Three-piece welded cans

Three-piece welded food cans are only constructed from steel, as aluminium is not suitable for welding by this particular process. Coils of steel, after delivery from the steel maker, are cut into sheets approximately 1 m2 . The cut sheets are then coated, and printed if necessary, to protect and decorate the surfaces. Areas where the weld will be made on the can body are left without coating or print to ensure the weld is always sound. The coatings and inks are normally dried by passing the sheets through a thermally heated oven where the temperature is in the range 150–205°C. Alternatively, for some non-food contact uses, ultraviolet (UV)-sensitive materials may be applied. These are cured instantaneously by passing the wet coating/ink under a UV lamp.

The sheets are next slit into small individual blanks, one for each can body, each blank being rolled into a cylinder with the two longitudinal edges overlapping by approximately 0.4 mm. The two edges are welded by squeezing them together whilst passing an alternating electric current across the two thicknesses of metal (see Fig. 5.3). This heats up and softens the metal sufficiently for a sound joint to be made. If the can is internally coated with lacquer it is generally necessary to apply a repair side stripe lacquer coat to the inside of the weld to ensure coating continuity over the whole can.

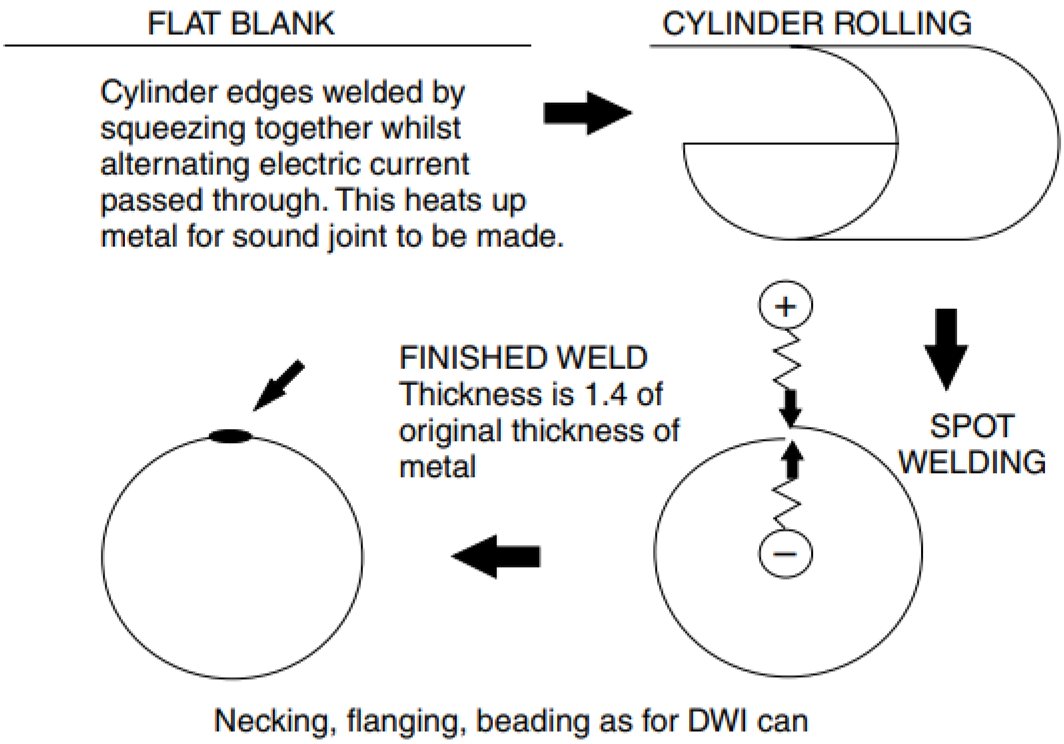

Figure 5.3 Three-piece can welding principles.

For food cans, the can body now passes through a flanging machine where the top and bottom of the can body are flanged outward to accept the can ends. For drink cans, the top and bottom edges of the can body are necked-in to reduce the diameter prior to the creation of the flanges. This permits ends to be fitted which are smaller in diameter than that of the can body, reducing the cost of the end and the space taken up by the seamed can.

For both food and drink cans, one end is then mechanically seamed-on to the bottom of the can body. This end is commonly referred to as the maker's end (ME). Where easy-open ends are fitted to three-piece cans, it is common practice for this end to be fitted at this point, leaving the plain end (non-easy-open) to be fitted after filling. This practice allows the seamed easy-open end to pass through the finished can testing process. The end applied by the packer/filler after can filling is commonly referred to as the canner's end (CE).

At this stage, tall food cans (height-to-diameter ratio more than 1.0) pass through a beading machine where the body wall has circumferential beads formed into it. The beads provide additional hoop strength to prevent implosion of the can during subsequent heat process cycles. All cans finally pass through an air pressure tester, which automatically rejects any cans with pinholes or fractures. This completes the manufacture of empty three-piece food and drink cans.

Two-piece single drawn and multiple drawn (DRD) cans

Pre-coated, laminated and printed tinplate or TFS is fed in sheet or coil form in a reciprocating press that may have single or multiple tools. At each tool station the press cycle cuts a circular disc (blank) from the metal and whilst in the same station draws this in to a shallow can (cup). During the drawing process the metal is reformed from flat metal into a three-dimensional can without changing the metal thickness at any point. After this single draw, the can may be already at its finished dimension. However, by passing this cup through a similar process with different tooling, it may be re-drawn into a can of smaller diameter and greater height to make a draw–redraw can (DRD). This process may be repeated once more to achieve the maximum height can. At each of these steps, the can base and wall thickness remain effectively unchanged from that of the original flat metal. These processes are shown in Figure 5.4. Following this body-forming operation, necking, flanging and beading operations follow according to the end use and height-to-diameter ratio of the can (as for three-piece welded cans).

For all two-piece cans pinhole and crack detection on finished cans is carried out in a light-testing machine. This measures the amount of light passing across the can wall using high levels of external illumination. One advantage of two-piece cans is that there is only one can end instead of two, meaning that one major critical control hazard point is eliminated.

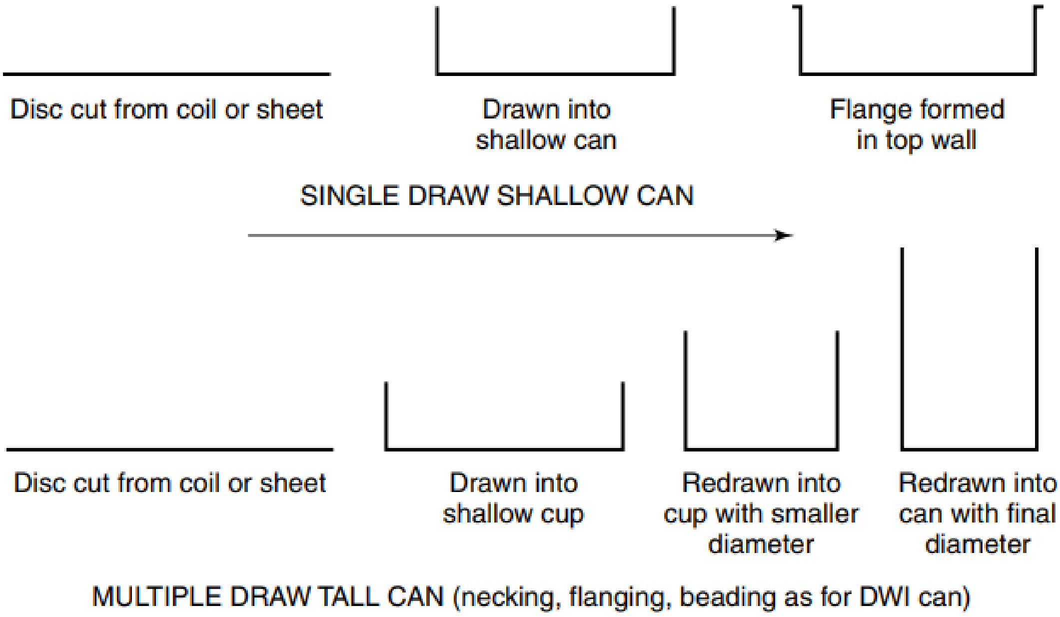

Figure 5.4 Two-piece drawn can forming.

The single drawing process is also used to make aluminium- or steel-tapered shallow trays for eventual heat-sealing with coated metal foil. The container bodies are constructed from metal laminated with organic film. The single drawing process is also used for the manufacture of folded aluminium baking trays and take away containers. In this process the aluminium is allowed to fold, as the metal is converted from a flat sheet into a shaped container.

Two-piece drawn and wall ironed (DWI) cans

The DWI cans are constructed from uncoated tinplate or aluminium. However, DWI cans for processed food are only made from tinplate as thin wall aluminium cans do not have sufficient strength to withstand the heat process cycles.

For this process, which is described in Figure 5.5, the coiled metal, as it is unwound, is covered with a thin film of water-soluble synthetic lubricant before being fed continuously into a cupping press. This machine blanks and draws multiple shallow cups for each stroke, as described under the section entitled Drawn cans above. The cups are then fed to parallel body-making machines which convert the cups into tall cans. This is the drawing and ironing process where the cups are first redrawn to the final can diameter and then rammed through a series of rings with tungsten carbide internal surfaces which thin (iron) the can walls whilst at the same time increasing the can height. During this process the can body is flooded with the same type of lubricant used in the cupping operation. In addition to assisting the ironing process, the lubricant cools the can body and flushes away any metallic debris. No heat is applied to the can during this process – any heat generated being from the cold working of the metal as it is thinned. After the forming of the can body the uneven top edge of the can is trimmed to leave a clean edge and a can of the correct overall height. Trimmed can bodies are passed through chemical washers and then dried. This process removes all traces of lubricant and prepares the metal surfaces for internal and external coating and ultimately external decoration (drink cans only).

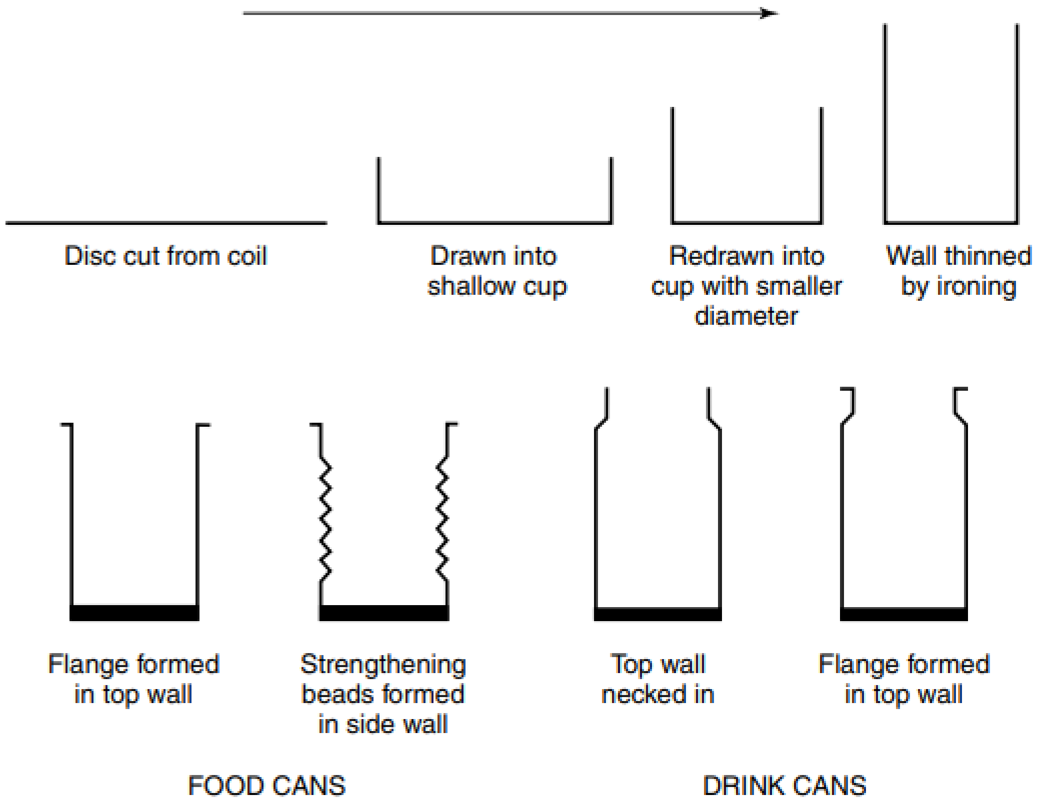

Figure 5.5 Two-piece drawn and wall ironed (DWI) can forming.

For food cans, which will ultimately receive a paper label, an external coating is applied by passing them under a series of waterfalls of clear lacquer which protects the surface against corrosion. The lacquer is dried by passing the cans through a heated oven. Following this the can body now passes through a flanging machine where the top of the can is flanged outwards to accept the can end, which will be fitted after the can is filled with product. The flanged can is next passed through a beading machine which forms circumferential beads in the can wall, to give added strength to the can. After all the mechanical forming operations have been completed, every can is tested by passing through a light tester which automatically rejects any cans with pinholes or fractures. The inside of each can is then coated with lacquer using an airless spray system. The special lacquer is applied to protect the can itself from corrosion and prevent its contents from interacting with the metal. This lacquer is finally dried in a thermal oven at a temperature of about 210°C.

For drink cans, the clean cans are coated externally with a clear or pigmented base coat that forms a good surface for the printing inks. The coating is then dried by passing the cans through a thermally heated oven. The next step is a highspeed printer/decorator which applies the printed design around the outside of the can wall in up to eight colours plus a varnish. A rim-coater coat applies a heavy varnish to the base of each can in order to provide added protection against scuffing during distribution and external corrosion, especially as such products are often kept in the cold humid conditions of chilled refrigerators. The cans now pass through a second oven to dry the ink and varnish. The inside of each can is coated with lacquer using an airless spray system. The special lacquer is applied to protect the can itself from corrosion and prevent its contents from interacting with the metal. This lacquer is finally dried in an oven at a temperature of about 210°C. Following this, the can body now passes through a necker/flanger machine where the diameter of the top wall is first reduced (necked-in) before the top edge is flanged outwards to accept the can end. After all the mechanical forming operations have been completed, every can is tested by passing it through a light tester which automatically rejects any cans with pinholes or fractures.