DRIVEN FROM OARS TO MOTOR ON THE OCEANS

My article last week on buoyancy and the stability of vessels at sea leads me to think about how ships move.

We are all familiar with motor vehicles moving on roads.

They rely on friction between the wheels and the surface of a road. Gravity holds a vehicle on the ground while the rotation of the wheels, acting on the road, provides the forward moving force. Once the force stops, the vehicle will gradually come to a halt, aided by friction.

A ship floats, and even without motive power, it can still move, impelled by the waves. To ensure it doesn't get too far away from a certain spot, it needs anchors attached to the seabed or a berth at a pier.

To give it forward movement, we need force acting from the ship toward its rear.

This follows Newton's Third Law, which states that actions and reactions are always equal and opposite. In simple words, whatever force we impose on an object, there is always an equal and opposite force present.

The simplest form of motive power for a boat are oars. By paddling them to push water backward, the resulting reaction force gives the boat forward motion.

As vessels get larger, we would need a lot of people at the oars and for them to row in unison.

This is obviously not practical, and with the steam age, came very early versions of motor boats. They use paddler wheels to provide the movement.

A pair of wheels installed on both sides of a motorboat has vanes fitted at their perimeters so that, as the wheels rotate, they push water toward the back of the boat.

The two wheels rotate at the same speed so that equal amounts of water are displaced, thus providing a force linear to the boat to allow it to move forward.

With steam power replacing human efforts, boats can travel at speeds much faster than those driven by oars.

The drawback of a ship's use of paddler wheels is that the vanes in the wheels continuously hit the surface of the water, creating turbulence and a lot of energy wastage. The ship cannot move fast and there is a lot of noise generated.

As steam power was progressively replaced by diesel oil-powered ships, the speeds increased and paddler wheels were no longer able to provide the necessary motive power.

Engineers then fitted Archimedean screws at the back of the boats.

These devices, totally immersed in water, are much more efficient in displacing water and ships equipped with these improved displacement devices were able to move a lot faster and with much higher efficiency.

The Archimedean screws were eventually replaced by propellers, which are much shorter and cheaper and easier to install at the back of the ship.

Propeller designs also improved as they evolve, offering better efficiency and durability, and propellers are now widely used in sea vessels of various sizes.

Modern cargo ships and cruise ships now also install side propellers at both the front and the rear for greater maneuverability.

These devices allow the ships to make sharp turns and move sideways at low speeds, making berthing in busy ports much easier.

Engineers conquer hydraulic principles to allow us to travel on water with high efficiency and good comfort.

Sea transport is essential for large cargo and passenger movements across continents.

Veteran engineer Edmund Leung Kwong-ho casts an expert eye over features of modern life