- Report deviations and faults.
- Possibility of coupling with the moulding machine controls
- Automatic temperature reduction during production interruption /disturbance
- Have interface for printer

One regulating module can control an individual circuit or a number of circuits joined together in case of large multi-cavity moulds. In the later case, all circuits governed by one module will be treated as identical. For example, 16 modules could regulate the temperature of 64 nozzles of a mould which are wired in groups of four.

The latest version of temperature controllers consists of versatile modules which are capable of regulating a number of circuits individually in all respects.

Conclusions

The advantages of a hot runner system are:

- No runners have to be cooled, ejected, reground and remixed.
- The mould is simpler as it does not have to open (and close) at two levels.
- The temperature of the melt to all cavities can be maintained at the required level.
- The balancing of filling can be manipulated through variation of temperatures of the nozzles.
- The product can be gated at the most suitable points.
- The melt reaches the cavity at the predetermined temperature.
- The machine needs less energy as it has to melt, cool, and inject only the material for the cavities and not for the runners.
- The production cycle is shorter as no runners have to be injected, cooled and ejected.
- The machine can be smaller and hence cheaper.

Disadvantages of hot runner systems are:

- High initial investment in the mould.
- Need for additional regulating equipment
- More chances of disturbance due to failure of heaters and thermocouples

sturdy and economical mould and a trouble free moulding, must be followed while designing the article. These are:

Uniform Wall Thickness

This must be regarded as a universal rule, applicable under all conditions. It ensures uniform mould filling, uniform cooling, uniform shrinkage and therefore less stresses and less warpage. Thicker sections (Fig. 4.98A) are bound to cave in upon moulding as shown through dotted lines. The article can be modified as depicted in Fig. 4.98B to fulfil the same function without being prone to the said defect. Wall thickness is primarily decided upon from the strength angle. Another factor governing the wall thickness, no less important, is the possible distance the selected material can flow with the given wall thickness before freezing. It is expressed as L/T ratio.

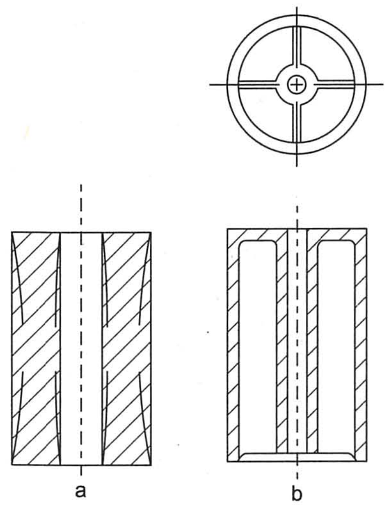

Fig. 4.98

Strengthening Ribs

Large surfaces can be strengthened by providing ribs instead of increasing the wall thickness. Thick sections cool slowly, prolong the cycle and may get sink marks. Ribs reduce material, decrease cooling time, add stiffness and strength and reduce warpage.

Thick ribs, too, can give rise to sink marks at their junction. Their breadth should not exceed two thirds of the thickness of the wall they join. For ribs which are joined to the article wall on one side only, the height is limited to thrice their breadth. A small fillet radius at the joint reduces the notch effect.

Cross ribs on a large area generate another source of moulding defects. There is unavoidable material accumulation where two ribs cross each other. One measure to reduce the

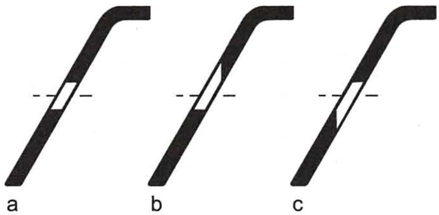

Fig. 4.112

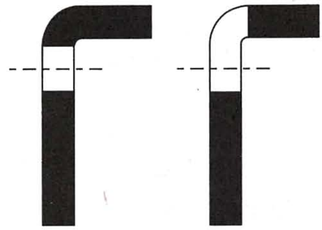

Fig. 4.113

Figure 4.113 shows yet another example of redesigned side opening.

Additional holes, apertures and cut outs, if located judiciously, can help reduce the weight of the article. It must, however, be examined whether they give rise to unacceptable weld lines or weak spots. In certain type of products, the cut outs may even add to the aesthetic appeal of he product.

Insert Moulding (Fig. 4.114)

Metallic inserts, such as reinforcing metal plates, electrical contact pins, internally threaded metal sleeves, etc., should not be too large as compared to the moulding. The thin plastics material around a big insert, when prevented from shrinking, may develop cracks. They should not be positioned near the surface or the edges. Provide flats, knurling, and grooves on the outer surface of round inserts to prevent turning and withdrawal. These undercuts should not have sharp edges.

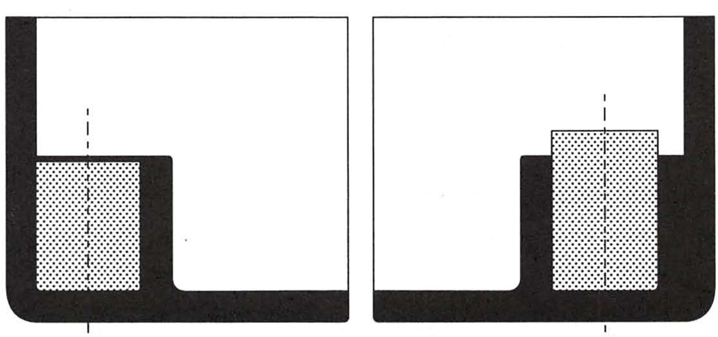

Fig. 4.114

powder. Its physical properties such as tensile strength, hardness, etc. depend upon the composition of the metal powder.

Out of a variety of metal powders available for the process, those most suitable for injection mould inserts are either a bronze-based mixture or a tool steel one. The former mixture is faster in manufacturing but is comparatively softer (115 HV) and is generally employed for moulds for trial series. It is, however, possible to mould up to a few hundred thousand components depending upon the thermoplastics to be processed. The maximum operating temperature is 400°C.

Inserts, laser-sintered out of the bronze mixture, display a minimum rest porosity of 8%. The surface is generally sealed by micro shotpeening before use. The redeeming feature is its good heat conductivity, which results in faster heat dissipation and shorter moulding cycles.

A tool steel material comprising Marging 300 (DIN 1.2709 - X3NiCoMoTi) is suitable for inserts for production moulds. In as-sintered state, the inserts possess a hardness of 35–37 Rc but can be easily hardened up to 50–54 Rc. In hardened state, their service life is comparable with those manufactured in traditional fashion. They can withstand temperatures as high as 1100°C. They are almost fully dense (porosity lower than 0.5%) and do not require a surface sealing treatment. The surface lends to a good finish through polishing.

Laser sintered inserts are generally incorporated in mould bolsters but up to a certain size, they can replace mould plates and form a mould directly. Figure 5.6 shows a laser sintered mould insert along with the moulding.

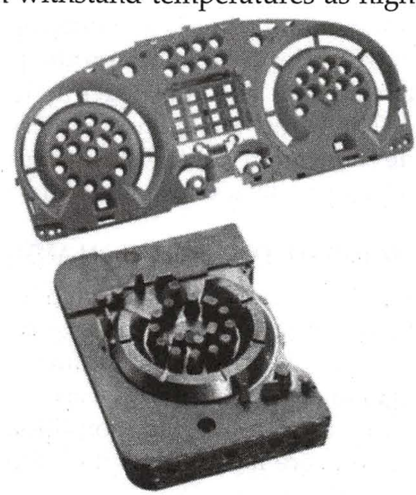

Fig. 5.6