Caster Technology and the Science of Swivel Offset

By Anton Malek | Darcor Casters & Wheels | Caster Technology, Workplace Ergonomics | June 23rd, 2015 | Comments (0)

When looking at the ergonomic performance of a caster, there are typically two main areas that have the most impact:

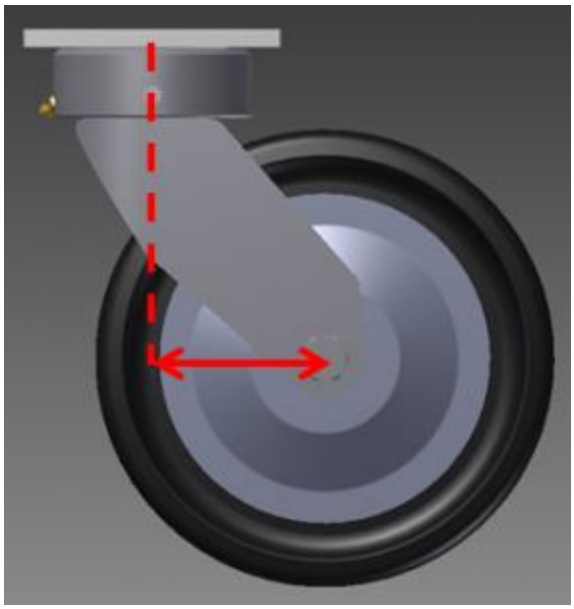
- push/pull forces, which is the force needed to start and continue moving a cart; and
- swivelling force, which is the force needed to swivel out a caster to move in a new direction.

To have an ergonomically sound caster, these forces need to be reduced so the user can move the material handling cart more easily. With easier movement of the cart, risk of injury to the user is reduced.

Caster Swivelling Force

Swivelling force refers to the force required to swivel the wheel. Swivelling force is highest when moving the caster wheels from a direction 90 degrees from their current position. Since this is the highest force, by reducing it, the overall ergonomic performance of the caster will increase significantly.

Figure. 1 – Swivel Offset



So, how can swivelling force be reduced?

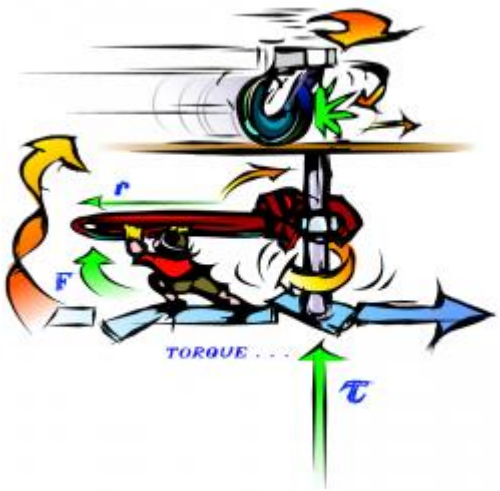
Caster technology offers four ways swivelling force can be reduced:

1. Bearing structure in the swivel head (which can range from roller, precision ball, tapered etc.),
2. The right wheel material (polyurethane, solid elastomer, hard rubber etc.),
3. A dual or triple wheel caster configuration, or
4. Increasing the swivel offset.

Let's focus on #4: increasing the swivel offset. The swivel offset is the distance between the centre of the king pin and the centre of the wheel axle.

Theory behind torque (or twisting force) suggests that the larger the moment arm (the distance between the center of the swivel head and the center of the axle bolt), the less force will be required from the user to get the necessary twisting force to swivel out or turn a caster.

Figure. 2 – Torque on Swivel Caster



The equation that shows this is:

$\tau = r \times F$

τ is torque/twisting force

r is radius of the arm, or in this case the swivel offset distance

F is the force applied to the swivel head of the caster

A good way to understand how a large offset reduces twisting force is comparing it to a lever. A lever of a small arm requires more energy to pull than a longer lever. In a similar way, a longer offset makes it easier to "swivel out" the caster in the direction of travel.

Keep in mind that this is an over simplification of what really happens, but this shows the fundamentals of how the increased moment arm (offset) helps reduce the swivelling force.

By increasing the offset and therefore reducing the swivel force, less exertion is required to swivel the caster out. With less force required to swivel the casters, workplace ergonomics is improved thereby reducing material handling injuries caused by pushing and pulling.

To find out how swivel offset caster technology can improve your workplace ergonomics, contact us.