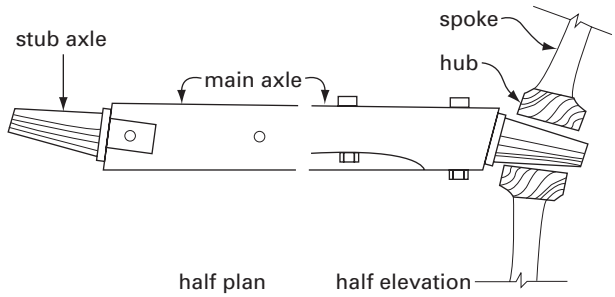

Figure 2.5
The axle had to be tilted down (pitch) to enable the cartwheel to transfer load nearly vertically to the ground, and then angled forward (foreway) to prevent the cartwheel falling off

was the advantage gained from the widening of the cart towards the top thus allowing overhanging loads to be carried. This could be achieved since that part of the dished wheel which transfers the load from axle to road must be vertical, and thus the upper half of the wheel leans outwards. This may have more validity than Sturt realised since legislation in 1773 restricted the track of broad wheeled vehicles to a maximum of 68 inches. Although dished cartwheels were narrow enough to be exempt from this legislation, the roads would have probably got so rutted by the broad wheeled vehicles that a cart with a wider track would have had to ride on rough ground.

Eventually Sturt discovered what he thought to be the 'true' reason for dishing. The convex form of the wheel was capable not just of bearing the downward load but also the lateral thrust caused by the horse's natural gait which tends to throw the cart from side to side with each stride, but this is still by no means the total picture. Several writers have since commented on Sturt's analysis and in particular Cross (1975) has pointed out that the dished wheel also needed foreway. To keep the bottom half of the wheel vertical the axle must slope down towards the wheel. In turn this produces a tendency for the wheel to slide off the axle which has to be countered by also pointing the axle forward slightly thus turning the wheel in at the front. The resultant 'foreway' forces the wheel back down the axle as the cart moves forwards. Cross appears to argue that this is a forerunner of the toe-in used on modern cars to give them better cornering characteristics. This is probably not accurate since, as Clegg (1969) has argued, this modern toe-in is really needed to counter a lateral thrust caused by pneumatic rubber tyres not present in the solid cartwheel.

There probably is no one 'true' reason for the dishing of cartwheels but rather a great number of interrelated advantages. This is very characteristic of the craft-based design process. After many generations of evolution the end product becomes a totally integrated response to the problem. Thus if any part is altered the

complete system may fail in several ways. Such a process served extremely well when the problem remained stable over many years as with the igloo and the cartwheel. Should the problem suddenly change, however, the vernacular or craft process is unlikely to yield suitable results. If Sturt could not understand the principles involved in cartwheel dishing how would he have responded to the challenge of designing a wheel for a steam-driven or even a modern petrol-driven vehicle with pneumatic tyres?

The professionalisation of design

In the vernacular process designing is very closely associated with making. The Eskimos do not require an architect to design the igloo in which they live and George Sturt offered a complete design-and-build service to customers requiring wheels. In the modern western world things are often rather different. An average British house and its contents represent the end products of a whole galaxy of professionalised design processes. The house itself was probably designed by an architect and sited in an area designated as residential by a town planner. Inside, the furnishings and fabrics, the furniture, the machinery and gadgets have all been created by designers who have probably never even once dirtied their hands with the manufacturing of these artefacts. The architect may have got muddy boots on the site when talking to the builder once in a while, but that is about as far as it goes. Why should this be? Does this separation of designing from making promote better design? We shall return to this question soon, but first we must examine the social context of this changed role for designers.

Approximately one in ten of the population of Great Britain may now be described as engaged upon a professional occupation. Most of the professions as we now know them are relatively recent phenomena and only really began to grow to the current proportions during the nineteenth century (Elliot 1972). The Royal Institute of British Architects (RIBA) was founded during this period. As early as 1791 there was an 'Architects' Club' and later a number of Architectural Societies. The inevitable process of professionalisation had begun, and by 1834 the Institute of British Architects was founded. This body was no longer just a club or society but an organisation of like-minded men with aspirations to raise, control and unify standards of practice. The Royal Charter of 1837 began the process of acquiring social status for architects, and eventually