Slowing down allows the aeroplane to complete a given turn in much less distance *and* in much less time. The radius of turn is reduced, while the rate of turn is increased.

Changing the bank at constant TAS: There are no surprises here. If bank is increased while TAS is kept constant, the aircraft will turn in a smaller radius. Since it now travels less distance to complete the turn, but is flying at the same speed, it takes less time - the rate of turn is increased. However it should be remembered that increasing the bank also increases the load factor and therefore the stalling speed.

Another interesting feature of turning performance is that the radius of turn depends upon the bank used and the TAS and *nothing else*. Aircraft weight has nothing to do with it. It is true that a heavy aircraft is likely to be flying faster, but it is not the weight that affects the turning performance- it is the speed. If two aircraft, one heavy and one light, carry out a turn at the same angle of bank and the same TAS, they will both turn in the same radius [Fig 9.10]. A Jumbo Jet and a Cessna 152 at the same angle of bank, would turn in the same radius *if*, and it's a big 'if', they were flying at the same *speed!*

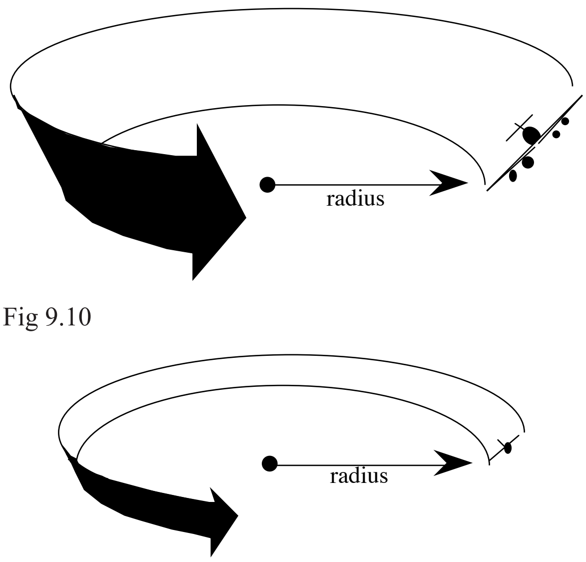

Fig 9.10

A heavy aircraft and a light aircraft turning at the same angle of bank and the same TAS, will turn in the same radius.

One last word on load factor. In a level turn, load factor depends upon angle of bank and nothing else. All aircraft in a level turn at 60° of bank experience a load factor of 2. If you carry out a 60° bank level turn at 60 kt the load factor is 2. If you carry out a 60° bank level turn at 120 kt the load factor is 2. If a Jumbo Jet and a Cessna 152 carry out a level turn at 60° of bank, no matter what the speed, the load factor is still 2.

The occupants of the aircraft experience a physiological response to the load factor through the 'g' load. When the load factor is 2, the occupants of the aircraft experience 2g, i.e. they feel as though their weight has doubled. You don't need an instrument to tell you that the load factor is increasing- you can feel it.

More about rate of turn. Rate of turn may be measured in degrees per second, however the rate of turn is also often expressed according to the number of seconds taken to turn through 360°.

A rate 1 turn is often called a 'standard rate' turn and from our discussion so far it should be clear that the angle of bank required to allow an aircraft to perform a rate 1 [or any other rate] turn will vary with the speed at which the aircraft is travelling. If a given increase in airspeed causes an even greater increase in radius of turn for any given bank, it follows that the aircraft will have to fly further to complete a 360° turn at a higher airspeed. We have already seen that an *increase* in airspeed at constant bank causes the rate of turn to *decrease.*

If and increase in true air speed at the same bank causes the rate of turn to decrease, it follows that to maintain the same rate of turn at an increased speed, a greater angle of bank would be required. It is sometimes stated (incorrectly) that a rate one turn is turn at 15° angle of bank. This would be true at only one true air speed. Every speed requires a different angle of bank to perform a rate one turn. A rough rule of thumb that is often used to determine the angle of bank required to perform a rate one turn is_

ANGLE OF BANK REQUIRED FOR RATE ONE = TRUE AIRSPEED ÷ 10 + 7

So at 100 knots, 17° angle of bank would be required for rate one. At 150 knots, 22° angle of bank is required for rate one etc.

In the world of IFR, the maximum angle of bank permitted is set at 25°, so at speeds above 180 knots, the angle of bank is limited to 25° and a rate of turn less than rate one is accepted.

