March 27, 1951 W. D. MACGEORGE 2,546,695

VALVE TIMER

Filed April 16, 1948

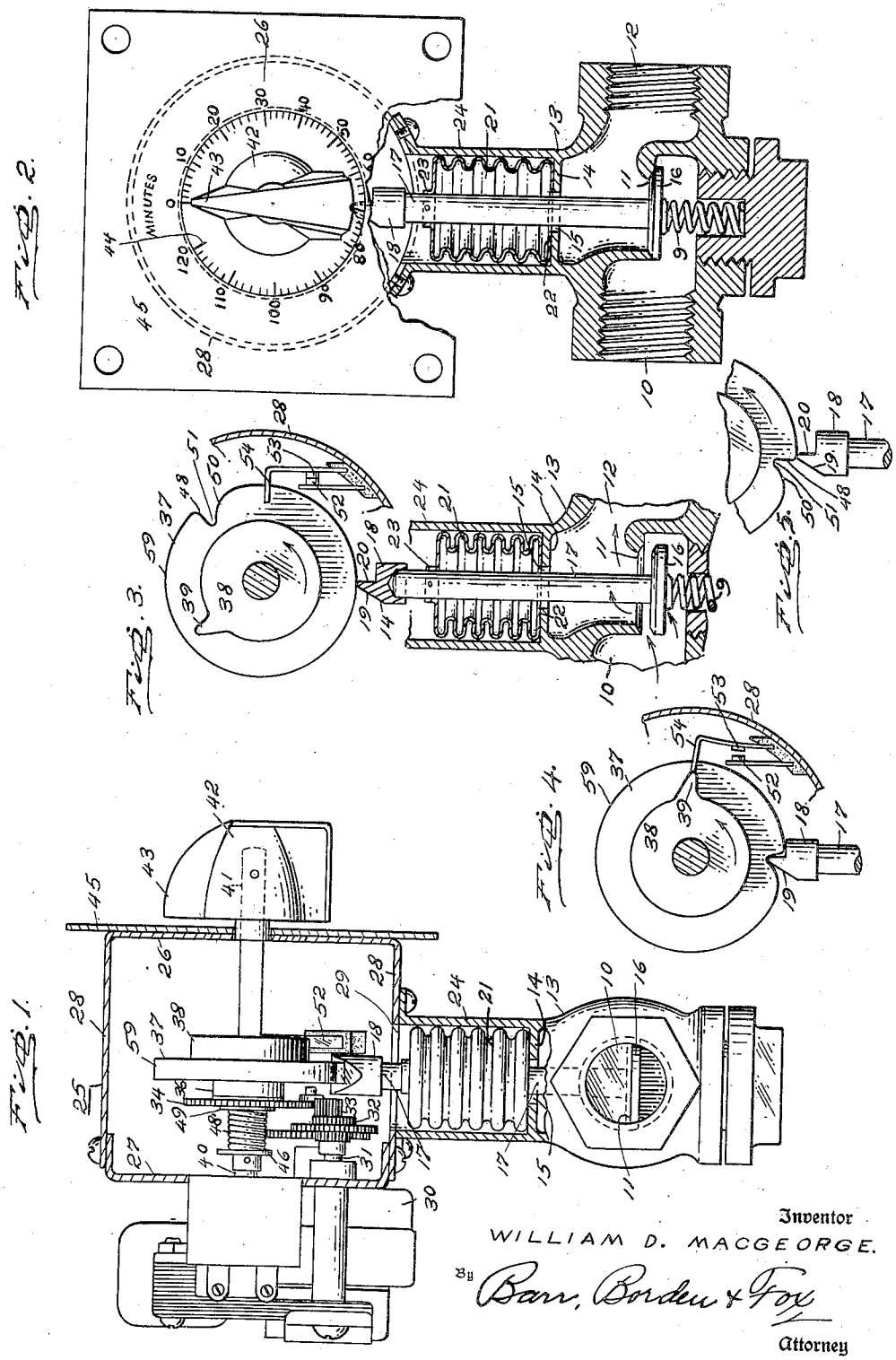


Fig. 2.

Fig. 3.

Fig. 5.

Fig. 4.

Fig. 1.

Inventor
WILLIAM D. MACGEORGE.
By Barr, Borden & Fox
Attorney

Patented Mar. 27, 1951

2,546,695

UNITED STATES PATENT OFFICE

2,546,695

VALVE TIMER

William D. Macgeorge, Havertown, Pa., assignor to Automatic Temperature Control Co., Inc., Philadelphia, Pa., a corporation of Pennsylvania

Application April 16, 1948, Serial No. 21,430

8 Claims. (Cl. 161—7)

1

This invention relates to valve timers, and particularly to a simplified structure combining a valve-operating element with an electric timer in which the setting of the timer opens the valve and starts the timed interval and the termination of the timed interval closes the valve and opens the control circuit to the motor and stops the timed interval.

In the accompanying drawings:

Fig. 1 represents a side elevation, partially in section of the valve and timer element according to a preferred embodiment thereof.

Fig. 2 represents a front elevation thereof, partially broken away to show details thereof.

Fig. 3 represents a fragmentary section partially in elevation of the condition of the parts during a timed interval with the valve opened.

Fig. 4 represents the final disposition of the timing cam when the timing motor circuit is opened as the valve closes.

Fig. 5 represents the disposition of the valve cam just prior to valve closure.

The valve has an inlet opening 10 into which fluid pressure is fed, leading through a valve seat 11 into a valve outlet 12. The valve body 13 includes a transverse partition 14 parallel to the valve seat and having a valve stem opening 15. A valve 16 is disposed for tight seating on the valve seat 11 so that fluid pressure against the closed valve tends to hold it tightly sealed. A valve stem 17 is provided passing upwardly through aperture 15 and at its upper end terminates in the shouldered cam wiping end 18 having the slightly curved inclined face 19 leading outwardly into the generally planar axial face 20 arranged to engage in a recess in a cam to be described. A bellows 21 is mounted within a cylindrical upper extension 24 of the valve body 13, with an open end 22 thereof tightly mounted on the plate or horizontal portion 14 communicating through partition opening 15 with the interior of the valve. The upper end of the bellows, at 23, is secured in fluid-tight relation to the valve stem 17. The resilience of the bellows or an additional spring 9 biases the valve 16 to seating and tight sealing with valve seat 11.

On the upper end of the cylindrical extension 24, a housing 25 is provided, comprising a front wall 26, a parallel rear wall 27 and an annular closure member 28 having a lower opening 29 generally registering with the upper end of extension 24. A self-starting synchronous unidirectional motor 30 is mounted on the rear of the rear wall 27, with a drive shaft 31 leading to a suitable gear reduction train 32, suitably supported in the housing, by which a timer drive pinion 33 is driven at a predetermined relatively slow rate as compared to the speed of motor 30. Pinion 33 is permanently in mesh with a larger gear 34 mounted loosely on the reduced end of a timing cam hub 36 carrying the valve cam 37 and having a front circuit-controlling cam hub 38 upon which a circuit-controlled radial dwell 39 is rigidly mounted in axially spaced relation to cam 37. The hubs and cams are mounted on a shaft 40, journalled in suitable bushings (not shown) in the rear wall 27 and front wall 26, and extending through and beyond the front wall of the housing. The front end 41 of the shaft 40 carries the keyed pointer indicator handle 42, the pointer portion 43 of which angularly sweeps an annular series of calibrations 44 on a dial plate 45 mounted on housing front plate 26. The pointer handle is the means for opening the valve and also for starting the timing cycle. It is driven by the timer in completing the cycle started by the initial manual motion. A flanged washer 46 is keyed or otherwise secured to the shaft 40, and engages one end of a compression spring 43' confined on the front end by a washer 49 or the like abutting frictionally against the gear 34 to force same against the enlarged portion of hub 36, to turn with the shaft under normal motor driving conditions.

2

The cam 37 for the valve has a cam wiping surface 59, of uniform radius for almost the entire periphery of the cam, interrupted by a single rather abrupt asymmetrical radial recess dwell 51 arranged to receive the free upper end 18 of the valve stem. Recess 51 is provided on one side with a generally radial flattened surface 48 forming one wall of the recess, intersected by a rearwardly curved abrupt surface 50. In the seated valve position the end 18 of the valve stem enters the recess dwell 51, with the generally planar axially extending surface 20 juxtaposed to the radial dwell surface 48, and with the rearwardly slightly inclined surface 19 juxtaposed to the curved surface 50 of the recess. It will be seen that the unidirectional movement of the valve cam relative to the end 18 of the valve stem, starting with the said valve stem end in the recess, is such as to quickly force the valve stem axially downward as the complemental curved surfaces of the recess and the valve stem engage as the cam moves in the direction of the arrow, i. e. counterclockwise, as shown in Figs. 2, 3, and 4. This opens the valve against the resilience of the bellows, and this opening is maintained as the valve stem end 18 rides on the outer cam

surface 59, and when the cam has completed its angular motion from the motor the generally flat complemental surfaces of the valve stem end and the recess insure a rapid release of the valve stem to respond to the bias from the bellows in forcing the valve stem end into the recess. This effects quick closing, and as the recess is slightly deeper than motion of the valve stem requires for tight sealing, the closing will be effective to tightly seal the closed valve.

In order to control the circuit through the motor, one lead from the supply line extends through the motor field or through relays or like devices for controlling the motor circuit, and to a slightly resilient contact 52 mounted insulatedly on the inner periphery of the housing, while the other lead from the supply extends to a resiliently mounted contact 53 having the resilient finger extension 54 in the path of rotation of the radially asymmetrical circuit cam dwell 39. The contacts 52 and 53 are normally biased toward closing, but are arranged to open when the dwell 39 on the cam hub 38 has moved to the position shown in Fig. 4 synchronously with entrance of the valve stem end into the recess dwell on the valve cam 37. Preferably, valve closing precedes by a slight interval the opening of the motor control circuit.

With the parts as shown in the relative positions indicated in Figs. 2 and 4, the valve will be closed and fluid flow stopped, the motor circuit will be open, and the pointer on the knob will point to "0" minutes, assuming, for purely illustrative example, the calibration of the device for a total of "120" minutes. Assuming a desired timing cycle of "valve-open" of eighty minutes, the operator manually turns the knob counterclockwise until the pointer is opposite the "80" minute calibration of the dial. This will move the parts to substantially the relative positions shown in Fig. 3. Such counterclockwise rotation of the knob will synchronously turn the cam shaft against the resistance of the motor shaft, through the frictional lost motion, and synchronously will force the end 18 of the valve stem downwardly out of the recess 51 of the valve cam 37, opening the valve, and will move dwell 39 on the contact cam 38 from engagement with arm 54 to permit the contacts 52 and 53 to bias to closed position, closing the motor circuit, while the end 18 of the valve stem bears against the periphery 59 of the valve cam 37. When the knob is released, the delivered cam-shaft-driving torque from the motor imparts a continued counterclockwise drive to the cam shaft, which rotates the cams and the knob, the pointer of which sweeps the remaining calibrations to give a continuing indication of the minutes remaining to complete the cycle of "valve open," gradually moving to the zero indication at which synchronously the valve stem end 18 is forced into the dwell recess 51 to close the valve under the bias thereof and also causes dwell 39 on the contact cam 38 to engage the arm 54 to force the contacts 52 and 53 apart to open the circuit through the motor.

It will, of course, be clear that the contacts 52 and 53 need not directly control the circuit through the motor, as any desired relays or other amplifying devices may be used. Of course, if a snap opening or closing switch is desired it will be used. It is necessary merely that the contacts control directly or indirectly the motor circuits.

It may well occur that in certain cases, it may be desired to eliminate the automatically operated switch members 52, 53, and 54, and to provide a snap or other switch for the motor circuit which is independently manually or otherwise controlled. With such independent motor control moved to start the motor running, the friction between the end 18 of the valve stem and the curved surface 50 of the recess dwell 51 with the valve closed, enhanced by the bias from the bellows, or from a related spring element 9 pushing the valve stem into the recess, is predeterminedly greater than the friction of the washer 49 against the reduced end of the hub 36, so that starting the motor to running simply moves the gear 34 without applying sufficient torque to the cam shaft as to move the valve cam. Turning the handle 42 applies a torque adequate to overcome the resistance of the valve stem end in the recess and opens the valve and moves the pointer to an indication of the remaining number of minutes, illustratively, that the cam must turn under applied torque from the gear 34 to turn the cam through the associated angular distance until the recess dwell 51 again registers with the end of the valve stem. When the valve stem end 18 is forced into the dwell recess 51 it acts as a stop to the further cam motion, even though the motor 30 continues to run.

Although the valve has been disclosed as one that is opened for the timed interval, it will be clear that if desired the timed interval may equally well be associated with closing a normally open valve for the timed interval. Usually, of course, the vave will be as disclosed and arranged to be normally closed, and to be opened for the timed interval.

The simplicity, economy and compactness of the assembly will be appreciated.

Having thus described my invention, I claim:

1. A valve timer comprising a valve body including a valve seat, a bellows in the valve body, a valve stem passing through the bellows and into the valve body, a valve on the stem, said bellows coupled at one end to said valve stem and in communication at the other with the valve seat and arranged to bias the valve toward seating on the valve seat, an electric timer comprising a motor, a reduction gear train driven by the motor, a timer gear in mesh with the reduction gear train, a cam shaft, cams mounted on the shaft, said timer gear being mounted on said shaft, means for frictionally coupling the timer gear to said shaft and permitting relative motion of the timer gear and shaft, a cam on said cam shaft operatively mounted relative to the end of said valve stem to permit seating of the valve in one relative position of the cam and the stem, and to unseat the valve in other relative positions of the cam and stem, a manual device for moving the cam shaft to open the valve and predetermine the timed interval without necessarily driving the timer gear, and circuit means operatively coupled to the cam shaft for opening and closing circuits through said motor whereby to run the motor when the valve is opened, and to stop the motor when the valve is closed

2. A valve timer comprising a housing, a cam shaft in the housing, a valve disc cam coupled to the cam shaft and having a recess in its outer periphery, a circuit cam coupled to the cam shaft and having a dwell, contacts normally biased to closing and operative by the dwell to open when the circuit cam occupies a predetermined angular position, a valve, means biasing the valve to closing, said valve including a valve stem having an end bearing against the periphery of the valve cam, said end of the cam arranged to enter the

recess dwell in a predetermined angular position of the valve cam, a timer dial, means juxtaposed to the dial for moving both of said cams in establishing a selected timer interval, an electric motor, means coupling the motor to drive the cam shaft through a frictional lost motion whereby the timing interval can be set with the motor stationary, and said cams being so arranged as to synchronously open the valve and close the motor circuits in setting a timed interval, and to synchronously close the valve and open the motor circuits when the timed interval has ended.

3. A valve timer comprising a housing, a cam shaft in the housing, a valve disc coupled to the cam shaft and having a dwell on its outer periphery, a valve, means biasing the valve to closing, said valve including a movable portion bearing against the periphery of the valve disc and arranged to close the valve when juxtaposed to said dwell, a timer dial, means juxtaposed to the dial for moving said valve disc and open the valve and for also setting a predetermined time interval from the calibrations of said dial, an electric motor, means coupling the motor to drive the cam shaft through a frictional lost motion whereby the timing interval begins with the opening of the valve and substantial release of the means juxtaposed to the dial, said motor driving said valve disc through a timer interval concluded by the juxtaposition of the movable means of said valve to said dwell and the closing of the valve as a result thereof.

4. A valve timer, comprising a valve body, a valve in the body, a valve stem on the valve, means biasing the valve stem to closing of the valve, a cam having a recess dwell, means on the valve stem for entering said dwell when the valve is closed and for opening the valve against friction between the dwell and said end of the valve stem when torque is applied manually to the cam, an electric motor, a gear driven at a predetermined rate of speed by said motor, friction means coupling said driven gear to said cam with torque insufficient to move the cam when the end of the valve stem is in said dwell, said friction coupling means delivering sufficient torque to said cam from said motor after rotation of the cam manually to force the valve open and the dwell to move out of registration with the end of said valve stem and to move the cam angularly until the end of the valve stem is again forced into the said dwell to stop the cam and close said valve.

5. A valve timer comprising a housing, a cam shaft in the housing, a valve disc coupled to the cam shaft and having a dwell on its outer periphery, a valve, means biasing the valve toward a normal setting, said valve including a movable portion bearing against the periphery of the valve disc and arranged to move the valve to an abnormal setting when juxtaposed to said dwell, a timer dial, means juxtaposed to the dial for moving said valve disc to move the valve to its abnormal setting and also for setting a predetermined time interval from the calibrations of said dial, an electric motor, means coupling the motor to drive the cam shaft through a frictional lost motion whereby the timing interval begins with the movement of the valve from its normal to its abnormal setting and substantial release of the means juxtaposed to the dial, said motor driving said valve disc through a timed interval concluded by the

juxtaposition of the movable means of said valve to said dwell and the return of the valve to its normal setting as a result thereof.

6. A valve timer comprising a valve body, a valve in the body, an adjustable electric timer having a variable timing cycle mounted on the body, switch means for the timer, and common manual means for moving the valve in one direction, preselecting and establishing the timing interval, actuating the switch means and initiating a timing circuit through the electric timer, and means operative synchronously with the conclusion of the preselected timed interval for reversely moving the valve and actuating the switch means to terminate the timing circuit.

7. A valve timer comprising an adjustable electric timer of variable time cycle including a synchronous uni-directional electric motor, a circuit controller, a valve including a valve-operating member, manual means for actuating the valve-operating member in one direction and to preselect a predetermined timing interval from the timer and to actuate the circuit controller for establishing the timing circuit through the motor, and means for synchronously returning the valve operating member to its initial position and to actuate the circuit controller and stop the timing motor at the conclusion of the selected timed interval.

8. A valve timer comprising a valve, valve-operating means for the valve, a synchronous uni-directional motor, a circuit controller for the circuit through the motor, a shaft in driven relation to said motor, oscillatable manual means mounted concentrically of the shaft and movable manually in one direction from a zero position to a variable selected angular position spaced from the zero position to predetermine the timed interval, said manual means engaging the valve operating means to operate the valve in one sense and also actuating the circuit controller to initiate the running of the motor, means comprising a lost motion between the motor and the manual means to permit the manual actuation of the manual means against the resistance of the motor and operative upon manual release of the manual means to move said manual means from the selected angular position back toward the zero position, and means operative at the termination of the timed period of motor running to actuate the valve-operating means in the opposite sense and to actuate the circuit controller to terminate the circuit through the motor to stop same.

WILLIAM D. MACGEORGE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,797,846	Stewart	Mar. 24, 1931
1,903,788	Lorenz	Apr. 18, 1933
1,993,926	Gauger	Mar. 12, 1935
2,025,511	Johnson	Dec. 24, 1935
2,208,956	Allenbaugh	July 23, 1940
2,230,191	Knight	Jan. 28, 1941
2,254,795	Daniels	Sept. 2, 1941
2,315,774	Couzens	Apr. 6, 1943