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What's New in Air Caster Technology?

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July 17, 2018

The technology behind air casters has been around for decades, but its evolution in recent years explains why industry is looking more closely at air casters as a preferred mover of heavy loads. It may seem hard to believe that hovercraft technology, once closely associated with table air hockey games, has developed into a widely used and essential industrial tool.

The fact is that the relatively small air caster, thanks to its technological upgrades and enhancements, has become a viable alternative to traditional load moving solutions such as wheels, rollers, rails and cranes because of its flexibility, ease of maneuvering and, perhaps most important, time and workforce efficiencies.

The science behind air casters is relatively unchanged. A thin film of compressed air is created under the air caster providing almost friction free movement, in addition to inflation of the air caster element for lift. These actions combine to provide a unique system capable of moving loads from 1,000 pounds to as much as 5,000 tons in a factory production environment. Unlike other traditional moving solutions, air casters are omnidirectional and flexible enough to complete equipment movement in nearly any location on the plant floor. By contrast, traditional load moving solutions require more personnel and time to adjust the move path and final location.

Air caster history in manufacturing

Heavy industry's first introduction to the use and value of air casters occurred in the 1960s when General Motors was seeking a more cost-efficient and flexible alternative for moving components though the assembly process. The first air casters had significantly less load carrying capability due to the casters' materials of construction — sheet rubber, which is not particularly strong. Adding reinforced fabrics to the rubber sheet greatly increased load-carrying capabilities. Modern air casters can handle higher air pressure giving increased capacity in a smaller space and providing additional lifting capabilities. Those improvements served one of the nation's largest aerospace corporations well. Following GM's lead, Boeing adopted air caster technology for moving its heavy equipment by adopting the use of reinforced fabric, e.g. urethane and neoprene.

Fundamental to the growing use of this technology for heavy industry is the increased air pressure capacity of the air casters. Unlike the pressure limitation of the earlier casters, many of today's reinforced fabric models can handle from 60-75 psi, resulting in three to five times the lifting capacity of the GM air casters of a half-century ago.

Some casters rely on various types of liquid instead of air for their operation. In parts of Asia, the working fluid is seawater instead of compressed air, which is used for moving concrete caissons. Other casters use machine tool coolant for their working fluid.

Traction drives and PLCs are responsible for another outgrowth of air caster technology—the air cushion transfer cart, which is capable of moving multi-ton transformers and pressure vessels as well as automating assembly lines in factories.

Air casters, wheel casters and floor surfaces

Plant and asset managers have always been concerned with maintaining facility flooring when wheel casters or rollers are used to move heavy equipment throughout the shop. The issues here are friction and wear. Concrete and epoxy floors, expensive to begin with, are subject to grooves and other damage from wheeled casters. Repair costs are likely to negatively impact operating budgets. That concern was at the forefront for a GF Machining Solutions facility in Lincolnshire, Ill. The plant had installed an expensive new epoxy floor in a room where multi-ton milling machines were previously moved by forklifts. Jesus Ledesma, Jr., refurbishment and facilities manager, said the only way to protect the floor was to change the load moving system.

“The floor didn’t take to forklifts and we didn’t want to damage it, so we turned to air casters,” Ledesma said. “Now I don’t have to use forklifts in this room anymore and the air casters are easily controlled.”

“With air casters, the coefficient of friction is nearly zero, so it takes very little effort to get the load moving,” said Forrest Ramey, maintenance superintendent of the power and industrial division of Hawaiian Dredging Construction Company. “We could have used rollers, but a much higher amount of force would have been needed to move the load.”

Uneven flooring is another problem area. Earlier versions of air casters were incapable of dealing with irregular floor surfaces, but advanced technology has led to development of different air caster types designed for load movement based upon the surface in the facility. Among the more recent developments is a composite air caster specifically designed to cross gaps and steps, a major problem that previously hampered air caster functioning. A membrane within the composite caster meters airflow to facilitate maneuvering on all types of uneven or gapped flooring, in particular wooden planks and suspended floors—two environments that limit the effectiveness of wheeled casters.

Air caster technology has been successfully applied in clean rooms where contamination has to be avoided at all costs. Air casters, with their low friction, can move semiconductor processing equipment and other specialized or sensitive equipment without damaging the flooring while isolating the load from vibration. Clean room equipment can weigh as much as 30,000 pounds. Wheel casters and rollers with their considerably higher friction, can damage the flooring, contaminate the clean room and compromise the seal, especially if the flooring is uneven or raised. Instead of causing grooves—the likely result of heavy loads carried by wheel casters or rollers on epoxy flooring, the air casters literally float the multi-ton load into the desired location—a time and cost savings application for a sensitive area.

It is important not to overlook the value that an integrated system of air casters, traction-drives and PLCs provides for heavy industry. By integrating all three into a single package, a product that weighs several hundred or thousand tons can be easily and safely moved into position on the factory floor, a vast improvement over conventional load movers. Advanced composites for air caster fabrics have opened even more applications. Among them is a high-performance urethane that maintains its functionality despite extremely high temperatures for use in vapor phase ovens or autoclaves, the transformer industry and satellite cycle testing.

Cost comparisons among the load moving alternatives have generally favored air casters. In the current market, four wheeled casters to move 100,000 pounds cost around $25,000 each, more than double the cost of the air casters according to their manufacturers. They also cite figures showing that an air caster transfer cart for moving 100 tons is half the cost of a wheeled moving cart for the same tonnage.

Industry’s experience with air casters

Forrest Ramey of Hawaiian Dredging can attest to the time savings and cost efficiencies of air casters, which is why his company decided to implement the technology for moving larger loads. “We recently moved a 30 foot long drum weighing 22 tons on air casters,” Ramey said. “Our time spent preparing the floor was relatively minimal, and we put down a path of sheet metal to travel across. Once the drum was on the air casters, we moved it approximately 100 feet in less than five minutes.”

Among the most important attributes for air casters is that a minimum of force, only five to 25 pounds, is required to move a 5,000 pound load. Wheel casters may require up to 300 pounds of force for the same load. Because air casters are omnidirectional, very little force is required to change their direction. Industries that have relied on wheeled casters or rollers concede that directional change is time consuming, can gouge or tear floors, and is anything but flexible. Ramey agrees.

“I have a situation which requires fine movements to work around existing obstacles,” he said. “I would have needed to reposition the rollers and adjust my pulling points numerous times, so the longer this takes, the more the process would have cost the company.”

In an era when complex technologies are viewed as the next industrial solution, the simplicity of the technologically improved air caster system stands in sharp contrast. Its maneuverability and versatility along with the safety of its process have rendered it a cost efficient option for industrial product and load movement. A technology in its infancy in the 1950s has proven to be more adaptable, relevant and viable for today’s heavy industry applications.

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