



tech briefs

Westinghouse Savannah River Company

Small Diameter Pipe Crawler

at a glance

Made from off-the-shelf components

Flexible and far-reaching

Navigates 90° bends

Nonscratching and nonsparking

U.S. Patent 6,427,602

for more information

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Moves forward and backward, up and down

Engineers at Westinghouse Savannah River Company (WSRC) have invented a new pipe crawler designed to move through 3 inch to 4 inch diameter pipes at longer distances, carrying more weight, than existing crawlers. Compact and flexible, the new crawler moves horizontally and vertically and navigates 90° bends.



An attached mini-camera transmits video images for remote inspection. Small tooling can be attached for a variety of applications.

Made from off-the-shelf components, the crawler is inexpensive and easy to assemble.

Background

Most existing small diameter pipe crawlers use the "push snake" method to move through pipes. This method limits the distance the crawlers can travel. Certain pipe configurations can cause the snake to buckle, further limiting the forward motion of the crawler. Great advances have been made in the miniaturization of cameras and sensors. But, few advances have been made in designing delivery systems with adequate motive forces to pull the weight of associated tethers through lengths and bends of small diameter piping systems.

Pneumatically operated

The new crawler comprises three connected units: a front gripping unit, a center drive unit, and a rear gripping unit. Air flow in and out of air cylinders within each unit activates pistons that engage and disengage gripping feet and move the crawler forward and backward through the pipe. Automatic operation of valves controlling air flow and pressure enables rapid movement of the crawler through the pipe.

Inch-worm movement

The piston in the front gripping unit rotates three gripping feet outward to grip the inside of the pipe. The piston in the center drive unit pulls the rear gripping unit forward. The piston in the rear gripping unit rotates the rear gripping feet outward to grip the inside of the pipe, while the piston in the front gripping unit pulls the feet away from the pipe surface. The piston in the center drive unit then pushes the front unit forward. The same sequence can occur in reverse to move the crawler backward.

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Small Diameter Pipe Crawler

This inch-worm movement propels the crawler with equal ease both forward and backward in a horizontal plane and up and down in a vertical plane.

The use of gripping feet provides a stronger grip against the inner pipe surface than the direct application of a piston rod, enabling the crawler to pull cables associated with cameras and instruments through the lengths and bends of piping systems

No scratching, no sparking

Springs coiled between the gripping units and the drive unit maintain the axial alignment of the crawler. The springs prevent the free end of the crawler from sagging or touching the adjacent pipe walls. This prevents damage to the crawler or to the interior pipe walls that could be caused by friction as the crawler moves through the pipe. This also prevents sparking, enabling use of the crawler in hazardous environments.

Flexible joints between the gripping units and the drive unit enable the crawler to navigate turns and bends as sharp as 90°. The springs provide sufficient tension to reestablish axial alignment after a turn.

Adaptable for many uses

A camera, surrounded by LEDs, attached to the front of the crawler provides visual images of the inside of the pipe. A similar camera assembly also may be attached to the rear of the crawler. The camera and LEDs are sealed, enabling the crawler to operate in liquid-filled pipes. Sensors and special-purpose tools, such as a tool to grab found objects, also may be attached.

Partnering opportunity

The U.S. Patent and Trademark Office has issued Patent 6,427,602 for this invention.

WSRC invites interested companies with proven capabilities in this area of expertise to enter into a licensing agreement with WSRC to manufacture and market this device as a commercial product. Interested companies will be requested to submit a business plan setting forth company qualifications, strategies, activities, and milestones for commercializing this invention. Qualifications should include past experience at bringing similar products to market, product design and development capabilities, reasonable schedule for product launch, sufficient manufacturing capacity, established distribution networks, and evidence of sufficient financial resources for product development and launch.

Technology transfer

WSRC is the managing contractor of the Savannah River Site for the U.S. Department of Energy. WSRC scientists and engineers develop technologies designed to improve environmental quality, support international nonproliferation, dispose of legacy wastes, and provide clean energy sources.

WSRC is responsible for transferring technologies to the private sector so that these technologies may have the collateral benefit of enhancing U.S. economic competitiveness.

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