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**PIPE CRAWLER DEVELOPMENT FOR DUCT ELBOW REMOVAL
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by

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PIPE CRAWLER DEVELOPMENT FOR DUCT ELBOW REMOVAL

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INTRODUCTION

The Equipment Engineering Section (EES) of the Savannah River Laboratory was asked to supply a pipe crawler capable of removing an elbow in the ventilation system of the Separations facility to alter air flow paths for fire safety. The elbow is to be removed to redirect air flow and prevent the high efficiency filters from clogging up with soot and cutting off air flow to an entire floor of the building during a fire. Flow is to be redirected to a large volume sand filter.

This work is applicable to facility decommissioning where radiological considerations prevent direct access to the work location.

DESCRIPTION OF THE ACTUAL WORK

This task requires the development of a specialized pipe crawler capable of crawling through 90 degree elbows and crawling up vertical pipe within a 36" process air duct. EES has developed several pipe crawlers using inch

worm motion capable of meeting these requirements, but which are much smaller in size. Rescaling and adapting a pipe crawler to manipulate a plasma arc torch is a new extension to pipe crawler technology, which currently is only being used to perform visual inspections.

The pipe crawler contains two main segments; a tractor for locomotion, and a cutting attachment to hold and articulate a plasma arc torch. The tractor portion of the crawler has been rescaled to negotiate 36" piping. This included increasing the physical size of the basic crawler, increasing its pulling power accordingly, and modifying the frame to allow additional flexibility. Flexibility was improved by utilizing a spring/shock arrangement around a two axis gimbal. (See figure 1.) The cutting attachment allows for two degrees of freedom; extension of the torch out to the pipe wall, and rotation to perform a 360 degree cut. The wheel on the attachment allows tight control of the distance between the torch tip and the pipe wall.

The control panel uses a 230 ft. tether for teleoperation within the duct, and is the same panel used for other EES pipe crawlers. (See figure 2.) The control panel has two video monitors and recording equipment for observing and documenting removal using up to 4 video cameras. The camera observing the torch will be fitted with an LCD welder's lense to allow viewing of the cut as it is made. The cutting attachment will be rotated using a separate controller.

Equipment will be qualified in a full-scale mockup prior to use. (See figure 2.)

RESULTS

Using a remote pipe crawler resolves the problems of radiation levels, air flow and simplifies the job. Radiation levels near the elbow to be removed are too high for personnel. Air flow through the tunnel would have to be shut down to allow personnel entry, requiring the entire facility to be evacuated during removal. Facility evacuation is not a viable option. And, by using a pipe crawler, the job can be completed by simply removing one elbow instead of making large scale modifications to the facility ventilation system.

Plasma Arc Cutting Crawler

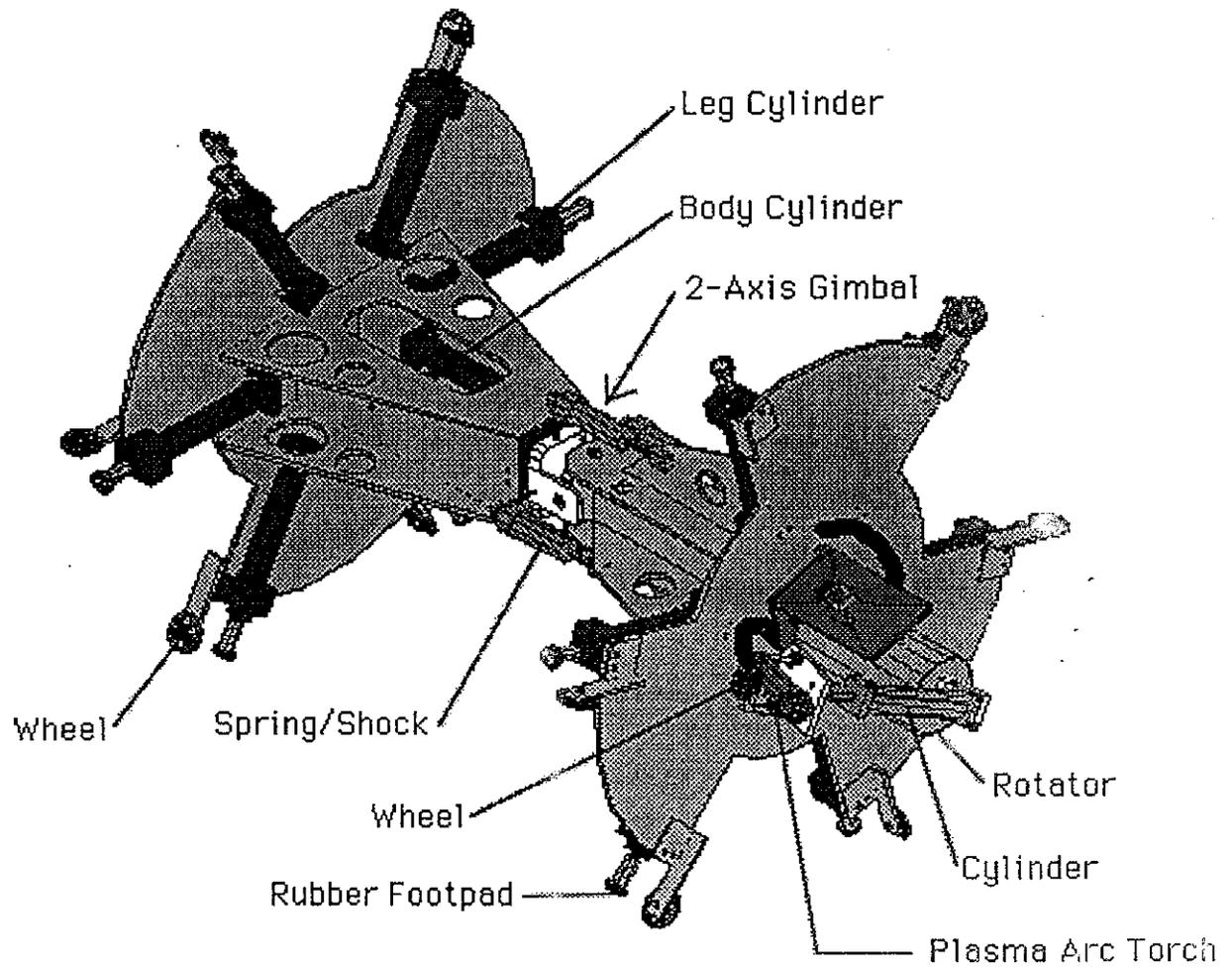


figure 1

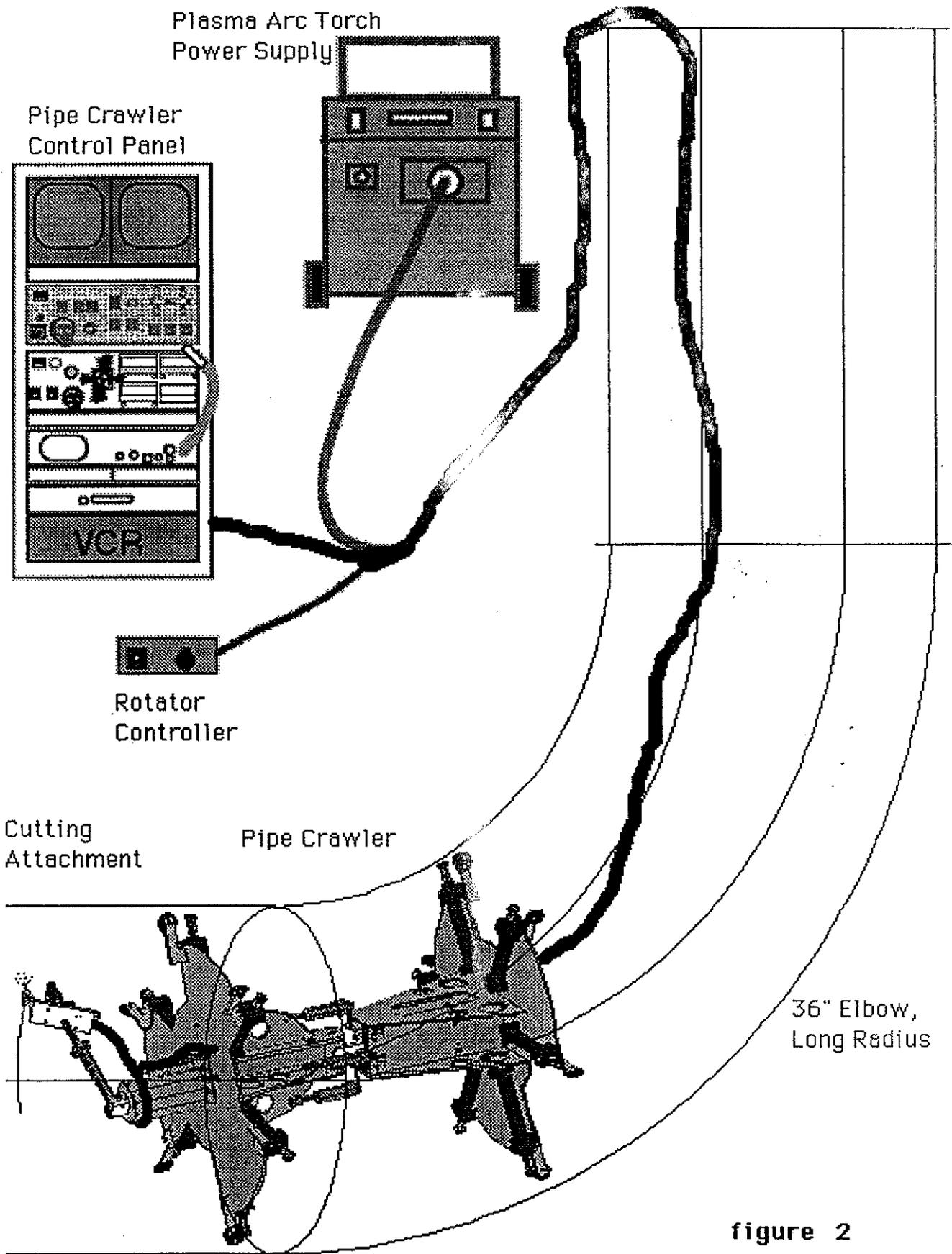


figure 2