Dec. 10, 1957 J. F. SHERWOOD 2,815,642

DEVICES FOR UTILIZING THE THERMAL EXPANSION OF WAX

Filed Oct. 21, 1955

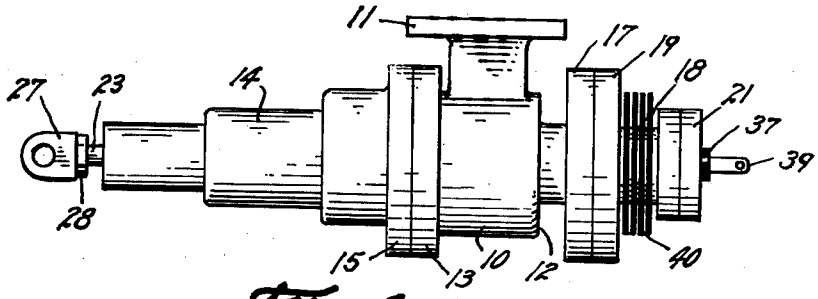



Fig 1

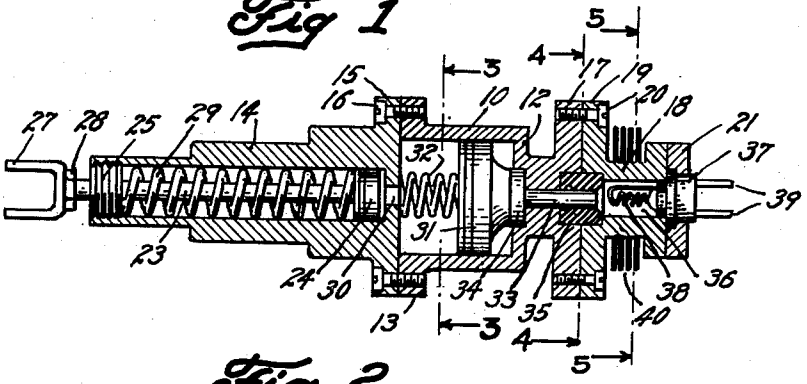



Fig 2

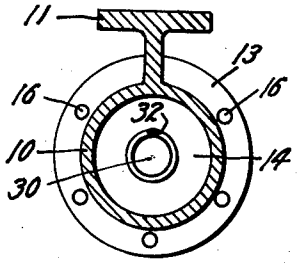



Fig 3

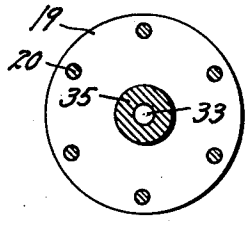



Fig 4

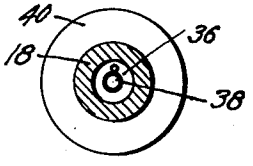



Fig 5

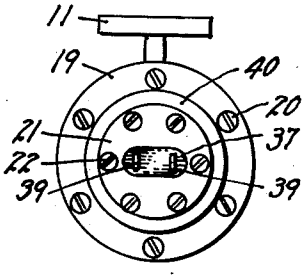



Fig 6

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# DEVICES FOR UTILIZING THE THERMAL EXPANSION OF WAX

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1 Claim. (Cl. 60—23)

This invention relates to an activating device for actuating any desired reciprocating or oscillating element in consequence of variations in electrical current. The principal object of the invention is to provide a small, compact unit which will operate from the small, exceedingly powerful thermal expansion of a wax to produce hydraulic actuating pressure, and which can be minutely and accurately controlled by control of an electrical current supply.

The invention has many uses, one of which is to operate flue dampers and fuel valves from thermostatic controls in industrial and domestic heating plants.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention, reference is had to the accompanying drawing which forms a part hereof. Like numerals refer to like parts in all views of the drawing and throughout the description.

In the drawing:

Fig. 1 is a side view of the improved actuating mechanism;

Fig. 2 is a longitutinal section therethrough, taken on the center line of Fig. 1;

Figs. 3, 4, and 5 are cross-sectional views, taken on the lines 3—3, 4—4 and 5—5, respectively, Fig. 2; and

Fig. 6 is an end view looking toward the right end in Fig. 1.

The improved actuating device comprises a hydraulic pump cylinder **10** provided with any suitable supporting bracket **11** and formed with a closed extremity **12** and an open extremity surrounded by a peripheral flange **13**. A hydraulic power cylinder **14** is mounted in axial alignment with the pump cylinder **10** and secured to the latter through the medium of a second peripheral flange **15** and suitable attachment screws **16**. A port **30** communicates between the cylinders **10** and **14**. The hydraulic power cylinder **14** is relatively longer and relatively smaller in diameter than the pump cylinder **10**.

The closed extremity **12** of the pump cylinder is formed with an attachment flange **17** to which an attachment flange **19** of a wax chamber member **18** is secured by means of suitable attachment screws **20**. The wax chamber member **18** is preferably provided with heat radiating fins **40**. A head disc **21** is secured to the wax chamber member **18** through the medium of suitable attachment screws **22**.

An actuating rod **23** extends axially through the power cylinder **14** and terminates, at its inner extremity, within the cylinder **14** in a power piston **24**. The actuating rod extends through a cylinder head plug **25** threaded or otherwise secured in the extremity of the cylinder **14**. The outer extremity of the actuating rod is provided with any suitable means for attaching the rod to the mechanism to be actuated. As illustrated, the means comprise a clevis **27** threaded onto the rod **23** and locked in place thereon by means of a suitable jam nut **28**.

A compression spring **29** is compressed between the



head plug **25** and the piston **24** and surrounds the rod **23** within the cylinder **14** to constantly urge the piston **24** toward the port **30**. The pump cylinder **10** is provided with a floating pump piston **31** which is constantly urged away from the port **30** by means of a return spring **32**.

The pump piston **31** is forced against the action of the spring **32** by means of a plunger **33** provided at its inner extremity with a plunger head **34** which contacts the piston **31**. In use, the entire open space between the pump piston **31** and the power piston **24** is filled with suitable hydraulic fluid.

The outer extremity of the plunger **33** extends into a high-pressure cylinder **35** concentrically embedded in the flange **17** and the flange **19** across the contacting plane of the two flanges. The high-pressure cylinder **35** is formed of a metal having high tensile strength, such as steel, and opens to the inner extremity of a wax chamber **36** completely filled with a suitable thermal expansible wax, such as paraffin. The outer extremity of the wax chamber is closed by means of an insulating gasket member **37** which forms the support for an electrical heating filament **38** which is embedded in the wax. The gasket also forms a support for electrical terminals **39** for conducting electrical current to the filament **38**.

Let us assume that the device is being used to control the flue damper of a heater in consequence of electrical variations in a thermostat circuit connected to the electrical terminals **39** and that the clevis **27** is connected to the flue damper so that when the mechanism is in the position of Fig. 2 the damper will be open. As the temperature rises, the flow of current through the filament **38** increases, causing the latter to heat the wax in the wax chamber **36**. This causes a thermal expansion of the wax so that the latter will exert pressure on the extremity of the plunger **33** to force the latter inwardly in the high-pressure cylinder **35** so that the plunger head will force the pump piston **31** against the hydraulic fluid in the pump cylinder **10**.

The hydraulic fluid will be forced under pressure through the port **30** into the power cylinder **14** against the power piston **24** to force the latter against the action of the spring **29** and transmit movement to the clevis **27** to move the damper toward the closed position.

If the flow of electrical current is increased, the expansion of the wax will be increased, and the movement of the actuating rod will continue. Should the electrical current be reduced to a pre-determined point, the expansion of the wax will cease and should the current be cut off, the wax will immediately thermally contract, the dissipation of heat being assisted by the radiating fins **40**, to allow the plunger **33** to move into the high-pressure cylinder **35** under the urge of the spring **32** and under the urge of the compression imparted to the hydraulic fluid in the pump cylinder **10** by the spring **29**.

While a specific form of the improvement has been described and illustrated herein, it is desired to be understood that the same may be varied, within the scope of the appended claim, without departing from the spirit of the invention.

Having thus described the invention, what is claimed and desired secured by Letters Patent is:

A device for imparting a reciprocal movement to a mechanism comprising: a power cylinder; a power piston in said power cylinder; a piston rod extending from said power piston and adapted to be connected to the mechanism to be actuated; a pump cylinder mounted on said power cylinder in communication with the latter through the medium of hydraulic fluid; resilient means urging said power piston against said hydraulic fluid; a pump piston reciprocally mounted in said pump cylinder; spring means urging said pump piston in one direction; a high-pressure cylinder supported from and in axial alignment with said

pump cylinder; a plunger in said high-pressure cylinder extending into contact with said pump piston so as to urge said pump piston in the other direction; a wax chamber communicating with said high pressure cylinder; wax completely filling said wax chamber, so that thermal expansion of said wax will cause the latter to act against the plunger to cause the latter to exert pressure against said hydraulic fluid, and a thermostatically controlled electrical heating element positioned within said wax chamber and embedded in the wax therein.

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