Special Forming Process

There are a great variety of sheet metal forming methods, mainly using shear and tensile forces in the operation.

- Progressive forming
- Rubber hydroforming
- Bending and contouring
- Spinning processes
- Explosive forming
- Shearing and blanking
- Stretch forming
- Deep drawing

Progressive forming
- Punches and dies are designed so that successive stages in the forming of the part are carried out in the same die on each stroke of the press.
- Progressive dies are also known as multi-stage dies.

Rubber forming
- In bending and embossing of sheet metal, the female die is replaced with rubber pad

Hydro-form (or) fluid forming process
- The pressure over rubber membrane is controlled throughout the forming cycle, with max pressure up to 100 Mpi
- As a result the friction at the punch-cup interface increases, this increase reduces the longitudinal tensile stresses in the cup and delays fracture

Spinning
- Shaping thin sheets by pressing them against a form with a blunt tool to force the material into a desired form

Conventional spinning
- A circular blank if flat or performed sheet metal hold against a mandrel and rotated, while a rigid metal is held against a mandrel and rotated, while a rigid tool deforms and shapes the material over the mandrel.

Shear Spinning
Fig. (a) Schematic illustration of the conventional spinning process (b) Types of parts conventionally spun.

All parts are antisymmetric
- Known as power spinning, flow turning, hydro-spinning, and spin forging
- Produces axisymmetric conical or curvilinear shape
- Single rollers and two rollers can be used
- It has less wastage of material
- Typical products are rocket-motor casing and missile nose cones.

**Tube spinning**

Thickness of cylindrical parts are reduced by spinning them on a cylindrical mandrel rollers
Parts can be spun in either direction
Large tensile elongation up to 2000% are obtained within certain temperature ranges and at low strain rates.
Advantages
Lower strength is required and less tooling costs
Complex shapes with close tolerances can be made
Weight and material savings
Little or no residual stress occurs in the formed parts

Disadvantages
Materials must not be super elastic at service temperatures
Longer cycle times

Explosive forming
Explosive energy used s metal forming
Sheet-metal blank is clamped over a die
Assembly is immersed in a tank with water
Rapid conversion of explosive charge into gas generates a shock wave. The pressure of this wave is sufficient to form sheet metals

Beading
The periphery if the sheet metal is bent into the cavity of a die
**Hemming**
- The edge of the sheet is folded over itself
- This increases stiffness of the part
- The metal strip is bent in stages by passing it through a series of rolls

**Seaming**
Joining two edges of sheet metal by hemming. Specifically shaped rollers used for watertight and airtight joints

**Deep drawing**
- Punch forces a flat sheet metal into a deep die cavity.
- Round sheet metal block is placed over a circular die opening and held in a place with blank holder & punch forces down into the die cavity

**Flanging**
Flanging is a process of bending the edges of sheet metals to 90°
Shrink flanging – subjected to compressive hoop stress.
Stretch flanging – subjected to tensile stresses
Fig. Various flanging operations (a) Flanges on a flat sheet. (b) Dimpling. (c) The piercing of the sheet metal to form a flange. In this operation, a hole does not have to be prepunched before the punch descends. Note however, the rough edges along the circumference of the flange. (d) The flanging of a tube; note the thinning of the edges of the flange.

Source: http://npr cet.org/e%20content/mech/MT.pdf