails 190 and the can separator 193 thereby causing the star wheel to rotate in the direction of the arrow in FIGURE 23. One of the six points of the star wheel 194 has a downwardly extending integral pin 196 which engages an actuator rod 197 on a micro-switch 198 mounted on the machine from below the conveyor chain 180. The rod 197 is pivotally mounted about a pivot point which in turn actuates a micro-switch 198 which closes contacts LS1 and LS2 to be described hereinafter. The star wheel 194 performs the function of separating the containers during any one revolution and therefore functions as a container counter as well as a safety device in a manner to be described hereinafter.

The primary function of the infeed conveyor is to receive a plurality of randomly grouped cans at the right hand end of the conveyor as viewed in FIGURE 20 and arrange the cans into two parallel rows between each of the can guide side rails 190 and the can separator 193 to deliver the parallel rows to the left hand end of the conveyor.

FIGURES 23 and 24 show detail views of a solenoid operated star wheel lock. The purpose of the lock is to remove the line pressure of the containers on the infeed side from the containers which are fed to the can transfer and control assembly 151. Thus, the lock functions to stop the rotation of the star wheels 194 after the passage of six containers past the star wheels and additional cans cannot be fed until the star wheel lock is removed.

The star wheel lock includes an inverted U-shaped yoke having a horizontal cross bar 199 and integral downwardly extending legs 200. A solenoid 201 is affixed to cross bar 202 forming a stationary part of the machine frame. The solenoid rod is affixed to a midpoint on the cross bar 199 so that when energized the yoke with cross bar 199 is elevated. Each of the legs 200 have a central bore slidably receiving a head bolt 203. A pin 204 is integral with the lower end of bolt 203, and is slidably received in an enlarged bore portion 205 in the bottom end of each leg 200. A coil spring 206 is trapped within the enlarged bore portion 205 between the inner surface of the bore and the pin 204. The spring 206 is in compression to constantly bias the bolt 203 and integral pin 204 to a downward position as shown in FIGURE 24. The lowermost end of pin 204 can enter a pin hole 207 in the star wheel 194. The solenoid 201, when energized, moves the yoke 199 upwardly, energizing the spring 206, so that cross bar 199 and pin 204 is positioned on the top surface 208 of the star wheel 194 since the star wheel has commenced rotation as soon as released and the pin hole 207 is no longer below the pin 204.

The pin hole 207 is located in the star wheel so that the pin 204 can enter the hole (to lock the star wheel against rotation) at about the same time that pin 196 activates the micro-switch 198 to close contacts LS1 or LS2. The scalloped edge of the star wheel receives individual containers in each scallop and the location of pin 196 and pin hole 207 are such that exactly six containers pass the star wheel when the micro-switch 198 is actuated to close the contacts LS1 and LS2.

Of course, the star wheel can be designed to pass any desired number of containers and the basic operation of the star wheel, micro-switch 198 and solenoid operated star wheel lock will function as described above.

The solenoid 201 is activated by a micro-switch 209 (see FIGURE 25) connected to a suitable control source and arranged to supply power to solenoid 201 upon activation of the micro-switch. The micro-switch 209 is mounted on the main machine frame to be activated by the can transfer and control assembly 151.
can transfer assembly is withdrawn to a position to receive containers from the infeed conveyor, the microswitch 209 is closed thereby energizing the solenoid 201 to raise the yoke 199 and 200 and withdrawing the pins 204 from the pin holes 207 in the star wheels. Container, if available on the infeed conveyor) immediately engages and rotates the star wheel in the moving toward the can transfer assembly. The micro-switch 209 is only momentarily closed by the can transfer assembly, consequently there is only a momentary activation of the solenoid 201 to withdraw the pins 204 from the star wheel holes, and the solenoid is then de-activated to drop the pins back onto the surfaces 206 of the star wheels.

It is pointed out that the pins 204 are spring biased downward such that each pin can enter its respective hole in the star wheel, thereby overcoming the possibility that the star wheels will not rotate in unison. Thus, if one star wheel rotates faster than the other star wheel, the pin will enter the hole in the faster rotating star wheel independently and in advance of the time the pin enters the hole in the slower-moving star wheel.

Both sides of the infeed conveyor have separate star wheels and micro-switches like switch 198. The micro-switch contacts on the left controls contact L.S and the micro-switch on the right side controls contact L.S. These contacts are in series to the main timer motor to be described hereinafter.

**Container transfer and control assembly**

The infeed conveyor moves the containers to a container transfer and control assembly 151 shown in FIGURES 25 and 26 or, in modified form, in FIGURES 27 and 28. As viewed in FIGURE 25, the containers are fed from the infeed conveyor perpendicular to the plane of the drawing and into the position shown by the containers in this figure. As viewed in FIGURE 25, the containers are fed from the left hand side toward the right hand side. The infeed conveyor is spaced from the main conveyor chain for mechanical reasons but can abut the main conveyor chain so cans are fed directly from the infeed conveyor to the main conveyor. In the preferred embodiment as shown, a small deaerate plate bridges the gap between the infeed and main conveyors. The can transfer and control assembly includes a flat pusher plate 210 connected by spacer plates to an H-shaped frame 211 having two vertically extending legs and a cross connector. A cam follower 212 is rotatably mounted near the upper extremity of each leg. A pneumatic cylinder 213 has a piston rod affixed to the cross connector of frame 211. The cylinder 213 is affixed to the machine frame and provides movement of the frame 211 and pusher plate 210 to push the cans from the solid line position in FIGURE 25 to the dash line position in FIGURE 25. The cans in FIGURE 25 (solid line position) are not subjected to line pressure due to the constant interfed of cans since the infeed of cans is stopped by the star wheel lock. A stop plate 214 (see FIGURE 15) prevents further movement of the cans in a direction perpendicular to the plane of the FIGURE 25. In my preferred embodiment shown in the drawings, two rows of six cans each are fed by the infeed conveyor and are stopped by plate 214. The infeed conveyor continues in operation and merely slides beneath the cans.

A cutoff plate 215 is affixed at a right angle to the pusher plate 210 and moves in unison with the pusher plate. When the pusher plate 210 moves the cans from the solid line position in FIGURE 25, the cutoff plate 215 simultaneously moves transversely across the infeed conveyor chain to function as a safety device in cutting off the supply of cans of the infeed conveyor in the event that a malfunction of either star wheel has released more than six cans to the transfer assembly. It is further pointed out that when in the transfer position “chiming” is the climbing of one rim or bead of a can up over the rim or bead of an adjacent can. To prevent “chiming,” a top transfer plate 216 is provided immediately above the cans and has a downwardly extending can divider 217 to separate the upper rims or beads of the cans in the manner shown in FIGURE 25. The can divider has grooves 218 to permit the cam followers 212 to pass through the can divider in the manner to be described hereinafter. The top transfer plate 216 is bent back on itself in a V-shape at its right hand end and then downwardly to form a rigid triangular enclosure. A bottom transfer plate 219 is affixed to the underside of the top transfer plate 216 in an inwardly directed V-shape as shown in FIGURE 25. The apex of the bottom transfer plate engages the left hand side of the cans as viewed in FIGURE 25 and prevents movement of the cans in a left direction. The top transfer plate is bolted to a piston rod 220 which is slidably received in a double acting pneumatic cylinder 221 provided with suitable sources of pressurized air 222 and 223 for expansion and retraction of the piston rod 220 in the manner to be described. The upper end of cylinder 221 is pivotally mounted to a clevis 224 affixed to risers forming part of the main frame of the apparatus. A pair of spaced guide rods 225 are individually mounted in each side of the cylinder 221. The lower ends of the rods 225 are affixed to the top transfer plate and the upper ends are slidably mounted in support bushings 226. The support bushings 226 are mounted on a mounting plate 227 which in turn is integral with a horizontal mounting plate 228 affixed to the machine frame. The guide rods function to maintain the top transfer plate in a true reciprocating path upon activation of piston rod 220.

In FIGURE 25, I have shown the solid line position for the can transfer and control assembly when cans are being received along the infeed conveyor, and a dashed line position for the cans and part of the can transfer and control assembly when the cans have been completely transferred to the main conveyor from the infeed conveyor.

FIGURE 26 shows the can transfer and control assembly in the same position as the dashed line position of FIGURE 25, a small deaerate plate bridges the gap between the infeed and main conveyors.

When pressurized air is admitted to pneumatic cylinder 213 to move the pusher plate 210 from right to left in FIGURE 25, pressurized air is simultaneously introduced through line 233 to move piston rod 220, top transfer plate 216 and bottom transfer plate 219 upward from the solid line position to the dash line position shown in FIGURE 25. The cam follower 212 functions as a safety device and underlies the bottom of the top transfer plate 216 to avoid downward movement of this plate in the event of pressure failure to the cylinder 221. In FIGURES 27 and 28, I have shown an alternate can transfer and control assembly. A pusher plate 230 is affixed to a piston rod 231 operated by a pneumatic cylinder 232 mounted on the machine frame. Introduction of pressurized air to the rear end of cylinder 232, moves the pusher plate transversely of the infeed conveyor transferring the cans from the infeed conveyor to the main conveyor in the manner hereinafter described. The cans enter the can transfer and control assembly on the infeed conveyor in the direction of the arrow shown in FIGURE 27 and are stopped by the stop plate 214. The cutoff plate 215 is attached at a right angle to pusher plate 230 and functions in the same manner as previously described.

A top transfer plate in FIGURE 233 is pivotally mounted at 234 to the top edge of pusher plate 230. One end of a connector rod 235 is pivotally affixed to the top surface of the top transfer plate 233 and the other end of the rod is pivotally affixed at 236 to a stationary part of the machine frame. A V-shaped bottom transfer plate 237 is affixed to the bottom end of the connector rod 235 and engages the sides of the cans away from the pusher plate 233. A can divider 238 is affixed to the midpoint
of the underside of the top transfer plate 233 and extends downward between the cans to prevent chiming of the cans as previously described.

A second cover plate 239 is positioned over the main conveyor 152 and is pivotedly mounted at 240 along one of the beams to a stationary part of the machine frame. A spring 241 is affixed at one end to the top of the cover plate and at the other end to a stationary part of the machine frame. The spring is in extended condition as shown in FIGURE 27 and biases the cover plate upward in a swinging motion about pivot 240 to the position shown in FIGURE 28. When released, the cover plate is released but stopped by a stop 240a.

When pressurized air is introduced into the right hand end (FIGURE 28) of cylinder 232, the piston rod 231 moves the pusher plate 230 toward the left thereby pushing the cans from the infeed conveyor to the main conveyor as shown in FIGURE 28. The rod 235 swings the top transfer upward about pivot 235 thereby releasing cover plate 239 to permit spring 241 to pivot the cover plate 239 upward. The final positions of the plates are shown in FIGURE 28. The outer edge of top transfer plate 233 overlies a part of cover plate 239 so that upon retraction of the pusher plate 230 by introducing pressurized air into the left hand side (FIGURE 28) of cylinder 232, transfer plate 233 forces cover plate 239 downward against the force of spring 241 to the position shown in FIGURE 27. The cycle is then repeated.

A micro-switch 269 is also provided on the assembly shown in FIGURES 27 and 28 for activation by pusher plate 230.

Orientation assembly

My preferred embodiment is arranged for rotating 12 chucks simultaneously to orient 12 cans. This assembly can be operated for less than 12 cans or can be increased in size to orient an indefinite number of cans depending upon the size and construction which one desires to build.

FIGURE 29 illustrates a part of the preferred embodiment of the orienting assembly 153 and shows an electromagnetic constantly rotating chuck 243, the internal structural features of which are shown in cross-section in FIGURE 43. This chuck 243 includes a central core 244 attached to a drive shaft 245, an arm 246 affixed to the lower end of the core 244 and a cap 247 affixed to the upper end of the core with a shell 248 forming side walls around the core. Cap 247 has a positive metal ring and a negative metal ring 250 against which carbon brushes 251 ride to supply electrical power for activating the electromagnetic field in the chuck created by wire windings 244a. The drive shaft 245 enters an orientation gear housing 252 suspended above the main conveyor by supports 253 affixed to the main machine frame. The housing consists of a base plate 254 affixed by bolts to a cover plate 255. Suitable bearings 256 mounted in the base and cover plates rotatably receive the drive shaft 245. A gear 257 is keyed to the drive shaft 245. The gears 257 on each of the drive shafts mesh thereby insuring the direction of rotation shown in FIGURE 42. It should be noted that each of the chucks are rotated in an opposite direction to the adjacent chuck. This type rotation is useful and effective when using the orientation assemblies shown in FIGURES 29, 30 and 32. In FIGURE 44, I have shown the purposes of orienting the idler gears 258. These gears are mounted within the housing 255 on shafts to provide rotation of all gears 257 and associated chucks in the same direction as shown by the arrows in FIGURE 44. This arrangement permits rotation of the chucks in the direction of the arrows shown in FIGURE 44 or all in a reverse direction from the arrows shown in FIGURE 44 dependent upon the direction of rotation of the turning motor, or the pulley belt arrangement. One of the shafts 245 extends upward through the cover plate 255 to provide an integral shaft extension 259 to which is keyed a pulley 260 driven by a motor 261 (FIGURE 19) with suitable belt connection. If a reversal of direction of rotation of gears 257 is desired, the belt is formed in a figure 8.

Referring to FIGURE 29, the electromagnetic chuck 262 attracts the ferrous container to the chuck after the container has been slightly elevated above the main conveyor. The electromagnetic chuck is constantly rotating, therefore upon attraction of the ferrous container to the chuck, the container immediately commences rotation until released from the chuck.

Referring now to FIGURE 47, I have shown 45, 46 and 47, I have shown the orientation lift plate which elevates the cans above the main conveyor. The plate dimensions are such that width-wise the plate can move vertically in the gap between the chains of the main conveying system, and is of a length sufficient to accommodate the number of cans which are to be oriented. In my preferred embodiment shown in the figures, I have shown a platform longly to accommodate twelve cans for simultaneous orientation.

The lift plate includes a base plate 263 having a plurality of detachable inserts 264 affixed to the base plate by screws. The inserts are circular plates covering about a 120° arc and having a flat central portion on an upraised peripheral ridge 266 as shown in FIGURE 47. The upraised ridge 266 is flat on its upper edge and has a sloped outer face 267. The container or can is received on the insert plate in the manner shown in dash lines in FIGURE 47 with the bottom rim, head or chime 268 positioned outside the ridge 266 and the lower edge of chime 268 being supported by an arcuate plate 269 affixed and conforming to the arcuate shape of insert 264. The bottom of the container or can does not engage the upper edge of ridge 266. The base plate 263 is connected to a piston rod extension 271 which in turn is affixed to a piston rod of a pneumatic orientation lift cylinder 271 mounted below the base plate and pivotally mounted to the main machine frame. Cross support plates 272 and a longitudinally supported plate 273 form part of the secondary main machine frame and are affixed to the main frame. The base plate 263 has downward extending integral guide rods 274 at spaced locations on each side of the cylinder 271 and are slidably received within ball bushings 275 mounted in a sleeve 276 affixed to support plate 273. The lower end of each guide rod 274 is headed and has a rubber washer. Upon actuation of the cylinder 271, the inserts 264 are elevated until the head on the guide rods 274 engage the lower end of sleeve 276 to provide a positive stop for the elevation of the plate.

The plate shown in FIGURES 29, 45, 46 and 47 is particularly directed to my preferred embodiment using a mechanical orientation stop to be described hereinafter. I have shown in FIGURE 29 a typical can having a steel body and steel top and bottom. The body is seamed in a conventional manner to form a vertical seam 277 and the top and end portions of the can are attached to the body by a crimping action which results in a bump 278 along the head or chime 268 of the can. This bump varies in the extent of its protrusion from the chime 268 but typically is about .011" in a steel can and between about .007" and .008" in an aluminum can. The embodiment shown in FIGURE 29 utilizes this protruding bump for orientation purposes. The mechanical orienting stop is located between the cans when they are positioned on the lift plate and an additional mechanical orienting stop is located at the right hand (forward) end of the lift plate as shown in FIGURE 45. Thus, in my preferred embodiment, every insert plate 264 has an orienting mechanical stop immediately adjacent its outside surface and inclined surface 267. This is clearly shown in an enlarged cross section in FIGURE 47. The insert plate 264 is rigidly mounted on the backing plate 263 of the lift plate by screws 279 or the like and a pointed car-
The orientation stop 280 is located a short distance from the edge of the insert plate as shown in FIGURE 47. The spacing between the vertical wall of the insert plate and the vertical wall and point of the orientation stop 280 is only sufficient to receive the chime or bead 268 of the can but not sufficiently wide to pass the bump 278 on the chime or bead 268. Thus, as the can is rotated, the bump 278 comes into engagement with the rounded point of the orientation stop 280 and rotation of the can is stopped. After rotation of the can is stopped in this manner, the magnetic chuck continues to rotate and slide on the top of the can until the electromagnetic chuck is de-energized.

The mechanical orientation stop 280 is normally shimmied outwardly by shim stock 281 from a spacer stop 282 to compensate for wear. The orientation stop 280, shim stock 281 and spacer stop 282 are covered by a washer 283 which is affixed to the base plate 263 by a screw 284 or the like.

As will be described hereinafter in more detail, I have provided a timing circuit for all of the chucks such that the chucks are demagnetized after a period of time limited to that period sufficient to permit about one 360° rotation of the cans. Thus, as the lift plate is elevated, the electromagnetic chuck engages the can for rotation for a time period at least sufficient to permit one 360° rotation of the can prior to being de-energized to release the can. For example: assume the chucks are rotating at a constant speed of 300 r.p.m., the chucks are automatically de-energized to release the cans after one-fifth of a second. This one-fifth of a second permits one revolution of the chuck and attracted can, thereby insuring that the bump 278 on the chime 268 of the can will engage the orientation stop 280 and orient the can in the desired position dependent on the position of the mechanical orientation stop 280. If the bump on the can is positioned initially directly over the orientation stop, the can will not rotate at all and will merely be released from the magnetic chuck upon deactivation of the chuck. This timing can also be accomplished on the master cam by timing the activation of the lifting cylinder and the magnets.

The distance between the upper edge of the insert plate and the underside of the chuck which engages the top of the chime of the can is slightly greater than the distance between these two points on the can. Thus, the magnetic chuck slightly raises the can off the upper ridge of the insert plate insuring free rotation of the can. Thus, upon deactivation of the magnetic chuck, the can is dropped a short distance from the magnetic chuck.

The orientation stops 280 can be located in any desired position along the insert plate to give desired orientation of the cans. Typically the cans contain a trade name or trademark for the products contained in the can and it is desired to orient the cans such that the trademark or trade name is facing outwardly of the ultimate package and the seam of the can is hidden from the view of the purchaser. I have also found that in orienting a product such as a six-can pack, it is desirable to orient the end cans on the six-pack with the trademark or trade name facing at an angle to the end of the packaging so that the trademark or trade name is visible from either a side inspection of the package or an end inspection of the package by the consumer.

After the cans have been oriented, pressurized air is fed to the top of the cylinder 271 to lower the orientation lift plate to a retracted position below the main conveyor thereby orienting the cans once again on the main conveyor. The main conveyor is then activated in its intermittent operation to move the oriented cans to the top clipping station.

In FIGURE 30 I have shown an alternative form of orientation assembly for use on all ferrous top cans and particularly those which do not have a bump on the chime. In this construction the magnetic chuck is identical to that hereinafter described and operates to magnetically at-tract and rotate the can when it is fabricated from steel. The orientation lift plate which I use in this assembly is a plain plate 286 movable vertically by a pneumatic cylinder mounted on the machine from below the plate. It is not necessary that this plate be vertically moving if the magnetic chucks have sufficient power to lift the cans from the main conveyor. I have found, however, that the can can be easily lifted by a pneumatic cylinder and therefore I have employed a pneumatic cylinder. In this manner the magnetic chucks are located a short distance from the top of the cans, the cans can be attracted to the chucks without the necessity of the vertical lift plate.

In the construction shown in FIGURE 30, I have utilized a transducer sensing head as shown in cross section in FIGURE 51. This transducer sensing head is of conventional construction and includes a central probe 287 integral with a permanent magnet 288 and an electrical coil 289 surrounding the probe. The transducer is housed within an outer sleeve 290, an inner sleeve 291, and a nose sleeve 292 through which the probe extends. An epoxy resin disc 293 is utilized to insulate the permanent magnet 289 from the sleeve 291. The probe is spring-biased outwardly by a spring 294. Suitable supports are provided from the machine frame to hold the transducer in proper position relative to the rotating cans.

The transducer sensing head is positioned adjacent to the side wall of the can such that it can detect the passage of the vertical seam 277 which has four metal thicknesses. The transducer is provided with suitable electrical connections to a timer and relay, such as a "Reed" relay, which disconnects the electrical power to the magnetic chucks thereby releasing the can in an oriented position. The relay not only de-activates the magnetic chucks but can activate an A.C. current to kill residual magnetism in the chucks. The operation of the transducer is well understood in that it senses the several layers of steel located in the vertical seam 277 of the side wall of the can.

In FIGURE 32 I have shown an orientation assembly similar to FIGURE 30 with the exception that it is utilized on an aluminum can. If the top or bottom of the can is ferrous metal, a magnetic chuck can be utilized in picking up the can, however, in the specific application shown in FIGURE 32, I have shown a vacuum chuck since the can is non-ferrous or at least the top is non-ferrous. The construction of the transducer sensing head shown in FIGURE 32 is substantially similar to that described with the respective FIGURES 30 and 51, with the exception that the transducer head of FIGURE 32 is much more sensitive to the passage of a magnetic influence such as magnetic ink on a non-ferrous surface. Since I have not utilized a magnetic chuck in the adaptation shown in FIGURE 32, the signal from the transducer head is passed through a timer which in turn activates a relay in the power supply line to the vacuum pump supplying the vacuum to the vacuum chuck and/or simultaneously vents the vacuum feed line to the chuck to the atmosphere. Thus, as the marked aluminum can passes the transducer head a signal is generated which in turn starts the timer mechanism. This timer mechanism has been preset to permit a rotation of the can until the seam of the can is located in the desired oriented position, and then to release the can from the chuck. The assembly of FIGURE 32 is particularly useful where a magnetic marking 295 has been placed in any location on the can. This magnetic marking can be incorporated into the pigment of one of the colors on the label of the can. By a proper setting of the timer 296, the rotation of the magnetic marking is limited and the can is released in its oriented position irrespective of the location of the magnetic marking on the can.

I have illustrated the vacuum head in cross section in FIGURE 38. The gear housing 252 for driving the vacuum chuck is identical to that previously described.
with the exception that the drive shaft of the vacuum chuck must be connected to a vacuum source. The drive shaft 245 extends through the base plate 256 of the gear housing and is modified to have a central bore 297 connected to a vacuum source. The lower end of the drive shaft is spaced from the base plate 256. The cover bar also has a central bore 301 forming a continuation of the bore 297 of the drive shaft and extends downwardly to the lower face 302 of the core bar. The bore 301 reduces to a lesser diameter in opening into the face 302. A cup-shaped housing 303 is slideably mounted on the drive shaft 245 and provided with an O ring 304 for sealing the sliding interface between the housing and the drive shaft. The housing is inverted with its open end down and its closed end immediately above the core bar 298. The lower end of the housing is partially closed by a cover plate 305 which threads into the open lower end. A central opening in the cover plate slidably receives a necked portion 306 of the lower end of the core bar. This necked portion is slidable within the opening in the cover plate by an O ring. The lower face of the cover plate receives a spacing plate 307 which threads into a circular threaded recess in the cover plate 305 and is locked into position by locking pins 308 driven into aligned openings in the spacer plate, cover plate and lower face of the core bar. The core bar is slideable vertically on the locking pins. The core bar has an internal flanged portion 309 which receives a large O ring to slidably seal the interface between the flanged portion 309 of the core bar and the housing 303. Thus, the core bar functions like a fixed piston within the cylindrical housing formed by the housing 303 and the cover plate 305.

Upon the application of vacuum through the bore 297 in the drive shaft, the vacuum suction exerts a force through the passages 299 to the chamber immediately above the core bar and below the top of the housing 303, thereby sucking the housing, face plate and spacer plate downwardly until the spacing plate engages a can top located below the chuck. Once the spacer plate 307 has engaged the top of the can, the full effect of the suction force is exerted on bore 301 in the core bar and provides a suction within the concave opening of the spacing plate 307 thereby drawing the can into tight contact with the plate and rotating the can in unison with the chuck. Preferably, the chuck is constantly rotating. Upon release of the vacuum force from the bore of the drive shaft, a coil spring 312 that is compressed longitudinally in the area between the flanged portion 309 of the core bar and the top face 310 of the housing, exerts a spreading force between the housing and core bar, thereby elevating the housing to the position shown in FIGURE 38 which effects a release of the can from the vacuum chuck and an elevation of the vacuum chuck out of contact with the can.

In FIGURE 31, I have shown an alternative form of my orienting assembly for use on ferrous metal cans having a prominent vertical seam. The electromagnetic constantly rotating chuck is identical to that previously described or a vacuum chuck as shown in FIGURE 38 may be used. I prefer to elevate the plate 286 between the conveyors to elevate the cans unless the cans are light. After the can has been elevated to the position in contact with the rotating magnetic or vacuum chuck, the timing mechanism of my machine actuates a mechanical seam feeler 315 which enters the space between the cans by a camming action to be described. The feelers are positioned between the cans with one feeler engaging each of the cans to stop the rotation of each can in an oriented position. These mechanical feelers 315 are similar in operation to the mechanical orientation stops 280 depicted in FIGURES 45–47, except the feelers stop the rotation of the cans by engaging the seams of the cans rather than the bumps 278 on the chimes of the cans.

The details of the feelers 315 are shown in FIGURES 48–50. An actuator shaft 316 extends upwardly from the feelers 315, through the gear housing 252 and has an upper end connected to a pneumatic cylinder or solenoid (not shown) for moving the shaft 316 vertically as viewed in FIGURES 48–50. The lower end of shaft 316 has integral, radially extending cam bars 317 (four in number in my preferred embodiment since four feelers are necessary to engage four symmetrically positioned cans), each having a longitudinal slot 318 extending radially of the shaft 316. A hollow tubular shaft 319 slidably receives the shaft 316. Shaft 319 also extends upwardly through the gear housing 252 and has an upper end connected to a pneumatic cylinder or solenoid (not shown) for moving the shaft 319 vertically as viewed in FIGURES 48–50. The shaft 319 can be moved vertically by the same cylinder or solenoid used to move shaft 316 by use of an appropriate lost motion connection whereby the shaft 319 is first moved downwardly between the cans while the shaft 316 is vertically stationary until the lost motion connection is exhausted and then the shaft 316 is moved downwardly by the cylinder or solenoid.

The shaft 319 has four vertically extending slots 328. The slots are positioned 90 degrees apart, center to center. One cam bar 317 extends outwardly from inside the shaft 319 through each slot 328. The cam bars are free to move vertically in the slots 328. The lower end 320 of shaft 319 is continuously flared outwardly in a cone shape with the apex of the cone pointed upwardly and the axis of the cone and shaft 319 being aligned.

A feeler finger, consisting of an upper bar 321 disposed parallel to and immediately below cam bar 317, a vertical connecting bar 322 and an inclined outwardly projecting stop bar 323, is located at four spaced locations around the lower portion of shaft 319. The upper bar 321 has an integral headed bolt 324 extended outwardly from from its top surface and is slidably received in slot 318 in the cam bar 319. The head of bolt 324 retains the upper bar 321 in a sliding relationship to the underside of cam bar 317. The bolt 324 is located on the bar 321 in a position permitting complete retraction of the feeler finger to the position shown in FIGURE 50 and extension of the finger to the position shown in FIGURE 49. The connecting bar 322 has a groove 325 extending crosswise of the bar. A continuous spring 326 extends around the four connecting bars and is located in the groove 325 of each bar. The spring is constantly contracting and thereby urges the feeler fingers inward toward the shaft 319. The stop bar 323 is maintained in a sliding relationship to the inclined outer surface of flared portion 320. The outer tapered sides 327 of the stop bar (when extended) engage the vertical seam of the can, as shown in FIGURE 49, to stop the rotation of the can induced by the solenoid.

In operation: the cans are fed to a position at the orientation station immediately below the rotating chucks with the mechanical feelers 315 located in a vertically withdrawn position between the chucks. The cans are then engaged with the chucks as previously described.

The shaft 319 is then moved downward between the cans until the flared portion 320 is engaged under the solenoid of the cans as shown in FIGURE 49. The shaft 316 is then moved downward thereby forcing the fingers 323 outward from the position shown in FIGURE 50 to the position shown in FIGURE 49. The bottom surface of
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fingers 323 engage the top surface of the flared portion 320 when shaft 316 moves downward, and since bolt 324 is free to slide in slot 318, the fingers are cannard outward along the flared portion 320. The tapered sides 327 of the fingers engage the rotating cans. When the vertical seam of the can engages the finger sides 327, the can is stopped and the chuck slides on the top of the can. In this embodiment, it is necessary to adjust the rotation of the cans with the various gear boxes previously described, to accommodate various commercial seam configurations of cans.

My feeler assembly can also be modified so that the vertical movement of the shaft 319 is not necessary. If the inclined angle of the flared portion 320 is substantially decreased from the vertical from that shown in the drawings, the shaft 319 can be a stationary extension from the underside of the gear box housing. With this configuration, the flared portion 320 is permanently located immediately above the tops of the cans so that the cans can clear the flared portion when they are fed to the orientation station. Since the inclined surface of the flared portion is steep, and the sloped underside surface of fingers 323 conform to the inclined surface, the fingers move, upon actuation of shaft 316, outwardly a substantial distance as well as outwardly to engage the can seams. Otherwise, this modified feeler assembly operates in the same manner as previously described.

FIGURE 39 illustrates another alternative form of the orientation assembly and is directed to a modified rotating chuck for use with the orientation lift plate shown in FIGURES 45 and 46 or the feeler fingers shown in FIGURES 48–50. The modified rotating chuck is driven by the shaft 245 as previously described. A chuck plate 330 is integral with the lower end of shaft 245 and preferably of a configuration conforming to the top of the conventional can. A portion 331 of the lower face of the chuck plate 330 is covered with a friction material having a high coefficient of friction. Thus, when the can is pushed against the chuck plate (which is constantly rotating), the can is engaged by the friction material and rotated in unison with the chuck plate.

Preferably, the cans are pushed against the chuck plate 330 by the orientation lift plate shown in FIGURES 45 and 46 and the operation of the lift plate and mechanical orientation stops is identical to that previously described. In the alternate method, the cans are pushed against the chuck plate 330 by a plain lift plate such as plate 286 previously described and the feeler fingers shown in FIGURES 48–50 are used to stop the rotation of the cans for orientation.

After the rotation of the cans has been stopped by the mechanical orientation stops or feeler finger, it is necessary to disengage the cans from the chuck plate 330 rapidly by a downward movement of the orientation lift plate or plain lift plate 286.

FIGURES 40 and 41 show another form of the constantly rotating chuck and useful as a substitute for the chucks previously described. The chuck is a mechanical chuck which is driven by drive shaft 245 in the manner described previously. A housing cover plate 332 is integral with the lower end of shaft 245 and is connected to a housing 333 by screws or the like. The lower end of the housing is closed and has at least four openings 334 spaced 90 degrees from each other, center to center. Contact strips 335 are mounted on the outside of the housing and are engaged by carbon brushes 336 supplying power to a magnet inside the housing. A magnet coil 337 is affixed to the inside surface of the housing 333 and receives a central core bar 338 reciprocally vertically in the coil upon energizing the magnet. A stop plate 339 is integral with the top of the core bar to limit the downward movement of the bar. A gripper pin 340 is slightly mounted in each hole 334 of the housing, and is biased inward by a spring 341. The holes 334 are inclined from the vertical and the pins 340 assume the incline of these holes so that the flat head surfaces 342 of the pins are inclined upwardly and outwardly. The lower end of core bar 338 is a conical surface 343 with the apex of the cone pointing downward. Upon energizing the magnet coil 337 (affected by the main timer control of the machine), the core bar 338 moves downward with the conical surface 343 engaging the surfaces 342 of the pins to push the pins outward to the dashed line position shown in FIGURE 41. The end points on the pins engage the inside surface of the chime or rim of the can as shown to rotate the engaged can in unison with the chuck. De-energizing the magnet 337 lifts the core bar since the springs 341 pull the pins inward to the solid line position shown in FIGURE 41.

FIGURES 33–35 illustrate an alternative mode of rotating the cans for orientation purposes. The various mechanical and electrical stop devices and sensing devices previously described are usable with the can drive mechanism shown in these drawings. This type drive mechanism is particularly adapted for use with containers which do not have a substantially flat top such as aerosol cans. A rotary shaft 345 is positioned along each side of the main conveyor at the orientation station. This shaft has a cut out portion 346 spaced from each other by flat lands 347. The number of arcuate portions is equal to the number of cans one desires to orient. Both ends of the shafts are rotatably mounted in pillow blocks 348 which are affixed to a support bar 349 swungly mounted on pin 350 affixed to a stationary portion of the machine frame. The support bars and shafts 345 are moved transversely toward and away from the main conveyor by pneumatic cylinders 351 controlled by the main machine timer. A motor 352 is mounted on each support plate to rotate the shaft 345. Preferably the motors are operated constantly but may be intermittently operated.

Each arcuate portion 346 has an integral drive thread 353 extending in a spiral configuration around the innermost part of the portion. The thread is at an oblique angle to the axis of revolution of shaft 345. The thread is preferably of a high coefficient of friction material such as rubber. The thread extends radially outward from the arcuate portion and engages the cans when the shafts 345 are moved to an inward position as shown in the drawings.

As the shafts 345 are rotated on a horizontal axis, the threads 353 engage the sides of the cans and cause rotation of the cans about their vertical axes. Since the cans are trapped within the arcuate portions, they merely rotate until their rotation is stopped by the mechanical stops such as I have previously described hereinafter. The shafts 345 are moved to an outward position, clear of the main conveyor, to release the cans for movement to the top clip application station.

FIGURES 36 and 37 illustrate an alternative can rotating assembly to that shown in FIGURES 33–35. This alternative assembly is usable in the same manner and arrangements previously described with respect to FIGURES 33–35. A plurality of rollers 355 are driven by integral shafts which in turn are driven by motors 356. The motors, drive mechanism, and rollers are mounted on a support plate 357 swungly mounted for movement toward and away from the main conveyor. This swinging movement is accomplished in the same manner as previously described by a pneumatic cylinder 358. A sufficient number of rollers is provided to engage and rotate every can.

The operation at the orientation station, when the cans have steel bodies and ends, using the electromagnetic chuck and the orientation lift plate shown in FIGURES 45 and 46, is controlled by the main machine timer control as follows:

(a) Cans are moved into position beneath the orientation chucks;
(b) Fingers are moved in transversely from the side of the main conveyor to unchime the cans (to be described hereinafter);
(c) Orientation lift plate is raised about 3¾" thereby raising the cans to within .010" of the bottom face of the electromagnets;
(d) Simultaneously the magnets in the chucks are energized, thereby attracting the cans (the chucks are constantly rotating, consequently, no rotation activation is necessary);
(e) Cans are oriented by chime bumps engaging orientation stop on lift plate;
(f) Timer control simultaneously deenergizes magnets, withdraws fingers and lowers lift plate after time period sufficient to insure at least one 360 degree revolution of cans;
(i) If magnets have hysteresis, then an A.C. current is introduced into the magnets to insure that cans are released;
(ii) Orientation lift plate moves about 3¾" below main conveyor chain to insure release of can bumps from the mechanical orientation stop on the lift plate.

It is important to use a lift plate in raising cans up to the magnetic chucks if the contents of the cans are degraded due to the shock caused in magnetically snapping the cans up from the main conveyor. Beer is a shock-degraded commodity.

The use of a vacuum chuck is normally too slow-acting for a high speed production line where cans having non-ferrous tops are being run, therefore, the friction or mechanical chuck must be used to maintain high packaging speeds. When using the friction or mechanical chucks, the fingers (to be described) are not moved outwardly to release the cans until after the cans have been released from the chucks.

The transducer sensing head cannot be used with the friction chuck, therefore, the use of the transducer is limited to the mechanical, magnetic and vacuum chucks.

The transducer sensing head, shown in cross section in FIGURE 51, preferably receives 27 volt D.C. current into the coil. The permanent magnet 288 and probe 287 are made from a mu metal (or alloy) capable of detecting differences in magnetic fields in its immediate area. The can, rotating near the probe, has a normal metal wall thickness of about 015", while the vertical seam has a metal thickness totalling about 0.060". Thus, there is a sharp change in the magnetic field between the normal side walls and the vertical seam. The coil 289 of the transducer is a sensitive detection system for changes in the magnetic field adjacent the probe and will change the voltage a minimum of .3 to 5 volts as applied to a timer relay. This variable voltage trips an adjustable timer circuit that is present to allow ½ revolution of can (less the delay time factor inherent in the circuitry) before release of the can from the chuck. At the end of the pre-set time, the timer circuit operates a "Reed" type relay (conventional high speed relay) that de-energizes the holding magnets in the electromagnetic chuck or releases the can from the mechanical or vacuum chucks, whichever the case may be. The "Reed" relay can also introduce an A.C. current into the electromagnetic chucks if hysteresis occurs. The end of the probe 287 normally must be within ½o of the can for proper operation.

The more sensitive transducer, for use on aluminum cans with a magnetic ink marking 277, does not require an impressed voltage on the coil 289 of the transducer to function as above described. The impressed voltage is unnecessary because the aluminum can side wall does not produce a signal as is the case with the ferrous can side wall and the ing marking will produce a clear signal upon passing the probe.

Top and bottom clip application stations

Referring now to FIGURE 15, the cans after orientation are moved to the top clipping station 154 and the cans of the top clipping station are simultaneously transferred to the bottom clipping station 155. The function of the top and bottom clipping stations is to engage the top and/or bottom of the oriented cans with the connecting clip or clips to form a package. Although it is well known to clip a plurality of cans together to form a package unit, I have found that it is desirable to provide a connector clip for both the bottom and the top of the cans. To achieve this end, I have found it necessary to reduce the weight of each of the connector units such that the weight of the connector units used both on the top and bottom of my package is substantially less than the weight of the single connector unit presently being used on existing packages on the market. I have found that the use of a top and bottom connector unit results in a rigid package which will withstand shock much more easily than a package unit having a clip only on the top or the bottom of the package unit. The clip made according to the present invention has a breaking point which insures that the consumer will receive a package which has not been subjected to excess shock since if the package is excessively shocked, due to improper handling, the clip will break, or yield, thereby indicating that the package should not be purchased by the consumer.

FIGURE 52 shows a side elevation view of the top and bottom clipping stations and FIGURE 53 shows an end elevation view of the clipping stations viewed from the right hand side of FIGURE 52, with some parts removed for clarity.

Referring specifically to FIGURE 52, the main conveyor passes at the level noted in this drawing and is constructed and arranged as hereinbefore described. The clipping stations shown in FIGURE 52 are specifically arranged to simultaneously clip 12 cans together, however, it should be realized that these clipping stations can be arranged for simultaneously clipping two or more cans to form a package. Each clipping unit includes a pneumatic cylinder 360 which is operable for extruding and retracting of a piston rod 361. Suitable supplies of pressurized air are provided to the upper and lower ends of the pneumatic cylinder 360 for actuation of the internal piston upwardly or downwardly as desired. The pneumatic cylinder 360 is attached to the frame of the machine by suitable angle irons in a conventional manner. The lower end of the piston rod has an integral pressure pad 362 which will be described in more detail in FIGURES 56-39. Guide pins 363 are integral with the top side of the pressure pad 362 and extend upwardly through and are slightly received within an olive bearing housed within an end plate 364 affixed to the lower end of pneumatic cylinder 360. Each guide pin 363 is headed to limit the downward movement of the pressure pad. The main conveyor has two parallel chains with a central opening between the chains. A rigid stationary bumper plate 365 is positioned in this opening and is suitably supported by risers 366 from the frame of the machine.

Referring to the bottom clipping station in the right hand side of FIGURE 52, pneumatic cylinders 367 are double acting and extend upwardly from the machine frame where they are mounted on mounting plates 368 integral with the frame. The cylinders are supplied with pressurized air at their upper and lower ends. The piston rod 369 of the pneumatic cylinder has an integral pressure pad 370 on the upper end and a guide pin 371 is integral with the bottom face of the pressure pad and passes downward in sliding relation through the bearing housed in a mounting plate 372. The pressure pads are described in more detail in FIGURES 60-62. Mounted above the pressure pad 370 and slightly above the top of the cans on the main conveyor is a bumper
plate 373. The cans are pushed against this plate 373 when the pneumatic cylinders 367 are actuated to elevate pads 370 and supply the connector clip for clipping the bottom of the cans. The bumper plate 373 receives a pair of spaced threaded bolt risers 374 which thread into openings on the top side of the bumper plate and the bolts pass through a mounting plate 375 integral with the frame of the machine. This mounting plate is the lower flange of an H beam 376. A tubular riser is positioned around each of the bolts and spaces the bumper plate from the flange of the H beam and suitable washers are positioned around the thread on the riser tube with respect to the flange of the H beam. This change riser is positioned around the bolt immediately above the flange of the H beam and a washer on the upper end of the bolt against the head of the bolt thereby providing a rigid stationary support for the bumper plate.

FIGURE 53 shows a side elevation view of the mounting structure for the pneumatic cylinders 367 and bumper plate 373.

Referring to FIGURES 56–59, the piston rod 361 of pneumatic cylinder 360 is affixed to pressure pad 362 to move the pad vertically when pressurized fluid is admitted and exhausted from the ends of the cylinder 360. The end plate 364 extends outwardly from the cylinder as viewed in FIGURE 57 and slidably receives the spaced pair of diametrically opposed guide rods 363 which guide the pressure pad 362 during its vertical movement. Since the guide rods 363 are headed, they provide a limit to the downward movement of the pressure pad 362. The central portion of the pressure pad includes an immovable rectangular plate 378 held in position by a pair of spaced headed pins 379 extending through openings in the pressure pad 362 and suitably secured thereto by screws 380. Each pin fits into the spaced openings 72, 72, in the clip shown in dashed lines in the figures. The heads of the pins are slightly oval such that the can heads can bewedged into the openings in the clip and provide sufficient friction holding the can so that the clip may be picked up in the manner to be described hereinafter. The heads of the pins slightly distort the round holes in the clips. Mounted around the periphery of the plate 378 are six can aligning pads 380. Each of these pads 380 has an arcuate peripheral portion 381 with a downwardly directed lip 382 which fits into and engages the top of the can as shown in FIGURE 58. The can aligning pads 380 located on the long side of the plate 378 have a peripheral arcuate length of about 290°. Each of the can aligning plates is movably supported to the plate 362 in the manner shown in FIGURE 58. Each can aligning plate has an integral rod 384 extending upwardly from the plate and is slidably received in an opening 385 in plate 362. A pair of spaced diametrically-opposed aligning pins 386 extend through special openings 387 in the plate 362 and are received into threaded openings in the can aligning plate 380. Pins 386 are headed to limit the downward movement of the plates 380 relative to plate 362. A pair of springs 388 are received into spring seats bored in the underface of plate 362 and top face of the plate 380. These springs are constantly in compression and bias the can-aligning plate 380 to a downward position as shown in FIGURE 58. When the pressure pad 362 is brought down into engagement with cans supported on the main conveyor, the can aligning plates 380 resiliently engage the top of the cans in the manner shown in FIGURE 58, thereby properly positioning the cans relatively to the clip shown in dashed lines in FIGURE 56, such that an accurate and complete attachment of the clip to the cans may occur by the proper clip parts being aligned rectly above the chime or head of the cans to which the clip is to be attached.

FIGURE 59 shows a modified form of the pressure pad in which the central rectangular plate 389 (for positioning the clip on the pad) is movably mounted relative to the plate 362. In this embodiment the rectangular plate is maintained in a spaced position from the plate 362 and the pins 390 are mounted in ball bushings 391 to provide relative movement between the plates 362 and 389. Thus, as the modified pressure pad as shown in FIGURE 26 is moved down for a clipping operation, the clip, which is held by the heads on pins 390 engages the can slightly before the can aligning plates 380 engage the top of the cans. However, the clipping operation does not occur until the rectangular plate 389 is moved upwardly into engagement with the lower face of the plate 362. This position would be analogous to the position shown in FIGURE 57 and the clipping operation is effected between the clip and cans.

FIGURES 60–62 show the bottom pressure pad 370. The piston rod 369 is integral with the pressure pad 370 through a threaded connection in the pad. The guide rod 371 is threadably received in the pressure pad and is supported by the cylinder as hereinabove described. The upper face of the pad is planar except for holes 392 for receiving retaining pins 393 which hold the clip in position on the pressure pad. These pins are circular and the upper face is beveled or sloped downwardly from its mid-point toward the edge as shown in cross section in FIGURE 62. The face of the pin is positioned toward the clip feeding assembly to be described. Each pin has a downwardly extending shoulder portion 394 which fits into the opening 392 in the top of the pressure pad and a screw 395 extends through a central opening in the pin 393 and threadably engages an opening in the pressure pad thus maintaining the pins on the pressure pads as shown in FIGURES 60–62.

FIGURES 54 and 55 show the pneumatically operated side fingers guides. These guides are located at the orientation station and the top and bottom clip application stations. Preferably the guides are operable simultaneously at these stations, however, they can be individually controlled and operated.

The guides include a stationary plate 396 affixed to the machine frame along both sides of and parallel to the main conveyor, and a pair of integral plates 397 located outside of and movable toward and away from the plate 396. The plate 396 has integral bumper rails 398 along its upper and lower edges. Pairs of spaced guide rods 399 are integral with and extend normal from the outside face of plate 396. These rods pass through openings in plates 397 and are slidably received in guide bushings 400 fixed to the outside surface of plate 397. Semi-rigid rubber or plastic (polyethylene, polypropylene or the like) fingers 401 pass through openings 402 in plate 397 and their inside ends are thread for locking engagement with plate 397. A pair of vertically aligned fingers 401 are located at each point where a pair of cans will abut when they are at repose on the main conveyor. Thus, the fingers will enter the vertical line where the cans are tangentially abutting to hold and de-chime the cans at the orientation and clipping stations. The fingers extend inward over the main conveyor when they are in engagement with the cans and are retractable to an outward position out of engagement with the cans and do not obstruct movement of the cans along the main conveyor. The fingers must be sufficiently rigid to hold and de-chime the cans, but sufficiently flexible and resilient to yield when a jam occurs in the machine. These flexible fingers greatly simplify the unjamming of the machine since it is sometimes necessary to pull or push cans along the conveyor chain and rigid fingers would not permit such movements.

A double-acting pneumatic cylinder 403 is mounted on the plate 397 and has an inwardly extending piston rod 404 passing through a hole in plate 397 and is fixed to
The introduction and exhaustion of pressurized air to cylinder 403 is controlled by the main machine timer. When pressurized air is admitted to the rod side of cylinder 403, the rod 404 is retracted and the cylinder pushes plate 397 by fingers 401 to an inward position over the conveyor and into engagement with the arc. When pressurized air is introduced into the other end of cylinder 403, the movements are reversed and the fingers are retracted.

**Clip feeding assembly**

FIGURES 63–68 show the top clip feeding assembly 154 and FIGURES 69–73 show the bottom clip feeding assembly 155. These assemblies are substantially similar in construction and operation except for the differences noted hereinafter.

Each of the clipping stations includes a clip chute consisting of a pair of angle irons 405 extending vertically with the open side of the angles facing each other to receive a stack of clips as shown in right hand chute of FIGURE 64. The lower end of each angle iron is affixed by bolts to a rigid, stationary plate 406 affixed on the frame of the machine. Immediately below the plate 406 is an integral push plate side guide plate 407 supported on an integral push plate bottom wear plate 408. A clip pusher plate 409 is positioned above plate 408 and between the side guide plate 407. The clip pusher plates 409 are located by air mounted to the frame of the machine. The admission and exhaustion of pressurized air to and from cylinder 401 is controlled by the main machine timer. The piston rod 411 of the air cylinder 410 is connected to a cross bar 412 which joins the two pusher plates 409 to move in unison upon activation of the air cylinder. The cross bar is also integral with a push bar bearing plate 413 which has an integral bolt 414 extending upwardly from its mid-point and positioned for sliding and rolling movement in a slot 415 secondary pusher bar 416 positioned between the two primary pusher bars 409. The secondary push bar 415 has a finger support bar 417 affixed to its outer end and extending transversely to a picker finger 418 extending inwardly toward the primary pusher plate 409.

This construction is shown in enlarged view in FIGURE 67. The shoulder bolt 414 extends upwardly through the slot 416 in the secondary push bar 415 and provides a lost motion connection between the primary pusher bar 409 for feeding the clip and the secondary pusher bar 415 which is fastened to the picker finger 418. Thus, as may be seen in FIGURES 65 and 67, as the air cylinder 410 is activated by introduction of pressurized air in the non-rod end, the primary pusher bar 409 moves a clip toward the top pressure pad 362, but the secondary pusher bar 415 does not commence its movement in unison with the primary pusher bar 409 until the shoulder bolt 414 reaches the inward end of the slot 416 in the secondary pusher bar 415.

The primary pusher plate 409 for feeding the clip has a stepped-down portion 419 for receiving the clip from the clip chute angles 405 and the stepped-down portion is enclosed by side walls 420.

FIGURE 67 shows the clip feeding pusher plate 409 in retracted position and FIGURE 68 shows the plate extended to the feed position. The pusher plate moves from left to right in FIGURES 67 and 68 in feeding the clip. The clip 421 on the stepped-down portion 419 is conveyed toward the pressure pad 362 shown in FIGURE 68 where the pressure pad picks up the clip preparatory to the top clipping operation. The clip is in a captive position on the stepped-down portion between the inside face of the portion, the side wall 420 and a resilient clip guide spring 422 which extends through the floor of the surface of the portion 419. A side view of this clip guide spring is shown in FIGURE 65 and the upper end of the spring extending above portion 419 is resilient such that it can be pushed downward flush with the surface of this portion. The clip is conveyed by the cylinder 410 to a position immediately below the pressure pad 362 which was described hereinbefore in FIGURES 56–59. In the last increment of its forward movement to its position under the pressure pad, the plate 409 and trips a 3-way valve which admits pressurized air into the upper end of the pneumatic cylinder 360, thereby moving the pressure pad 362 downwardly until the pins 379 on the pressure pad (which are slightly oval) are wedged into the circular holes in the clip 421. This wedging action releasably secures the clip to the pins 379 of the pressure pad as described hereinbefore. The main machine timer actuates the pneumatic cylinder 410 to withdraw the pusher plate 409 from beneath the pressure pad 362. The 3-way valve is released upon withdrawal of plate 409 such that pressurized air is released from the upper end of the air cylinder, thereby retracting the pressure pad 362 to an elevated position preparatory to the top clipping operation. The air cylinder 410 completely retracts the pusher plate 409 to the position such that the stepped down portion 419 lies immediately below the feed chute angles 405 as shown in FIGURE 65.

As shown in FIGURE 67, the picker fingers 418 support the stack of clips within the feed chute angles 405 during the feeding stroke of the pusher plate 409 until the lost motion connection between the bolt 414 and slot 416 is exhausted. Assuming that a clip 421 is positioned on the stepped down portion 419 and the picker finger 418 is beneath the stack of clips in the chute (as shown in FIGURE 67, the pusher plate moves toward the pressure pad 362 to deliver a clip and the picker finger 418 remains stationary until the shoulder bolt 414 reaches the right-hand end of the slot 416 in the secondary pusher bar 415 (this position is reached just prior to the clip 421 entering under pressure pad 362), at which point the secondary pusher bar 415 and integral finger support bar 417 and picker finger 418 are moved in unison with the pusher plate 409 from left to right in FIGURE 67. The picker finger is only moved a slight distance to the right sufficient to move the picker finger from its position beneath the stack of clips in the feed chute angles 405, thereby releasing the stack to drop upon the upper surface of the pusher plate 409. As the pusher plate 409 commences its retracting movement from right to left in FIGURES 57 and 68, the picker finger remains stationary since the shoulder bolt 414 is freely sliding in the lost motion slot 416 in the secondary pusher bar 415 and the picker finger does not commence a retracting right-to-left movement until the shoulder bolt 414 reaches the left-hand end of the slot 416. As the pusher plate continues its retracting movement from right to left, the shoulder bolt 414 engages the end of the slot 416 and moves the secondary pusher plate 415 and integral finger support bar 417 and picker finger 418 from right to left thereby moving the tapered end of the picker finger between the bottom-most clip and the next-to-the-bottom-most clip in the stack. The picker finger thereby cuts off the supply of clips to the surface of the pusher plate and provides a single clip on this surface. As the pusher plate continues its retracting movement from right to left, the single clip which is below the picker finger (and the clip is immovably trapped within angle 405 which extends down to the top surface of pusher plate 409) drops to the stepped-down portion 419 preparatory to the next clip feeding cycle. A resilient control spring 425 (see FIGURE 65) is integral with the underside of picker finger 418 to snap the single clip to the stepped-down portion 419 during the retracting stroke of the pusher plate 409.

FIGURES 67–73 show the operation of the clip feeding assembly for supplying a clip to the lower pressure pad 370 which clips the bottom of the cans. The operation of this assembly is substantially identical to that described above with respect to the top clip feeding assembly for the top pressure pad. The essential differences
are noted in the figures and description and similar numerals indicate similar mechanisms. The clips are supplied by the clip-feed chute angles 405 to a clip pusher plate 426. The essential difference between the bottom clip feed assembly and the top clip feed assembly previously described is that the bottom clip pusher plate is merely fast plate sliding on a stationary plate 427. The bottom clip pusher plate 426 does not have a stepped-down portion for feeding the clip but rather merely slides the clip over the stationary plate 427. The plate 427 extends to a position immediately adjacent the bottom pusher plate 70 as shown in FIGURES 69-73. The forward end of pusher plate 426 has sidewall extensions 428 and the clip being fed is located between the sidewalls and ahead of the plate 426. In FIGURE 40 I have shown the clip 429 in position for feeding to the lower pressure pad 370. The clip 429 has been separated from the stack of clips 430 in the angles 405. When pneumatic cylinder 416 is activated, the pusher plate 426 pushes the clip 429 from left to right in FIGURE 70, while the picker finger 418 remains stationary due to the lost motion connection between bolt 414 and the secondary pusher bar 415 as has been previously described. The picker finger support frame 417 has an integral spring 431 extending in an opposed direction to the picker finger and bent downward to engage the clip 429 during feeding as shown. As the clip 429 is pushed close to the pressure pad 370, the top of the clip is engaged by the outer end of the spring 431 at the clip mid-point (FIGURE 71). At this point, the shoulder bolt 414 has reached the right-hand end of the slot 416 in the secondary pusher bar 415, and further movement of the clip pusher plate 426 from left to right results in both the picker finger 418, spring 431 and clip 429 moving from left to right in unison to the position shown in FIGURE 72. The picker finger support frame 417 has moved from the position immediately below the stack of clips 430 and the stack is permitted to fall downwardly onto the top surface of the clip pusher bar 426. As the clip 429 moves from the position shown in FIGURE 71 to the position shown in FIGURE 72, it must ride up over the pins 393 on the upper face of the bottom pressure pad 370. Since the upper face of each of the pins 393 is sloped, and the spring is bearing downwardly on the center of the clip 429, the clip is snapped down over the pins 393 to a stationary position as shown in FIGURE 72. As the pusher plate 426 moves forward on the retraction stroke, from the position shown in FIGURES 72 to the position shown in FIGURE 73, the picker finger 418 and spring 431 remain stationary until the shoulder bolt 414 has reached the left-hand end of the slot 416 in the secondary pusher bar 415. At this point, the picker finger 418 and spring 431 commence movement from right to left in unison with the pusher plate 426, and the picker finger moves between the lowermost clip in the stack 430 and the next-to-lowermost clip, thereby releasing the lowermost clip onto the top surface of pusher plate 426. The clip feed chute angles 405 extend down to a position immediately above plate 426 thereby trapping the clip below the picker finger against movement toward the left as the pusher plate 426 is further retracted. As the plate 426 is further retracted, the clip drops downwardly onto plate 427 preparatory for the next clip feeding cycle. The final position of the clips and the picker finger is shown in FIGURE 70.

Clip transfer assembly

FIGURES 80 and 81 show the clip transfer assembly for supplying racks of clips to the clip feed chute angles 405. The rack for the clips consists of a tube base plate 435, reduced in thickness in its mid-portion 436 to reduce the weight of the plate, having circular openings 437 extending vertically through the plate and into which hollow tubes 438 are positioned to form an integral unit. In the preferred embodiment, two spaced rows of tubes 438, with four tubes in each row, is a size and configuration convenient for handling, both from the bulk and weight standpoint, however, the rack may be increased or decreased in size, as desired by the individual user. An essential characteristic of this rack is that the rows of tubes must be substantially parallel and spaced from each other a sufficient distance to prevent the clips from intermingling. FIGURE 80. The tubes 438 enter the holes in the clips. The clips are fabricated at a molding plant, automatically or manually stacked in four parallel rows in shipping cartons for transfer to the ultimate consumer. Upon arrival of the packaged clips at the consumer's point, the clip rack container is opened, exposing the upper surface of the rows of stacked clips. I have provided a clip transport assembly as shown in FIGURES 80 and 81 for removing the clips from the shipping carton and placing them in operative position on the machine. This clip transport assembly consists of the clip rack 435, and handling assembly comprising a pair of spaced parallel plates, the lower plate 440 having a plurality of downwardly extending tubes 441 integral with the plate at their upper ends. The tubes 441 are of slightly lesser diameter than the inside diameter of the tubes 438 on the clip rack, thereby permitting easy insertion of the tubes 441 inside the clip rack tubes 438 as shown in FIGURE 81. The tubes 441 provide a housing for the clip rack lift assembly which includes an upper plate 442 having a plurality of downwardly extending tubular housings 443 which extend into the tubes 441 of the lower plate 440 as shown in FIGURE 81. The lower end of each tubular housing 443 is closed except for a square central hole which receives a torquing rod 444 formed in a spiral shape. The torquing rod extends downwardly to a cylindrical rod 445 to which it is immovably affixed. A spring 446 is positioned around the entire length of the torquing rod between the cylindrical rod 445 and the bottom portion of the tubular housing 443 and this spring is loaded to be in compression at all times. The cylindrical rod 445 extends downwardly to a position slightly above the lower end of the tube 441 which extends slightly below tube 438. A clip lifting cam plate 446 is pivotally mounted by a screw 447 to the lower end of cylindrical rod 445. The pivot point, i.e., screw 447, of the clip lifting cam plate is off-center from the rod 445 as shown in the figure in the lower right hand corner of the drawing. The lower face of the clip lifting cam bar is flush with the lower end of tube 441. An arcuate portion of the arcuate portion is flush with the lower end of tube 441. As the rod 445 rotates in the direction of the arrow 451, the edge surface 452 of the clip-lifting cam plate 446 rides against the edge 449 of tube 441, thereby camming the clip-lifting cam plate 446 outwardly to the dashed line position which is the extended position of the cam plate. Upon rotation of the inside solid bar in the direction opposite to the direction of the arrow 451, the clip lifting cam plate 446 swings into engagement with edge 448 of tube 441 and the clip lifting cam plate 446 is swung inwardly to the solid line position which is the retracted position of the cam plate. I have provided roll pins 453 set in grooves in the rod 445, to prevent downward movement of the rod 445 upon rotary movement. I have also provided a second roll pin 454 integral with the rod 445 and extending through a groove cut in the tube 441. This groove extends 180° around the tube 441 and provides a limit for the rotation of the rod 445 relative to the tube 441.

Operation of the clip transfer assembly: assuming that the clips are in four vertical stacks in a shipping container, the clip rack transfer assembly is inserted downwardly into the openings of the eight aligned holes in the clips to the position shown in FIGURES 80 and 81. The upper end plate 440 is then pushed downwardly toward the clip rack, thereby causing the torquing bar 444 to rotate due to its passage through the square hole in the
bottom end of the tubular housing 443. The rotation of the torque bar also rotates the rod 445 which causes the clip lifting cam plate 446 outwardly to the dash line position as previously described. In this position, a clip lifting cam plate 446 is positioned beneath the lowermost clip in each stack of clips on the tubes 438 and the entire assembly may be easily lifted from the shipping container. The spring 446 around the torque bar 444 biases the plate 442 to the position shown in FIGURE 81 when the plate is released thereby camming the clip lifting cam plate 446 extending along the solid line position to release the clips from the ends of the tubes 438 on the clip rack. The plate 442 is easily moved toward the clip rack by placing a hand over the end of the plates 442 and 435 and squeezing the plates together.

Assuming now that the racks of clips have been removed from the shipping container, it is necessary to place them in the feed position on the machine. The clips are positioned into two opposite positions on the clip racks since it is necessary to feed the clips to the lower pressure pad with the clip chine engaging fingers and hooks facing upwardly while the clips fed to the top pressure pad must have their clip engaging fingers and hooks facing downward. The racks of clips are supplied from the molding plant with the clips facing in the correct direction for use on the machine.

Clip supplying assembly

FIGURES 74–79 show the clip supplying assembly for feeding racks of clips to the clip feeding assembly. The clip racks consist of a tube base plate 435 and eight integral tubes 438 positioned in two parallel rows of four tubes each. The tube base plate 438 has a longitudinal groove 452 extending along the long edge of the plate. A pair of spaced clip rack guide rails 456 are provided at each clip feeding station. The rails are spaced apart a distance equal to the width of the tube base plate 435 and extend transversely of the machine. The rails 456 are guide ways which slidably receive the tube base plate 435. Through use of the clip transport assembly which has been previously described, the clip rack is positioned on the rails 456 with the tubes 438 extending downward on the side of the machine shown in FIGURE 19. I have shown four pairs of space rails 456, since it is necessary to feed clips to four individual clipping stations in my present embodiment as shown in the drawings. However, the machine can be arranged to feed more or less clip racks to the machines, as desired.

The clip transport assembly removes the clips and clip rack from the shipping container and the entire assembly is placed such that the bottom end of tubes 438 are positioned immediately above the top plate 457 on the machine supporting the clip supplying assembly. The rails 456 are supported from plate 457 by risers 458. The clips cannot escape from the lower end of the tubes 438 due to the underlying plate 457.

A pneumatic cylinder 459 is mounted immediately above and between the rails 456 as shown in FIGURES 75–77. A solenoid-actuated pilot valve 460 controls the admission and exhaustion of pressurized air to and from the cylinder to move the piston rod 461 of the cylinder 459 to the right or left as viewed in FIGURE 75. The outer end of the piston rod is integral with a spaced index pawl bar 462 as shown in enlarged FIGURE 78. The index pawl bars 462 extend centrally of and parallel to the rails 456 and support a plurality of index pawls 463 mounted on axles 464 extending transversely of and rotatably received within holes in the index pawl bars 462. The ends of the pawl axles are slightly received in grooves 465 extending the entire length of the inside face of rails 456. The top surface of tube plate 435 has a plurality of aligned pawl receiving holes 466 located in a row between holes for tubes 438. When pressurized air is admitted to the right hand end of cylinder 459 as shown in FIGURE 75, the piston rod 461 moves outwardly of the cylinder and simultaneously moves the index pawl bars 462, along with the index pawls 463 toward the left as viewed in FIGURES 74 and 75. Each of axles 464 and index pawls 463 are freely swappable in the holes 466 located in the top surface of the tube base plate 435. The pawls are shown in engagement with the holes in FIGURE 74. Therefore, a left movement of the piston bar 462 results in a simultaneous left movement of the clip racks positioned on the rails 456. All of the racks are moved simultaneously on any single pair of rails since individual pawls engage the holes in the racks along the entire rails.

Assuming that the clip supplying assembly is in the position shown in FIGURE 75 and pressurized air is admitted to the right-hand end of the cylinder to move the piston rod 461 toward the left, the individual pawls 463 engage in the holes 466 of the tube base plate 435 and as the index pawl bar 462 is moved toward the left, the clip racks slide left along the clip rack rails 456. The movement of the piston rod 461 is limited to a distance just sufficient to equal the distance between each of the tubes 438 attached to the tube base plate 435. Thus, each full stroke of piston rod 461 index pawls 463 is located in line with the distance between the tubes and provides a new supply of clips to the clip feed chute angles 405 as shown in FIGURE 69. Upon introduction of pressurized air into the right hand end of cylinder 459 (FIGURE 75) the pawl bars 462 and pawls 463 are withdrawn to the right and the pawls swing upward to ratchet to the succeeding hole 466 in the tube base plate 435 preparatory to the next clip rack feeding stroke of cylinder 459. In FIGURE 69, I have shown a micro-switch 470 located at the top of the feed chute angles 405. This micro-switch is normally depressed to an inactive position by the presence of clips in the angles 405 and on the tubes immediately above the angles as shown in FIGURE 69. When clips are fed to the clipping pressure pad, the stack of clips decreases until the stack is below the micro-switch 470, thereby permitting the micro-switch to spring upwardly to activated position and closing a control circuit to solenoid actuated valve 460. The solenoid opens valve 460 thereby admitting pressurized air to the right hand end of the cylinder 459, as viewed in FIGURE 75, to move the piston rod 461 and index pawl bar 462 toward the left to advance the clip rack until the next tubes containing a stack of clips is positioned above the angles 405 of the clip chute, as previously described. The presence of the supply of clips in the angles 405 depresses the micro-switch 470 thereby opening the circuit and de-energizing the solenoid controlling valve 460 which then admits pressurized air to the left hand end of cylinder 459 (FIGURE 75) to retract piston rod 461, pawl bars 462 and pawls 463.

FIGURES 75 and 79 show a detent mechanism to prevent inadvertent dislocation of the clip racks when manually feeding the racks from the shipping containers to the machine. The racks are fed on the right hand end of the rails 456 as viewed in FIGURE 75. This detent mechanism consists of a small pneumatic cylinder 472 attached to the machine frame and having a piston rod 473 with a ball and socket in its end as shown in cross section of FIGURE 79. This ball in the socket is of a size only sufficient to fit into the opening in the upper end of tube 438 at its point of affixation to the tube base plate 435. The ball is normally biased downwardly by a spring 475 spirally wound around the piston rod 473 and in compression between the socket end and the end of cylinder 472. Upon activation of the micro-switch 470 and the subsequent actuation of the solenoid-actuated pilot valve 460, pressurized air is introduced into the lower end of air cylinder 472 to elevate the ball out of the upper end of tube 438, thereby releasing the clip rack for supplying clips to the clip feed chute angles 405 as previously described.
Referring now to FIGURE 83, I have shown a schematic of the pneumatic system for the machine.

An air compressor is provided on the machine and supplies pressurized air through conventional pneumatic elements including a swing check valve, an air filter, a pressure regulator and an air lubricator. Pressurized air is supplied from the air lubricator to a step-down pressure regulator which in turn supplies a low-pressure manifold and accumulator, preferably at about 30 lbs./sq. inch. A second line from the air lubricator supplies air to the high pressure manifold and accumulator, which preferably is a spring-loaded accumulator.

One line from the low-pressure manifold and accumulator supplies air to a second step-down pressure regulator which delivers air pressure preferably at about 20 lbs./sq. inch. The pressurized air from this pressure regulator is supplied to a 4-way valve operated by solenoid S1. When the solenoid is not energized, the valve is in the position shown in the drawing and pressurized air is supplied to the upper end of a pneumatic cylinder which is operatively related to the progression advance mechanism for the main conveyor chains. The progression advance mechanism for the main conveyor chain has a "Hilliard" single-revolution clutch. This mechanism is of conventional construction and requires an air-cylinder to release the clutch for a single revolution. With the valve in the position shown, the "Hilliard" clutch is locked and cannot rotate.

The valve, in the position shown, also supplies pressurized air to the lower end of a progression lock cylinder which must be released before the main conveyor chain can advance. The primary function of the progression lock cylinder is to pneumatically dog the main conveyor chain to the exact stopping position desired. In the position shown, the progression lock cylinder is positively locking the dog mechanism and must be released before the chain can advance. With the valve actuated to its second position by solenoid S1, the upper end of the progression advance cylinder and the lower end of the progression lock cylinder are exhausted to an exhaust manifold and pressurized air is supplied to the lower end of the progression advance cylinder and the upper end of the progression lock cylinder whereby the "Hilliard" clutch is released by the progression advance cylinder for a single revolution and the dogging mechanism is released by the progression lock cylinder. The solenoid S1 is de-energized immediately after (about 0.1 second based on 50 cycles per minute) the "Hilliard" clutch and dog mechanism have been released, thereby returning the valve to the position shown in the drawing, and limiting the clutch to a single revolution and forcing the dog to a riding position to insures immediate and accurate dogging as soon as the conveyor chain has progressed one station.

A second line from the low-pressure manifold supplies pressurized air to a bottom clip transfer 4-way valve operated by solenoid S3, which, when in the position shown in the drawing, supplies pressurized air to the bottom clip transfer cylinder, thereby retracting the pusher plate which feeds a clip to the bottom pressure pad. Simultaneously, the opposite side of the cylinder is connected to the exhaust manifold. Thus, in the normal position of the valve, the pusher plate is retracted. When the solenoid S3 is energized, the valve is moved to its second position to supply pressurized air to advance the piston in the bottom clip transfer cylinder, thereby feeding a clip to the bottom pressure pad, and the unpressurized side of the bottom clip transfer cylinder is connected to the exhaust manifold.

A third line from the low-pressure manifold and accumulator supplies pressurized air to the clip rack transfer cylinders and the indexing caster cylinders. It should be noted that there is no return line to the exhaust manifold from the clip rack transfer cylinders and indexing caster cylinders since the air is exhausted to the atmosphere. However, it is within the scope of my invention to exhaust the air from these cylinders to the exhaust manifold. The air supply and cylinder arrangement is identical for all the clip racks, therefore, only one will be described herein. The cylinders are controlled by a valve actuated by a solenoid, S6, S7, S8 or S9. When the valve is in the position shown in the drawing, pressurized air is supplied to the upper end of the indexing caster cylinder which controls the detent on the clip rack feeding mechanism. This causes the detent to enter the opening in the tube as heretofore described, thereby minimizing inadvertent displacement of the clip rack during feeding of clips to the can transfer control cylinder and manually, pressurized air is fed to the front of the clip rack transfer cylinder, thereby retracting the piston rod in the cylinder and the pawl attached to the rod as heretofore described. The rear portion of the cylinder is exhausted as shown. When the solenoid is energized to activate the valve to its second position, the upper end of the index caster cylinder is exhausted and the piston rod is raised by a spring as shown. The detent is raised simultaneously with the rod to free the clip rack for movement toward the clip chutes. Pressurized air is also fed to the rear side of the clip rack transfer cylinder to move the piston rod and attached pawl away from the can transfer control cylinder, a clip rack to proper position over the clip chute. As soon as clips are fed into the clip feed chute, the micro-switch at the top of the chute is opened by the clips and solenoids S6, S7, S8 or S9 is de-energized to return the valve to the position shown in the drawing. The solenoids S6, S7, S8 and S9 are energized and de-energized only by the micro-switches located at the top of the respective clip feed chutes. The micro-switches are designated LS6, LS7, LS8 and LS9 respectively on the electrical drawing.

A fourth line from the low-pressure manifold and accumulator supplies pressurized air to a top clip transfer 4-way valve operated by solenoid S2 which, when in the position shown in the drawing, supplies pressurized air to retract the top clip transfer cylinder, thereby retracting the pusher plate which feeds a clip to the bottom pressure pad. With the valve in this position, the opposite side of the top clip transfer cylinder is exhausted through the exhaust manifold. Thus, in the normal position of the valve, the pusher plate is retracted. When the solenoid S2 is energized, the valve is moved to its second position to supply pressurized air to the rear end of the clip transfer cylinder, thereby advancing the piston rod and feeding a clip to the top pressure pad. Simultaneously, the unpressurized side of the top clip transfer cylinder is exhausted through the exhaust manifold.

A fifth line from the low-pressure manifold and accumulator supplies pressurized air to a can transfer 4-way valve operated by solenoid S4. When this valve is in the position shown in the drawing, it supplies pressurized air to a pressure regulator, which steps the air pressure down to preferably 25 p.s.i. and supplies the stepped-down air pressure to the rear end of the can transfer cylinder, thereby activating the piston rod and can pusher plate to feed cans from the infeed conveyor to the main conveyor as heretofore described. The unpressurized side of the can transfer cylinder is exhausted through the exhaust manifold.

The valve also supplies pressurized air to secondary manifold which in turn supplies pressurized air to the side guide cylinders for moving the side guides inward, as heretofore described. The unpressurized sides of the side guide cylinders are exhausted to the secondary exhaust manifold which, in turn, is exhausted to the primary exhaust manifold. I have preferably shown such four side guide cylinders, although a greater or lesser number of cylinders can be used in moving the side guides.

The secondary pressure manifold also supplies pressurized air to the can transfer control plate and indexing the can transfer control plate upwardly out of engagement.
with the cans located on the infeed conveyor at the time the can transfer cylinder is activated to move cans from the infeed conveyor to the main conveyor. The unpressurized side of the can transfer control cylinder is exhausted to the primary exhaust manifold which, in turn, is exhausted to the primary exhaust manifold.

When the solenoid S4 is energized, the can transfer 4-way valve is moved to its second position. At this valve position, pressurized air is supplied to the manifold which previously functioned as the secondary exhaust manifold. The operation of the side guide cylinders, the can transfer cylinder, and can transfer control cylinder is reversed with the previous secondary pressure manifold functioning as a secondary exhaust manifold. Thus, with the can transfer 4-way valve in the second position, the side guide cylinders are activated to move the side guides inwardly to engage the cans on the main conveyor chain, the can transfer control cylinder is lowered to move the can transfer control plate to a position on the top of the cans located on the infeed conveyor, and the can transfer cylinder piston rod and attached pusher plate are withdrawn to receive cans from the infeed conveyor.

The high-pressure manifold, previously described, supplies pressurized air to the orientation lift plate cylinder and the top and bottom clip cylinders which move the pressure pads at both the top and bottom clamping stations to and from the clamping positions. Pressurized air is supplied from the high-pressure manifold and accumulator to a clip cylinder which moves the pressure pads in the manner hereinbefore described which, when in the position shown in the drawing, supplies pressurized air to the upper ends of the bottom clip cylinders, thereby retracting the clip cylinders to a withdrawn position with the bottom pressure pad below the main conveyor chain. Simultaneously, pressurized air is supplied to the lower end of the top clip cylinders, thereby retracting the top clip cylinders to a withdrawn position with the top clip pressure pads in an elevated position. Simultaneously, pressurized air is supplied to the upper end of the orientation lift plate cylinder, thereby retracting the lift plate to a position beneath the main conveyor chain. This cam operated valve has a normal position, shown in the drawing, in which the pressurized air line is closed and the pressure of the top clip cylinders is exhausted through the exhaust manifold. The bottom ends of the bottom clip cylinders are also exhausted through the exhaust manifold.

When the solenoid S5 is energized, the clip cylinder valve is moved to its second position, thereby supplying high pressure air to the bottom ends of the bottom clip cylinders to elevate the bottom pressure pads and clipping the lower ends of the cans with clips. Simultaneously, high-pressure air is supplied to the upper ends of the top clip cylinders through the cam operated valve (in its normal position) to move the top clip pressure pads downwardly to clip the top of the cans. The lower ends of the top clip cylinders and the upper ends of the bottom clip cylinders are exhausted through the exhaust manifold at this time.

When the clip cylinder valve is in its first position, high-pressure air is supplied to the top end of the orientation lift plate cylinder to retract the lift plate to a position below the main conveyor chain. The lower end is simultaneously exhausted through the exhaust manifold. When the solenoid S5 is energized and the valve is moved to its second position, high-pressure air is supplied to the lower end of the orientation lift plate cylinder to raise the lift plate and elevate the top of the cans. The lower end of the cylinder is simultaneously exhausted through the exhaust manifold.

The function of the cam operated valve is to activate the top cylinders to cause downward movement of the top pressure pads in picking up clips from the clip pusher plate when the plates are in fully extended position below the pressure pads. After retraction of the top clip cylinders, the top clip pusher plates are de-energized in the manner hereinbefore described and the pusher plates move the clips to a position directly below the top clip pressure pads. The pusher plates engage the cam operated valve during their feeding movement and move the valve to its second position shown in the drawing. Since the solenoid S5 is de-energized at this point in the cycle, high-pressure air is being fed to the lower ends of the top clip cylinders. Upon activation of the cam operated valve to its second position, high-pressure air is simultaneously fed to the upper ends of the top clip cylinders. Thus, the effective piston area of the top of the piston is its entire area while the effective piston area of the bottom of the piston is the area of the piston minus the area of the piston rod. Even though the air pressure above and below the piston is equal, there is a differential pressure on the piston which results in a slow downward movement of the top clip pistons and their integral clip pressure pads. The pressure pads continue their downward engagement the clip pusher plates, resulting in the pins on the pressure pads being wedged within the openings in the clips to pick up the clips from the pusher plates. The clip pusher plates are then retracted from below the top clip cylinders and pressure pads and release the cam operated valve to return to its original normal position, thereby exhausting the top ends of the top clip cylinders and permitting them to retract to an elevated position with the clips attached to the pressure pads.

**Electrical system**

In FIGURE 84 I have shown a schematic of the electrical system used on the machine. All "CR" designations indicate Control Relays, all "LS" designations indicate Limit or Micro Switches, all "S" designations indicate Solenoids, and all "TS" designations indicate Timer Switches controlled by the cams rotated by the program timer motor.

A power source, preferably 230 v., 3-phase, 60-cycle, is supplied to a main disconnect switch and fuse arrangement to supply power to the in-feed conveyor motor, the orientation motor for rotating the magnetic chucks, and the main conveyor chain progression motor. Each of these motors is provided with starter relay and overloads in a conventional manner. A main start-stop switch is provided for all motors of the machine. The 230 v. power source is supplied to a step-down transformer which provides a 115 v. power source to the main start-up circuit for the machine. The 115 v. power source is supplied to micro-switch LS1 and LS2, connected in series. These micro-switches LS1 and LS2 are the switches controlled by the cam counting star wheel. These switches are normally open until engaged by the pin on the underside of each star wheel. The LS1 switch is controlled by one of the star wheels and the LS2 switch is controlled by the second star wheel. When six cans have passed through each of the star wheels, the switches LS1 and LS2 are tripped from open to closed position to complete the circuit to an automatic cycle switch, which is an on-off switch to initiate automatic cycling of the machine. The circuit is then complete to micro-switch LS3. This micro-switch is in the path of the main conveyor chain and is tripped from a normally open to a closed position by the lug attached to the conveyor chain. The micro-switch is located at a point adjacent to the vertical rise section of the conveyor chain just prior to the horizontal movement of the chain. Micro-switch LS3 is a safety switch which insures proper positioning of the chain prior to commencement of a subsequent cycle. If the main conveyor chain has not advanced sufficiently far, this switch will not be tripped closed by the lug and therefore the machine will remain inoperative until the malfunction is corrected. The circuit is then complete to energize a
program timer motor TR1-M. Simultaneously, control relay CR1 is energized to close its contacts CR1-1 and CR1-2. Since the cans driven by the motor TR1-M inherently coast when power is removed, control relay CR1 is necessary to insure that the cycle starts at the right point, that is: when LS1, LS2 and LS3 have been triggered to closed positions. A single-cycle switch is furnished to timer switch TS1 to occupy switch LS1 and LS2 and the automatic cycle switch. This single cycle switch is for purpose of cycling the machine for one cycle rather than utilizing the automatic cycle. It should be noted that the single cycle switch does not bypass the micro-switch LS3, thus preventing a cycle of the machine if the main conveyor chain is improperly positioned so that micro-switch LS3 is not triggered to a closed position.

The timer switch TS1 is controlled by the cam driven by the program timer motor and is closed for a sufficient time to allow the progression of the main conveyor chain through a complete normal cycle. Switch TS1 is a bypass contact to permit continued operation during the open period of switch LS3.

The timer switch TS2 is controlled by the cam driven by the timer motor TR1-M and is closed during 90% of the cycle of the machine. The timer switch TS2 opens when the can transfer plate returns to its position to receive the cans from the infeed conveyor. To this end, if there were insufficient cans available on the infeed, at least one of the switches LS1 or LS2 will remain open, and a new cycle is not initiated.

Timer switch TS2 is controlled by the cam of the program timer motor TR1-M. The cam closes the timer switch TS2 momentarily at the commencement of the cycle completing the circuit and energizing normally open control relay CR2, thereby closing its contacts CR2-1 and CR2-2. Switch TS2 is necessary in the circuit to insure a consistent starting point for the start-up cycle of the machine.

The circuit is completed to the electronic orientation controls when required, and these controls will be described hereinafter.

When contact CR2-1 closed, the circuit was completed to a step-down transformer which lowers the voltage from 120 v. to 10 v. to provide a low voltage basic circuit for the machine primarily for safety reasons. This low voltage circuit controls all subsequent operations of the machine to complete a given cycle. Each of the timer switches TS4, TS11, TS3 and TS10, are controlled by the cam driven by the program motor TR1-M. The first operational step in the circuit is the closing of the timer switch TS3 which completes the circuit to solenoid S4, thereby activating the can transfer to pneumatically move the cans from the infeed conveyor to the main conveyor chain and simultaneously activating the side guides to an inward position. The second operational step is the closing of timer switch TS10 which completes the circuit to solenoid S5, thereby activating the top and bottom clip application mechanism pneumatically and simultaneously activating the lift plate at the orientation station to elevate the cans at this station for orientation. The third operational step in the cycle is the opening of timer switch TS10, thereby de-energizing solenoid S5 and pneumatically withdrawing the clip application pressure pad to retracted positions and retraction the lift plate below the orientation station to return the cans on the main conveyor chain. The fourth operational step is the opening of timer switch TS3, thereby de-energizing solenoid S4 and pneumatically withdrawing the can transfer plate to a retracted position over the infeed conveyor and pneumatically retracting the side guides to release the cans on the main conveyor chain. The fifth operational step is the closing of timer switch TS1 which completes the circuit to micro-switches LS4 and LS5. Switch LS4 is positioned at the side of the main conveyor to be tripped closed by the cans as they move along the main conveyor to a proper position beneath the top clipping station and the other switch LS5 is tripped closed by cans moving to a proper position above the bottom clipping station. These switches LS4 and LS5 prevent the feeding of a clip to either the top or bottom pressure pads if cans are not available for clipping at either clipping station. Assuring that micro-switches LS4 and LS5 are closed, i.e., there are cans in a proper position on the main conveyor at the top and bottom clipping stations, the micro-switch LS4 completes the circuit to the solenoid S2 and thus pneumatically feeds a clip from the feed chute to the top clip pressure pad. The micro-switch LS5 completes the circuit to the solenoid S3 and thus pneumatically feeds a clip from the feed chute to the bottom clip pressure pad. The sixth operational step in the program of the machine is the closing of the timer switch TS4 which completes the circuit to the solenoid S1 and thus activates the drive system of the main conveyor chain and moves the main conveyor to transfer the cans one station. The seventh operational step in the program of the machine is the opening of the timer switch TS4, thus de-energizing solenoid S1 and providing a limit stop for the forward motion of the main conveyor and assures accurate positioning of the main conveyor. The eighth operational step in the program is the opening of timer switch TS11 which de-energizes solenoids S2 and S3 (assuming switches LS4 and LS5 are closed) and withdraws the top and bottom clip feed pusher plates to a retracted position to receive another clip from the respective clip feed chutes. The circuit is also complete to micro-switches LS6, LS7, LS8 and LS9. These micro-switches are located at the top of the clip feed chutes and are normally held open by the clips in the respective feed chutes. When the level of the stack of clips in any feed chute drops below the location of the micro-switch, the switch closes thereby signalling a need for additional clips. The closed micro-switches, either or all, LS6, LS7, LS8 and LS9, energize their individual solenoids S6, S7, S8 and S9 which control the pressurized air supply to the air cylinders mounted above the clip racks. The air cylinders are activated to feed an additional stack of clips on the clip rack to a position over the partially empty clip feed chute. As soon as sufficient clips have been fed to the clip feed chute, the micro-switch located at the chute is tripped open by the clips and the air cylinder feeding a new rack of clips is retracted pneumatically.

A clip rack single-cycle switch is provided for each clip feed control to activate the clip rack feeding mechanism during the initial start-up loading of cans into the machine. The solenoids S1, S2, S3, S4, S5, S6, S7, S8 and S9 control valves which introduce and exhaust pressurized air to and from the pneumatic cylinders which have been previously described.

An additional micro-switch LS10 is provided in the 230 v. circuit. This switch is closed upon withdrawal of the can pusher plate for transferring cans from the infeed conveyor to the main conveyor and energizes solenoid S10 which withholds the holding pins from the star wheels, thereby permitting the star wheels to rotate and feed cans on the infeed conveyor to the pusher plate preparatory to transverse transfer to the main conveyor. Switch LS10 is only momentarily closed during the retraction of the pusher plate, thus solenoid S10 is energized only a sufficient time to withdraw the pins from the star wheels and the solenoid then immediately is de-energized to release the pins. The pinning of the star wheel, thereby insuring that the pins will drop into the positions in the rotating wheels and only the desired number of cans will be fed to the pusher plate.

Electronic orientation circuit

FIGURE 85 is a schematic of the electronic orientation circuit. Preferably 120 volt, single-phase, 60-cycle power is supplied to a transformer which steps-down the voltage to
32 volts, which in turn is supplied to an A.C.-D.C. rectifier 488. The rectifier supplies power to an electronic timer 489. A second 120 volt, single-phase, 60-cycle power source is supplied to another transformer 490 which steps the voltage down and supplies power to rectifier 491 through timer switches TS5 and TS6. These timer switches are controlled by cans driven by timer motor TR1-M. Switch TS5 closes to supply power to the electromagnetic chucks at the orientation station sufficient to pick up the cans from the orientation lift plate. Switch TS5 opens, removing the pick up power, just prior to switch TS6 closing to supply power to the electromagnetic chucks at the orientation station sufficient to hold the cans on the rotating chucks. Residual magnetism retains the cans on the chucks during the short period of time between opening switch TS5 and closing switch TS6.

The switches TS5 and TS6 complete the circuit to rectifier 491 where the voltage is rectified. The circuit is then complete to a normally closed contact in a "Reed" relay 492 which in turn supplies power to the magnets in the electromagnetic chucks 493.

Power is also supplied from rectifier 491 through timer switch TS7 and TS8 and a coil in the "Reed" relay 492 to the electronic timer 489.

Power is also supplied from the rectifier 491 through timer switches TS7 and TS9 to the coil of a transducer sensing head relay 494. When the coil of the relay 494 is energized, the circuit is closed from the transducer sensing head 495 to the electronic timer 489.

The timer switches TS7, TS8 and TS9 are controlled by cans driven by timer motor TR1-M. Switches TS7 and TS9 close at the appropriate time to energize the coil of the sensing head relay 494 thereby closing the circuit between the transducer sensing head 495 and electronic timer 489.

The timer switches TS7, TS8 and TS9 open and close substantially simultaneously at the proper time in the cycle. The machine cycle is as follows:

(i) Switch TS5 closes to provide pick-up power to the electromagnetic chucks;
(ii) Switch TS5 opens;
(iii) Immediately thereafter, switches TS6, TS7, TS8 and TS9 close substantially simultaneously such that switch TS6 supplies holding power to the electromagnetic chucks to hold the cans on the chucks; switch TS7 and TS9 supply power to the coils of the sensing head relay 494 to close the circuit between the transducer sensing head and the electronic timer 489; and switch TS5 completes the circuit to the "Reed" relay 492 so the relay will energize when the electronic timer reaches its pre-set time, thereby opening the circuit between the rectifier 491 and the electromagnetic chucks 493 to de-energize the chucks and release the cans magnetically held by the chucks.

As soon as the circuit is closed between the transducer sensing head 495 and the electronic timer 489, the sensing head is electrically prepared to generate a signal as soon as the seam of the can passes the head 495. When the seam passes, a signal is sent from the head 495 to the electronic timer 489 thereby initiating a timing cycle preset on the timer 489. The pre-set time on the timer is determined by measuring the time necessary for the seam of the can to rotate from its signal generating position adjacent the transducer sensing head 495 to its desired oriented position. This time period is dependent on the speed of rotation of the cans (and cans) and the location of the desired oriented position. When the pre-set time has elapsed, the electronic timer energizes the coil in the "Reed" relay thereby opening the circuit between the electromagnetic chucks 493 resulting in a release of the cans from the chucks in their desired oriented position.

FIGURE 82 shows a modified form of my invention in which the clips are applied to the cans while in constant movement. The modification provides a continuously operating machine operable normally at higher production rates than the intermittent machine previously described.

A continuously moving feed conveyor 477 supplies cans to an orientation station 478 where the cans are oriented as previously described except on a continuously moving basis rather than an intermittent basis. The orientation chucks are driven through the gear box which is movable in unison with the conveyor 477. The oriented cans are moved to a pair of opposed clamping wheels 479 and 480. The wheels are similar in operation and controlled to rotate in unison with each other. The top wheel 479 has a plurality of pressure pads 481 mounted on its periphery. These pressure pads are similar in construction to the pads previously described. A stack of clips 482 are fed to the wheel 479 and individual clips are picked up and held by each pressure pad 481. As the wheel is rotationally driven about its axis 483, the clips are moved downwardly to engage the top chins or beads of the cans moving beneath the wheel 479.

The bottom wheel 480 has pressure pad 481 on its periphery and individual clips are fed to the pads by a clip feeding device 484. The clips are picked up and held by the pressure pads 481 at the feeding device. As the wheel is rotationally driven about its axis 485, the clips on the pads move upwardly to engage the bottom chins or beads of the cans moving above the wheel 480.

After a clip has been applied to the top and bottom of the cans, the resulting package 486 continues on the conveyor 477 to a removal point.

The wheels 479 and 480 need not be directly opposed to each other, but rather can be spaced along the conveyor 477 so that the top and bottom clips are not applied simultaneously as shown in FIGURE 82.

FIGURE 86 is the timer cam profile. The timer cam, driven by timer motor TR1-M, opens and closes timer switch contacts TS1 through TS12 in the sequence and for the time periods shown in FIGURE 86.

Timer switch TS1 is the LS3 by-pass contact. This contact is a holding contact that by-passes the main conveyor chain limit switch when the chain moves. TS1 closes with timer switch TS4 and opens just before time switch TS3 closes.

Timer switch TS2 is the proper starting sequence contact and insures that each cycle of the machine starts at exactly the same point. This switch closes just before switch TS3 closes, and is set for a 10 degree closed time.

Timer switch TS3 is the can transfer and side guide contact and actuates the pneumatic cylinders that transfer containers from the intake conveyor to the main conveyor, and the pneumatic cylinders that move the container guides.

Timer switch TS4 is the main conveyor contact and actuates the pneumatic cylinder that permits activation of the single revolution clutch ("Hilliard") and the pneumatic cylinder that disengages the dog from the slot on the circular plate for positioning the main conveyor chain after a single forward cycle of the chain.

Timer switch TS5 is the pick-up voltage contact for the rotating electromagnetic chucks and applies the pick-up voltage (preferably 120 v. D.C.) to the magnets in the electromagnetic orientation chucks.

Timer switch TS6 is the holding voltage contact for the rotating electromagnetic chucks and applies the holding voltage (preferably 60 v. D.C.) to the magnets in the electromagnetic orientation chucks.

Timer switch TS7 is the sensor head contact number 1 and completes the circuit to timer switch TS9 and the sensing head so that signal generated by the can seam
(or magnetic ink marking on can) passing the sensing head can start the timing cycle of the electronic timer.

Timer switch TS8 is the relay contact and completes the circuit to the relay (preferably "Reed") so relay will energize when the electronic timer reaches its pre-set time limit, i.e., "times out."

Timer switch TS9 is the sensing head contact number 2 (in series with TS7) and completes the circuit to the sensing head (transducer) for the purpose explained above for TS7. This contact eliminates the voltage surge as contact TS7 closes from firing the electronic timer before the sensing head senses the seam of the can.

Timer switch TS10 is the clip application and orientation lift plate contact; and actuates the pneumatic cylinders that apply the clips to the top and bottom of the cans, and the pneumatic cylinder that elevates and retracts the orientation lift plate.

Timer switch TS11 is the clip feed contact, and actuates the pneumatic cylinders that feed the clips from the clip feed chute to the top and bottom pressure pads.

Timer switch TS12 is the can counter by-pass contact and functions as a holding contact as the star wheel rotates.

While I have described my present preferred embodiments of my invention, many modifications and changes can be made within the scope of the following claims.

I claim:
1. A method of orienting and assembling containers, such as cans and the like, to form a package, comprising: (a) feeding a plurality of said containers along a feed path to an orienting station, said plurality being sufficient in number to form only a single package; (b) simultaneously rotating all of said plurality of containers about a vertical axis; (c) stopping the rotation of each container in its designated position; and (d) thereafter uniting a clip to said plurality of containers to form a single package.

2. A method according to claim 1 including the steps: individually engaging each of said containers with a rotating driving force to rotate the engaged container and forcing said predetermined point on each container, and stopping the rotation of each container in the desired oriented position in response to the sensing step.

3. A method according to claim 2 wherein each of said articles has a longitudinally extending seam, and sensing said predetermined point on each container by engaging said seam with a stationary stop to arrest the rotation of the container.

4. A method according to claim 2 wherein each of said containers has a substantially longitudinally extending, multiple-layer metallic seam, and sensing said predetermined point on each container by electrically sensing said metallic seam and arresting said rotation of the container in response to the sensing.

5. A method according to claim 2 wherein each of said containers is a substantially cylindrical container having a chime on at least one end concentric with the axis of rotation of the container, and a small localized bump extending outwardly from the chime; and sensing said bump by engaging it with a stationary stop to arrest the rotation of the container.

6. A method according to claim 2 wherein said driving forcing is continuously rotating; including the steps of: limiting the engagement time period between the driving force and engaged container to a period sufficient to complete substantially only one rotation of 360° of the container, and disengaging the force and the engaged container immediately after said time period.

7. A method of assembling substantially cylindrical containers to form a package unit, said containers having top and bottom ends, comprising: feeding a plurality of the containers along a path to an orienting station; elevating each container at the orienting station above said path, each cylindrical body being disposed vertically; engaging the top end of each container with a driving force to rotate the container about its axis of rotation; stopping the rotation of each container to orient said indicia in a desired location; disengaging the driving force from the container top end; moving a plurality of the oriented containers from the orienting station to an assembling station; then fastening together the bottom ends of the containers at the assembling station to form a package unit; and, removing the package unit from the assembling station.

8. A method according to claim 7 including the steps of: sequentially segregating individual groups of at least three containers from the plurality of containers being fed to the orienting station; and sequentially feeding each individual group to the orienting station; and, simultaneously orienting all the containers in each group.

9. A method according to claim 7 including the steps of: sequentially segregating a sufficient number of containers from said plurality being fed to the orienting station to form at least two package units having at least three containers in each unit; sequentially feeding the segregated containers to the orienting station; simultaneously orienting all the segregated containers; simultaneously moving all the segregated oriented containers to the assembling stations; and, simultaneously forming at least two package units at the assembling station fastening together top and bottom ends of the containers.

10. A method of assembling a plurality of articles with a connector unit comprising feeding a plurality of articles in a successive manner along a predetermined path to a transfer station, segregating a predetermined number of said articles from the succession of articles at the transfer station, then transferring said predetermined number from the transfer station to an orienting station, orienting each of said articles at said orienting station, feeding a connector unit to a position adjacent said orienting articles, releasably engaging said connector unit with each of said oriented articles to form a package unit, and removing said package unit.

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