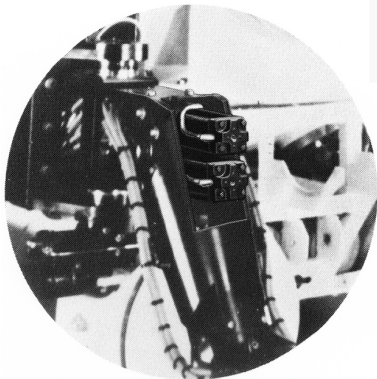


## HYDRAULIC ACTUATORS CONTROL MANIPULATOR ARMS ON DEEP SEA DIVING BELL

### The Application



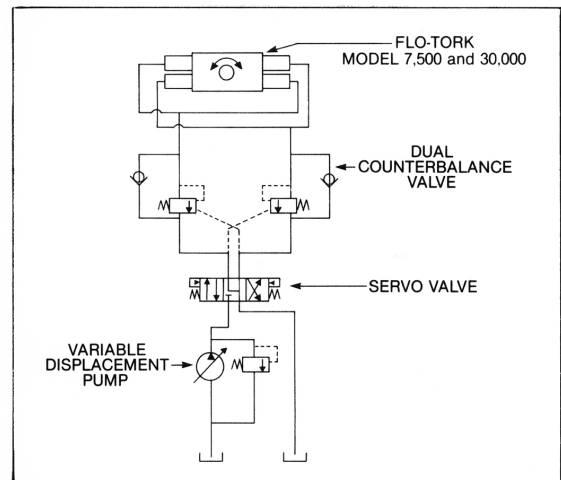
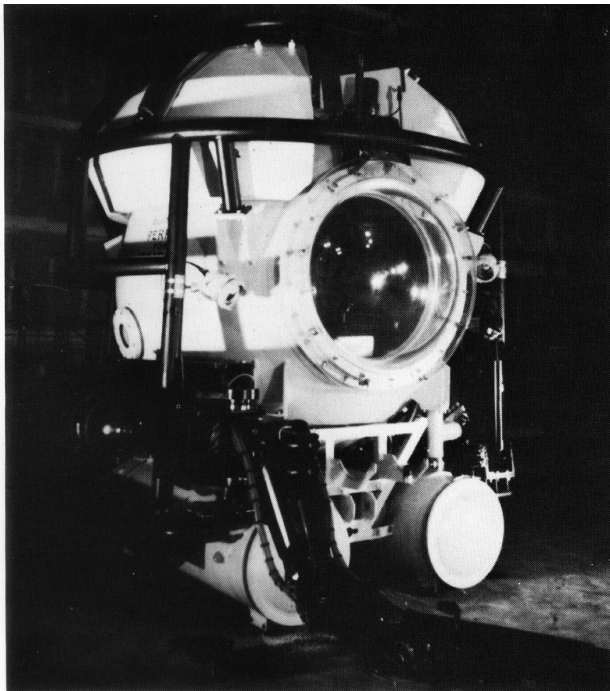
### The Actuators

Moog Flo-Tork Hydraulic Rotary Actuator models 7500 X 180° and 30000 X 180° are employed. Each actuator is equipped with anti-friction bearings, heat treated racks, one-piece heat treated stainless steel pinions, double ported cylinder heads and aluminum housings to minimize weight and protect against salt water corrosion.

A seven-function manipulator arm, designed by Perry Oceanographics, performs various external functions aboard deep sea submersible crafts. Each manipulator is controlled by four Moog Flo-Tork hydraulic rotary actuators, two cylinder actuators, and a hydraulic motor. The actuators are operated by a proportional servo valve in combination with a multi-function, single joystick which controls shoulder, elbow, and wrist joints located on the manipulator arm. The operator, working inside the diving bell, or by remote control, can position and control the manipulator arm to perform a wide range of jobs.

A special wrist extension feature, incorporated in this design, allows increased utilization of tools. From the wrist, a tool can be inserted in a hole, or driven in a straight line without actuating any joints other than the extension feature.

A submersible craft equipped with two seven-function manipulators allows the operator to dive with each manipulator preset in different operational configurations. This allows the operator to handle almost any situation he may encounter.



### Advantages

The Moog Flo-Tork rotary actuators supply the manipulator with smooth, responsive, zero-leakage operation. The sealed design of the actuator allows for deep submersion without fear of internal contamination by sea water through the use of pressure compensation in the housing/gear case. These custom-made actuators are provided with stainless steel shafts to protect against corrosion, and anodized aluminum housings to eliminate over 1/3 of the standard actuator's weight. The design of the Moog Flo-Tork actuators allow the manipulator to have more flexibility than would be possible with conventional hydraulic cylinders.

### How It Operates

The Perry Manipulator is rate controlled by a single seven-function joystick. Potentiometers in the joystick sense its position and transmit signals proportional to its displacement to servo valves which control arm speed. A special hydraulic manifold which operates off a 2000 psi supply contains servo valves in series with dual counterbalance valves to power the arm. The operation of the manipulator is smooth with precise control, allowing the operator to quickly learn and coordinate its movements with the joystick.