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Design of Electric Actuator

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Abstract: *Various mechanical, hydraulic, pneumatic, electrical, and hybrid actuators can alter motion per the requirements of particular applications. However, except for electrical ones, all actuators are restricted due to their size, complex auxiliary equipment, frequent need for maintenance, and sluggish environment in renewable applications. This brief review paper highlights some unique and significant research works on applying electrical actuators to renewable applications. Four renewable energy resources, i.e., solar, wind, bio-energy, and geothermal energy, are considered to review electric actuators applicable to renewable energy systems. This review analyses the types of actuators associated with the mentioned renewable application, their functioning, their motion type, present use, advantages, disadvantages, and operational problems. The information gathered in this paper may open up new ways of optimization opportunities and control challenges in electrical actuators, thereby making more efficient systems. Furthermore, some energy-efficient and cost- effective replacements of convectional actuators with new innovative ones are suggested. This work aims to benefit scientists and new entrants working on actuators in renewable energy systems. And we Ishwari Jadhav, Sakshi Jagtap, Nandini Ahire, Prasad Mahajan. This Project is a sponsorship project which is sponsor by Techno Valves.*

Keywords: *Electric Actuator, Gate Valve, Stepper Motor.*

I. INTRODUCTION

Electric Actuator refers to the linear movement of the electric gate valve actuator through electric voltage and signal control to open or close the gate valve. Electric gate valves can help you achieve the purpose of remote control, help you reduce labor costs, and improve production efficiency.

Electric gate valve is one of the most commonly used cut-off valves, mainly used to connect or cut off the medium in the pipeline, not suitable for adjusting the flow of the medium. The gate valve is suitable for a wide range of pressure, temperature and caliber, especially suitable for medium and large diameter.

Electric gate valve is suitable for water, oil, cement, paper pulp and other media, and is widely used in paper and pulp, power plant, shipyard, waste water treatment and so on. Gate valves are divided into rising stem gate valves and non-rising stem gate valves according to the stem structure and movement mode.

The stem of the rising stem gate valve drives the gate up and down together, and the drive thread on the stem is outside the valve body. Therefore, the opening and closing and position of the gate can be intuitively judged according to the movement direction and position of the valve stem, and the drive thread is convenient for lubrication and it is not corroded by the fluid, but it requires a larger installation space.

The drive thread of the non-rising stem gate valve is located inside the valve body. During the opening and closing process, the valve stem only rotates, and the gate moves up and down in the valve body. Therefore, the height dimension of the valve is small. Non-rising stem valve gates are usually equipped with an opening and closing position indicator above the valve cover, so as to be suitable for ships, pipe trenches and other environments with small spaces and high dust content.

Gate valves can also be divided into wedge type and parallel type according to the structure of the gate. Wedge gates can be divided into rigid single gates, flexible single gates and double gates.

The wedge-type rigid single gate is simple in structure, small in size, and reliable in use. However, the processing and matching accuracy of the wedge angle is relatively high, and it is prone to clamping and scratching. It is suitable for gate valves of various media and pressures at room temperature and medium temperature.

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II. OBJECTIVES

- To make electric actuator which require less timeto open and close.
- It takes 15 sec we have reduced it till 10 sec
- By Increasing the efficiency of motor.
- Reduce the thrust of gate of gate valve.

III. LITEATURE SURVEY

Electric actuators are divided into two different types; rotary and linear. Rotary electric actuators rotate from open to closed using butterfly, ball, and plug valves. With the use of rotary electric actuators, the electromagnetic power from the motor causes the components to rotate, allowing for numerous stops during each stroke. Either a circular shaft or a table can be used as the rotational element. When selecting an electric rotary actuator, the actuator torque and range of motion should be considered. The actuator torque refers to the power that causes the rotation, while the full range of motion can be either nominal, quarter-turn, or multi turn. Linear electric actuators, in contrast, open and close using pinch, globe, diaphragm, gate, or angle valves. They are often used when tight tolerances are required. These electric actuators use an acme screw assembly or motor-driven ball screw to supply linear motion. In linear electric actuators, the load is connected to the end of a screw that is belt or gear driven.

rotary electric actuators provide linear motion via a motor-driven ball screw or screw assembly. The linear actuator's load is attached to the end of a screw, or rod, and is unsupported. The screw can be direct, belt, or gear driven. Important performance specifications to consider when considering for linear actuators include stroke, maximum rated load or force, maximum rated speed, continuous power, and system backlash. Stroke is the distance between fully extended and fully retracted rod positions. The maximum rated load or force is not the maximum static load. The maximum rated speed is the maximum actuator linear speed, typically rated at low or no load.

Continuous power is sustainable power; it does not include short-term peak power ratings. Backlash is position error due to direction change. Motor choices include DC (direct current), DC servo, DC brushless, DC brushless servo, AC (alternating current), AC servo, and stepper. Input power can be specified for DC, AC, or stepper motors.

Rotary electric actuators provide incremental rotational movement of the output shaft. In its most simple form, a rotary actuator consists of a motor with a speed reducer. These AC and DC motors can be fabricated to the exact voltage, frequency, power, and performance specified. The speed reducer is matched with the ratio to the speed, torque, and acceleration required. Life, duty cycle, limit load, and accuracy are considerations that further define the selection of the speed reducer. Hardened, precision spur gears are supported by antifriction bearings as a standard practice in these speed reducers.

Hardened, precision spur gears are supported by antifriction bearings as a standard practice in these speed reducers. Compound gear reduction is accomplished in compact, multiple load path configurations, as well as in planetary forms. The specifications for rotary actuator include angular rotation, torque, and speed, as well as control signals and feedback signals, and the environment temperature. Electric quarter-turn actuators are very similar to electric multi turn actuators.The latest generation of quarter-turn actuators incorporates many of the features found in most sophisticated multi turn actuators, for example, a nonintrusive, infrared, human–machine interface for set-up, diagnostics, etc. Quarter-turn electric actuators are compact and can be used on smaller valves. They are typically rated to around 1500-foot pounds. An added advantage of smaller quarter-turn actuators is that, because of their lower power requirements, they can be fitted with an emergency power source, such as a battery, to provide fail-safe operation.

Thrust actuators can be fitted to valves which require a linear movement. Thrust actuators transform the torque of a multi-turn actuator into an axial thrust by means of an integrated thrust unit. The required (switch-off) actuating force (thrust and traction) can be adjusted continuously and reproducibly. Linear actuators are mainly used to operate globe valves. Thrust units, fitted to the output drive of a multi turn actuator, consist mainly of a threaded spindle, a metric screw bolt to join the valve shaft, and a housing to protect the spindle against environmental influences. The described version is used for direct mounting of the actuator to the valve. However, fork joint thrust actuators (indirect mounting) can also operate butterfly valves or dampers, when direct mounting of a part-turn actuator is not possible or efficient.The thrust units of the thrust actuators for modulating duty also comply with the high demands of the modulating duty.

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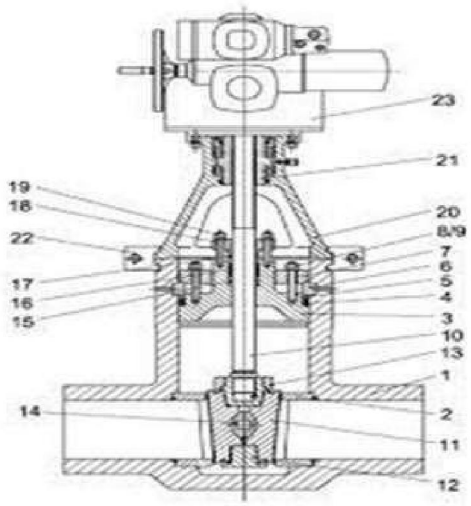
IV. CONSTRUCTION

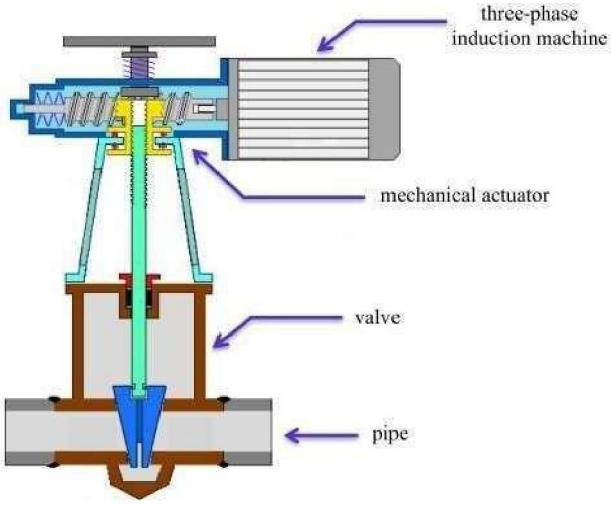
Electric actuators differ significantly from pneumatic or hydraulic actuators. They are not driven by compressed air or oil pumped by a pump, but by electricity. Thanks to this, control and operation of such an actuator are much simpler and cheaper. You do not have to worry about leaks that could occur with a hydraulic or pneumatic cylinder. Such losses could reduce the force of the actuator. Additionally, there is no need to replace expensive pumps or compressors, which wear naturally. The installation controlling the electric actuator is therefore much less complicated, and thus cheaper and easier to install. It is presented in a simplified way in the figure below. It illustrates the operating principle of electric Screw actuator.



V. WORKING PRINCIPLE

Working Principle of Electric Gate Valve:

The electric gate valve is powered by electric energy to turn on the electric actuator to drive the valve, and the valve stem is connected to drive the valve plate to move up and down or open and close, so that the valve can control the switch of the pipeline medium. It can be remotely controlled when it is added into the control box and other accessories, which is convenient and trouble-free. Principle of electric gate valve, working principle of electric gate valve is connected to drive the valve plate to move up and down or open and close, so that the valve can control the switch of the pipeline medium. It can be remotely controlled when it is added into the control box and other accessories, which is convenient and trouble-free. Principle of electric gate valve, Working principle of electric gate valve.



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VI. APPLICATION

- Chemical Industries
- Power Plants
- Pharmaceutical Industries
- Agriculture, etc.

VII. CONCLUSION

Electric linear actuators are devices that convert electrical energy into motion. There are different types of electrical actuators offering different capabilities. Electric actuators are more advantageous than their counterparts since they can be easily assembled, are more precise and cost less, only to mention a few benefits. They can also be safely used in a wide variety of applications.

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