FIRST consideration the development of suitable landing gear for helicopters, with their unique ability of being able to take vertical or near-vertical take-offs and landings, appears a simple matter. In practice, however, many factors and problems arise that are not encountered on fixed-wing aircraft. These combine to make helicopter landing gear an item requiring specialist attention.

A further factor demanding the serious attention of designers is that of ground resonance—the unbalanced reactions set up by the rotors when running-up on the ground, an effect which can build up to dangerous magnitudes. One answer to this problem is to increase the tyre-inflation pressure to a figure far in excess of that required to cater for the normal dynamic loads, in order to provide as little undamped energy as possible. If this solution is adopted, however, a still heavier tyre-construction becomes essential. The operation of helicopters from ships necessitates high tyre pressures for a similar reason, since any tendency for a helicopter to rock on soft tyres can soon lead to trouble in high winds.

On some American helicopters orthodox measures have failed to dampen the resonance sufficiently, and it has been necessary to fit solid tyres. At best a palliative, this step necessitates re-designing the undercarriage with a suitably increased reaction.

On the Bristol Type 173 the cure for the severe resonance experienced during the initial trials was effected mainly by cross-connecting the undercarriage shock-absorbing systems and by refining the damping system of the rotors. The tyre-inflation pressure was increased, but this formed a comparatively minor part of the treatment. The peculiar “hoops” projecting from the sides of the fuselage of the prototype 173 are part of the cross-link system and are eliminated in the cleaned-up undercarriages fitted to later versions.

Brakes—As with tyres, the maximum loads imposed upon the brakes often prove to occur during the ground handling of helicopters and not during landing or take-off.

Although helicopters almost always have some forward speed when landing, the resultant kinetic energy is very low when compared with that of a fixed-wing aircraft of similar weight. There is thus little heat to dissipate, and the brake drum or disc, instead of doing duty as a heat reservoir, merely serves as a friction surface. The drum or disc can, therefore, be of lighter construction than is usual in normal aircraft, with a consequent saving in weight.

Wheels—Generally speaking, wheels designed specifically for use on helicopters are of lighter construction than those of similar size used on fixed-wing aircraft. Also, because any rotation is relatively of both shorter duration and lower speed, the ball or roller bearings usually fitted to aircraft wheels can be replaced with plain bearings; this results in a useful saving in weight.

The Air Horse provided a good example of what can be achieved by close co-operation between the landing-gear specialists and the airframe constructor. The wheels of the Air Horse look ridiculously small compared with the vast bulk of the rest of the machine and from ordinary considerations they are small.

The answer lies in the fact that the whole undercarriage is one of many novel features incorporated in the design. Because the machine was originally conceived as an aerial crane for the lifting of awkward high-density loads over rivers, or for carrying large tanks of insecticide for crop spraying, it was obvious that for most of the time it would be flying very close to the ground—too low, in fact, for the rotors to go into autorotative pitch in the event of engine failure. For this reason it was decided to fit an undercarriage capable of absorbing the energy of a high-velocity descent such as would result from the engine cutting at a moderate height above the ground. The legs, designed by Automotive Products, Ltd., have a free travel of no less than five feet. The three legs can absorb the energy equivalent to a free drop of 26 feet by the whole machine, the maximum load in each leg