Review Paper on Hydraulic Actuators

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Abstract- *An actuator is a component of a machine that is responsible for moving or controlling a mechanism or system, for example by actuating (opening or closing) a valve; in simple terms, it is a "mover".*

I. INTRODUCTION

An actuator requires a control signal and a source of energy. The control signal is relatively low energy and may be electric voltage or current, pneumatic or hydraulic pressure, or even human power. The supplied main energy source may be electric current, hydraulic fluid pressure, or pneumatic pressure. When the control signal is received, the actuator responds by converting the energy into mechanical motion.

An actuator is the mechanism by which a control system acts upon an environment. The control system can be simple (a fixed mechanical or electronic system), software-based (e.g. a printer driver, robot control system), a human, or any other input.[1]

The history of the pneumatic actuation system and the hydraulic actuation system dates to around the time of World War II (1938). It was first created by XhiterAnckeleman (pronounced 'Ziter') who used his knowledge of engines and brake systems to come up with a new solution to ensure that the brakes on a car exert the maximum force, with the least possible wear and tear.

II. HYDRAULIC

A hydraulic actuator consists of cylinder or fluid motor that uses hydraulic power to facilitate mechanical operation. The mechanical motion gives an output in terms of linear, rotatory or oscillatory motion. As liquids are nearly impossible to compress, a hydraulic actuator can exert a large force. The drawback of this approach is its limited acceleration.

The hydraulic cylinder consists of a hollow cylindrical tube along which a piston can slide. The term *single acting* is used when the fluid pressure is applied to just one side of the piston. The piston can move in only one direction, a spring being frequently used to give the piston a return stroke. The term *double acting* is used when pressure is applied on each side of the piston; any difference in pressure between the two sides of the piston moves the piston to one side or the other.[2]

Hydraulic Systems Attributes:

- **Mounting Configuration**

This attribute describes the way in which the actuator attaches to the actuated device. Valve actuators sometimes mount directly to the valve flange or use trunnion mounts to give access to valve stem packing glands. Relative advantages of each method are described in the reference cited below.

- **Actuation Features**

Selecting double acting or spring return here will choose the failure mode of the actuator upon loss of air or hydraulic pressure.

- **Output Torque**

Output torque applies to both electric and fluid powered rotary actuators and describes the rotational force the actuator can apply to the valve to close it. It is usually expressed in in-lb. or Nm.

- **Maximum Extension/Retraction/Holding Force**

These attributes apply to linear actuators and may be sometimes be expressed as a single value such as maximum thrust force. They are usually given in lbf or N.

- **Maximum Speed**

For powered actuators, this is the highest linear or rotational speed the unit can deliver. It is usually expressed as rpm for rotary actuators and as in/sec for linear devices.

- **Enclosure Protection Rating**

Electrical enclosures are specified in accordance with NEMA or IEC criteria for environment and ingress protection.

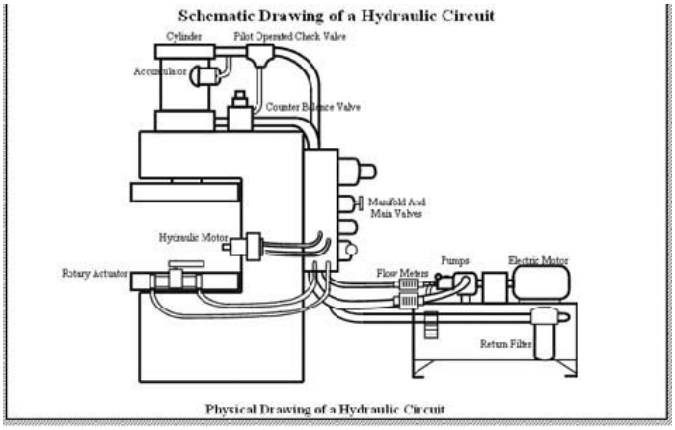


Fig.01 Schematic Diagram of hydraulic circuit

III. PRINCIPLE OF PNEUMATIC SYSTEMS

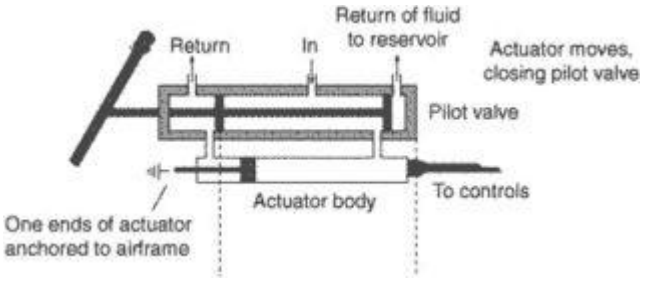
A cylinder or fluid motor that converts hydraulic power into useful mechanical work. The mechanical motion produced maybe linear, rotary, or oscillatory. Operation exhibits high force capability, high power per unit weight and volume, good mechanical stiffness, and high dynamic response. These features lead to wide use in precision control systems and in heavy-duty machine tool, mobile, marine, and aerospace applications. *See* Control systems

Cylinder actuators provide a fixed length of straight-line motion. They usually consist of a tight-fitting piston moving in a closed cylinder. **The piston is attached to a rod that extends from one end of the cylinder to provide the mechanical output.The double-acting cylinder (Fig. 1) has a port at each end of the cylinder to admit or return hydraulic fluid**. A four-way directional valve functions to connect one cylinder port to the hydraulic supply and the other to the return, depending on the desired direction of the power stroke.

Limited-rotation actuators are used for lifting, lowering, opening, closing, indexing, and transferring movements by producing limited reciprocating rotary force and motion. Rotary actuators are compact and efficient, and produce high instantaneous torque in either direction. Figure 2 shows a piston-rack type of rotary actuator. Hydraulic fluid is applied to either the two endchambers or the central chamber to cause the two pistons to retract or extend simultaneously so that the racks rotate thepinion gear.

Rotary motor actuators are coupled directly to a rotating load and provide excellent control for acceleration, operating speed, deceleration, smooth reversals, and positioning. They allow flexibility in design and eliminate much of the bulk and weight of mechanical and electrical power transmissions.

Motor actuators are generally reversible and are of the gear or vane type.



Applications:

- **.Damper Drive In Power Utility Plant - MT20Ts-16**
- **.Coal Mine Diverter Chute**
- **.Dry Kiln Vent Control**
- **.Rack & Pinion 1/4 Turn Actuator**
- **.Rotary Torque Arm Actuator**
- **.Top Ash De-Watering**
- **.Valve Actuator And Position Controller**

Limitations:

- infinitely variable control of gear-ratio in a wide range and an opportunity to create the big reduction ratio;
- small specific weight, i.e. the weight of a hydroactuator is in ratio to transmitted capacity (0,2...0,3 kg / kWt);
- opportunity of simple and reliable protection of the engine from overloads;
- small sluggishness of the rotating parts, providing fast change of operating modes (startup, dispersal, a reverser, a stop);
- simplicity of transformation of rotary movement into reciprocating one;
- opportunity of positioning a hydraulic engine on removal(distance) from an energy source and freedom in making configuration.

Disadvantages of hydraulic actuators:

- efficiency of a volumetric hydraulic actuator is a little bit lower, than efficiency of mechanical and electric transfers, and during regulation it is reduced;
- conditions of operation of a hydraulic actuator (temperature) influence its characteristics;
- efficiency of a hydraulic actuator is a little reduced in the process of exhaustion of its resource owing to the increase in backlashes and the increase of outflow of liquid (falling of volumetric efficiency);
- sensitivity to pollution of working liquid and necessity of high culture service.

IV. CONCLUSION

Our conclusion is we can know how to construct accurately and can arrange the component of hydraulic circuit systematically. Then we can know how to report and explain briefly the operation of hydraulic experiment in group. Next we can learn to find out the correct component and equipment. For our recommendation there are components that have been damaged mixed with the component that can work.

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