

Sept. 20, 1960

R. B. MATTHEWS

2,953,197

BURNER CONTROL APPARATUS

Filed March 26, 1956

3 Sheets-Sheet 1

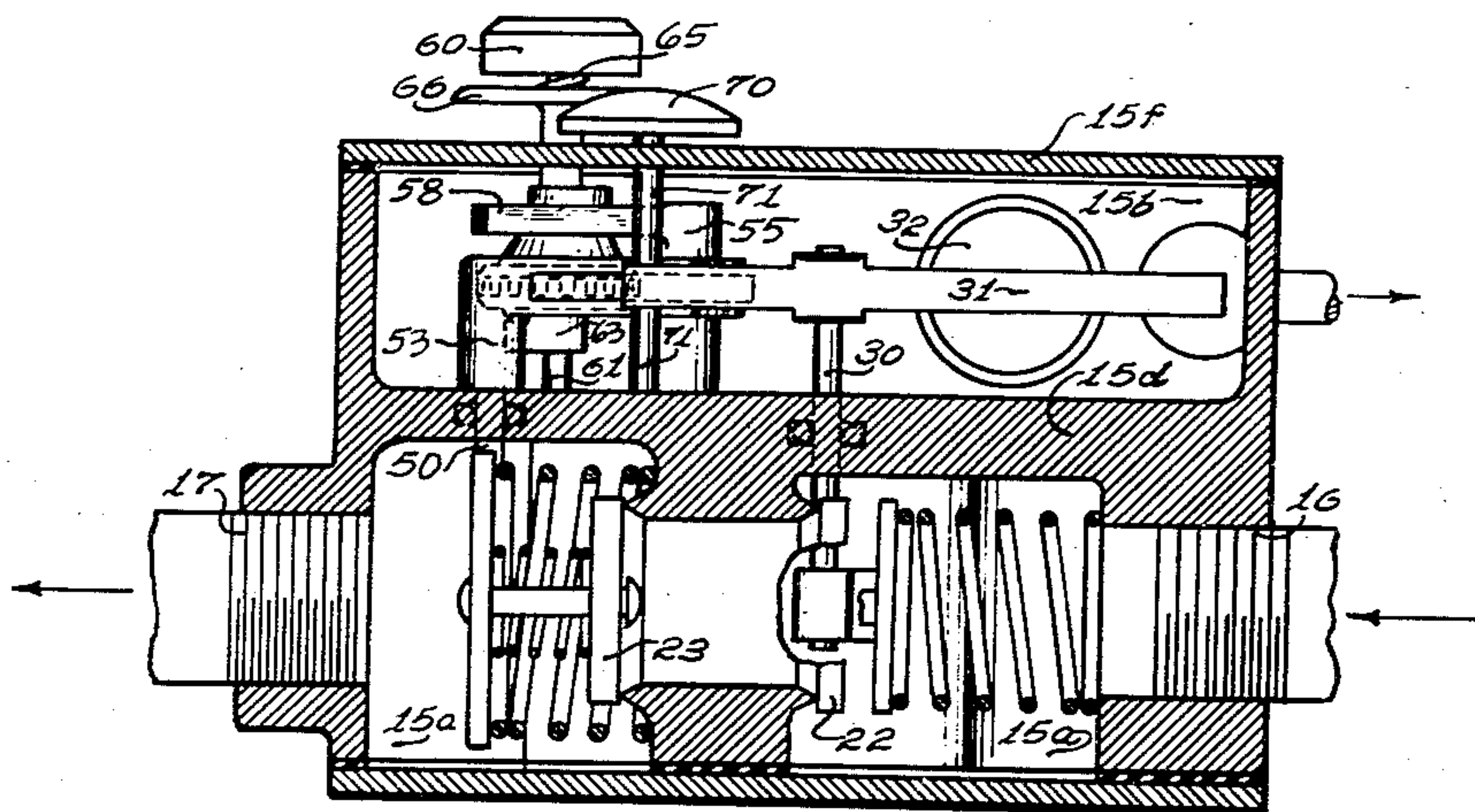
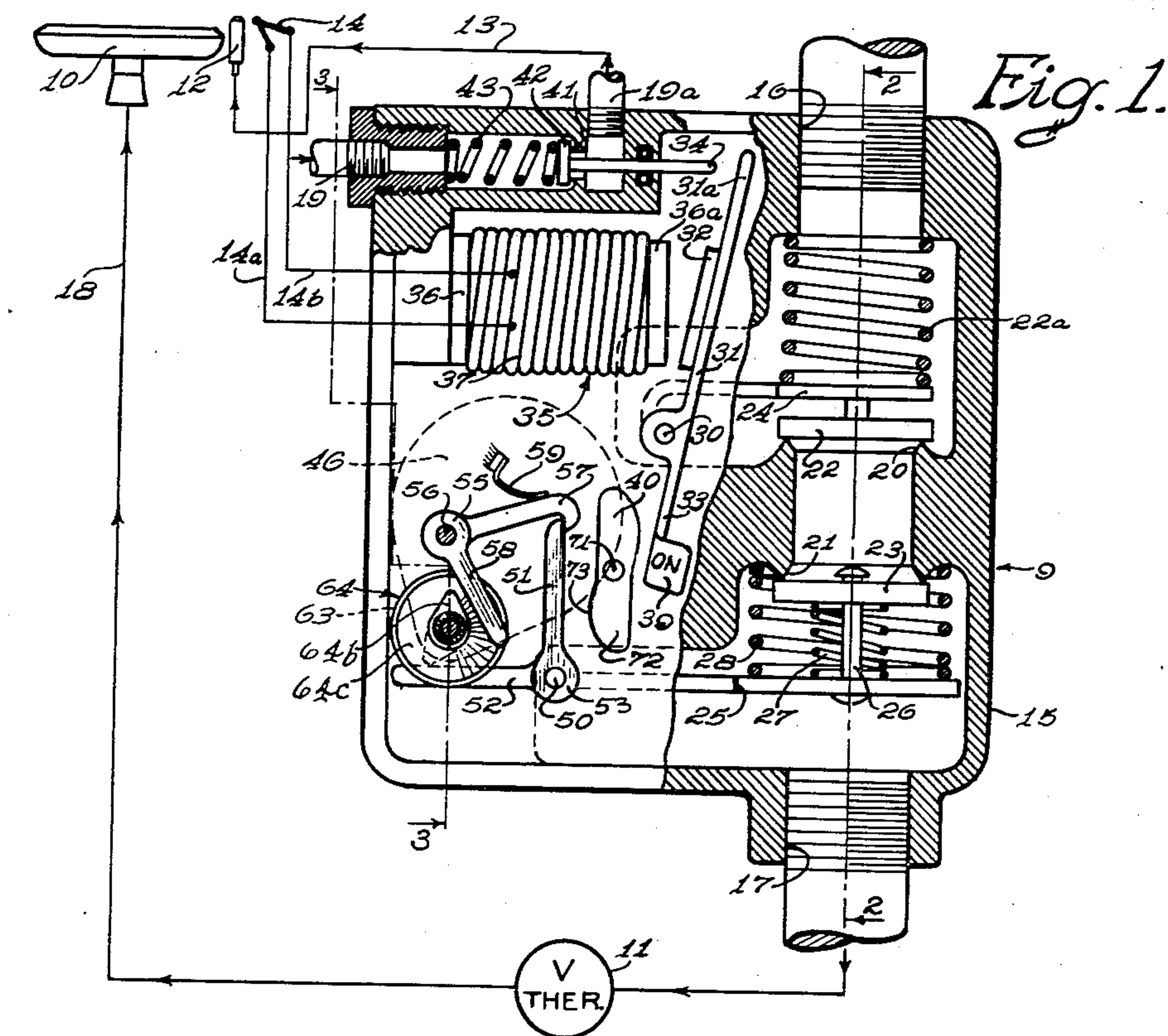


Fig. 2.

INVENTOR.  
 Russell B. Matthews  
 BY  
 Seeger & Schwallbach  
 Attorneys

Sept. 20, 1960

R. B. MATTHEWS

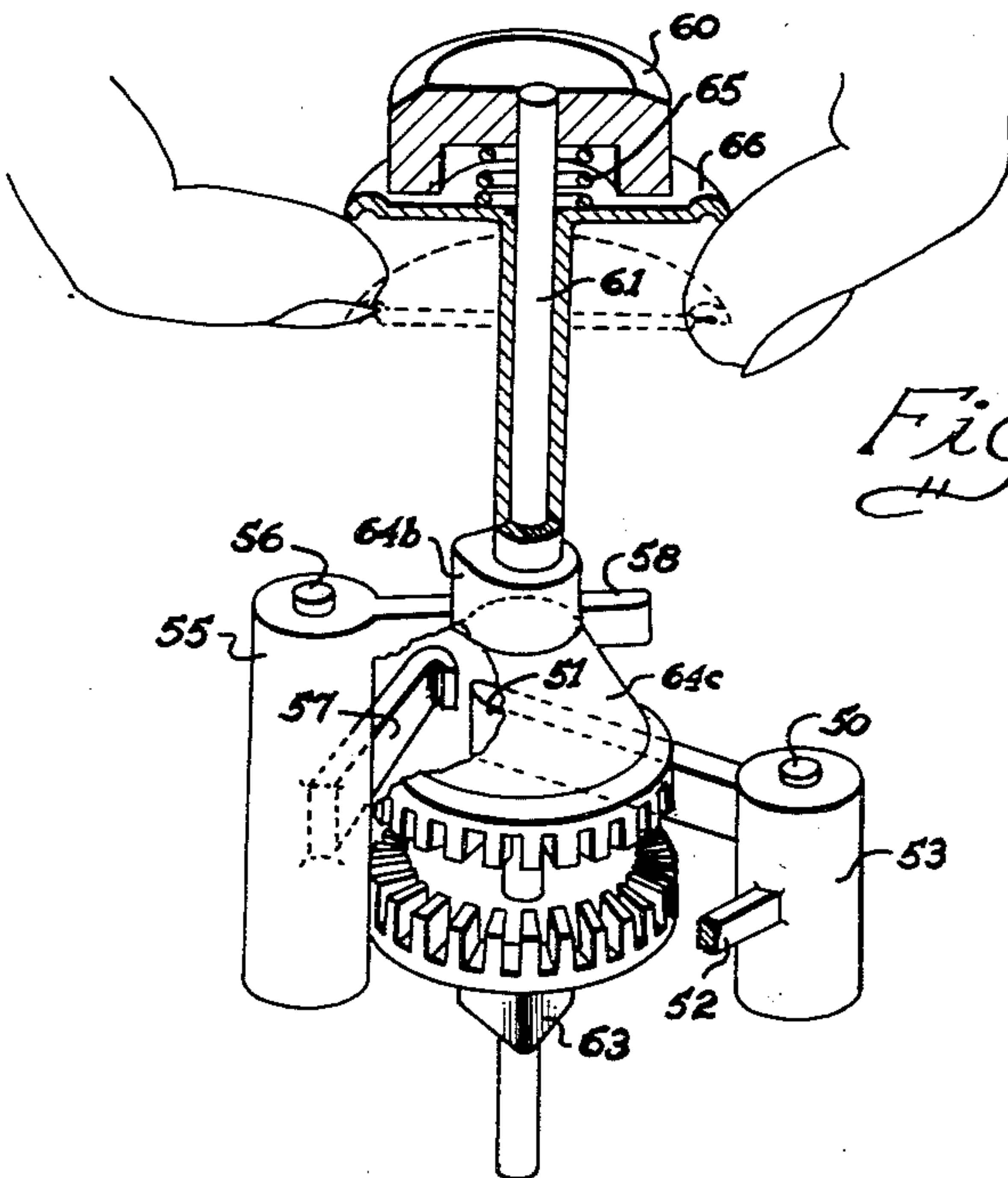
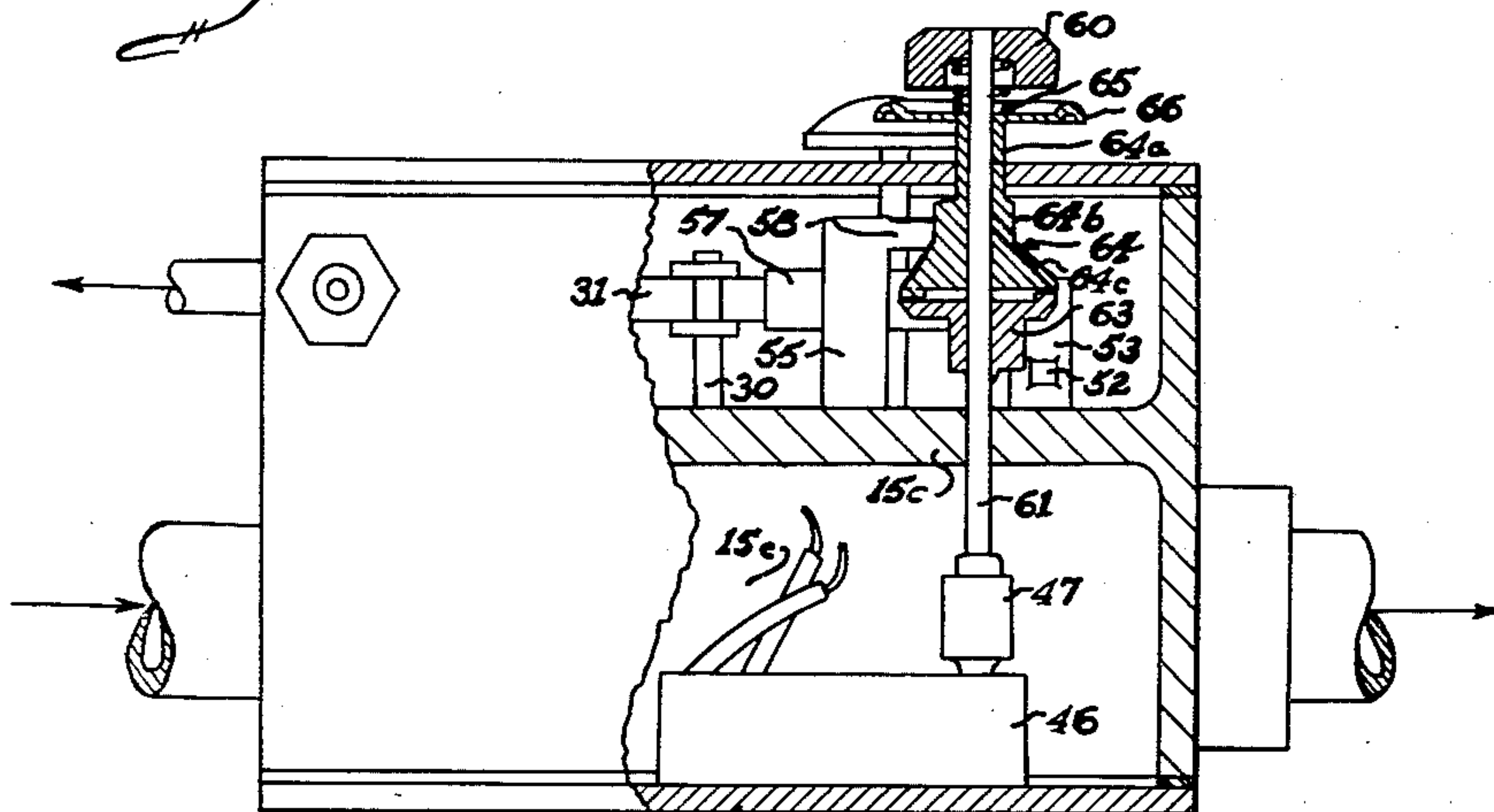
2,953,197

BURNER CONTROL APPARATUS

Filed March 26, 1956

3 Sheets-Sheet 2

*Fig. 3*



*Fig. 4*

INVENTOR.

*Russell B. Matthews*

BY

*Deegert & Schwalbach*  
*Attys*

Sept. 20, 1960

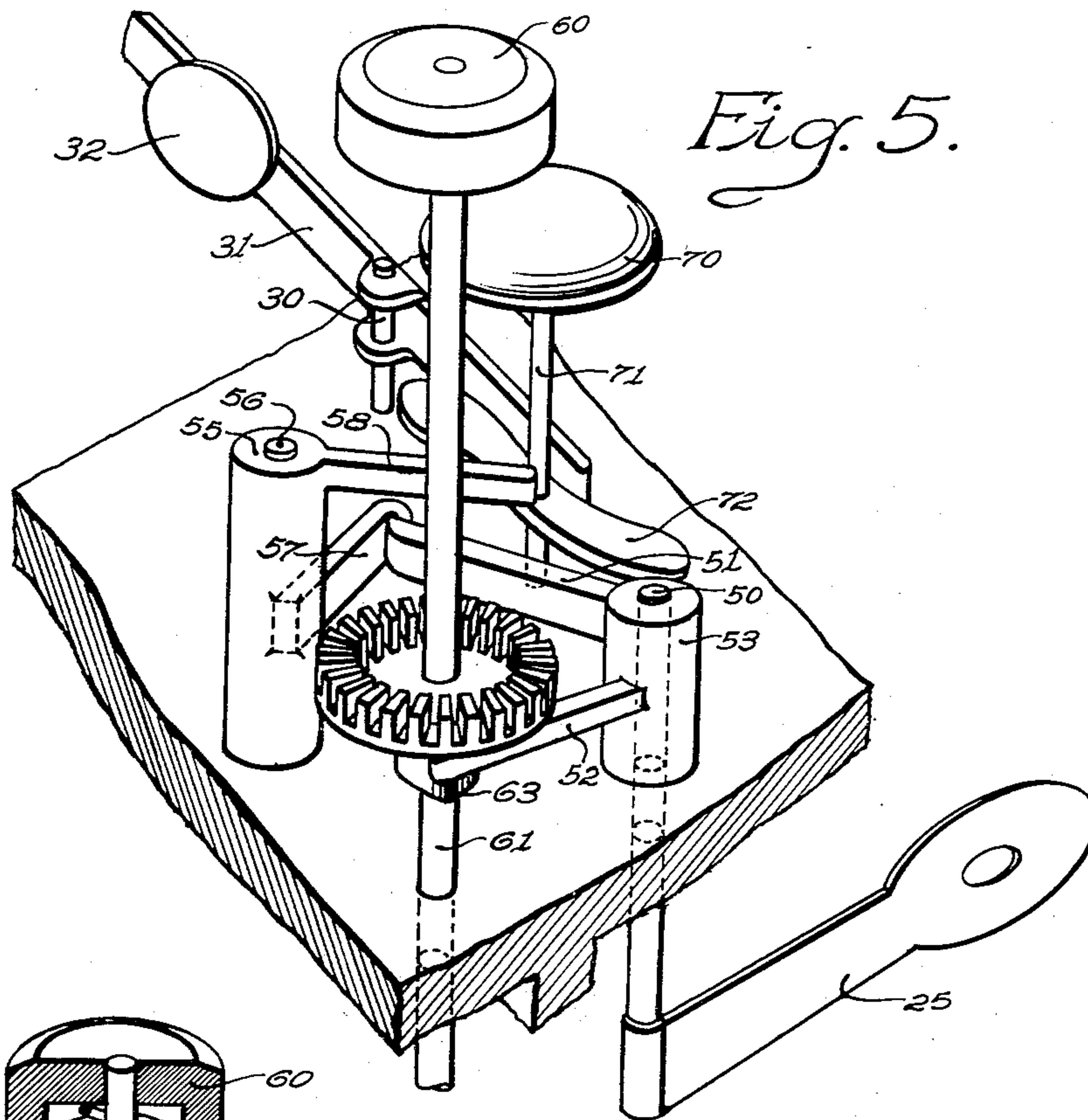
R. B. MATTHEWS

2,953,197

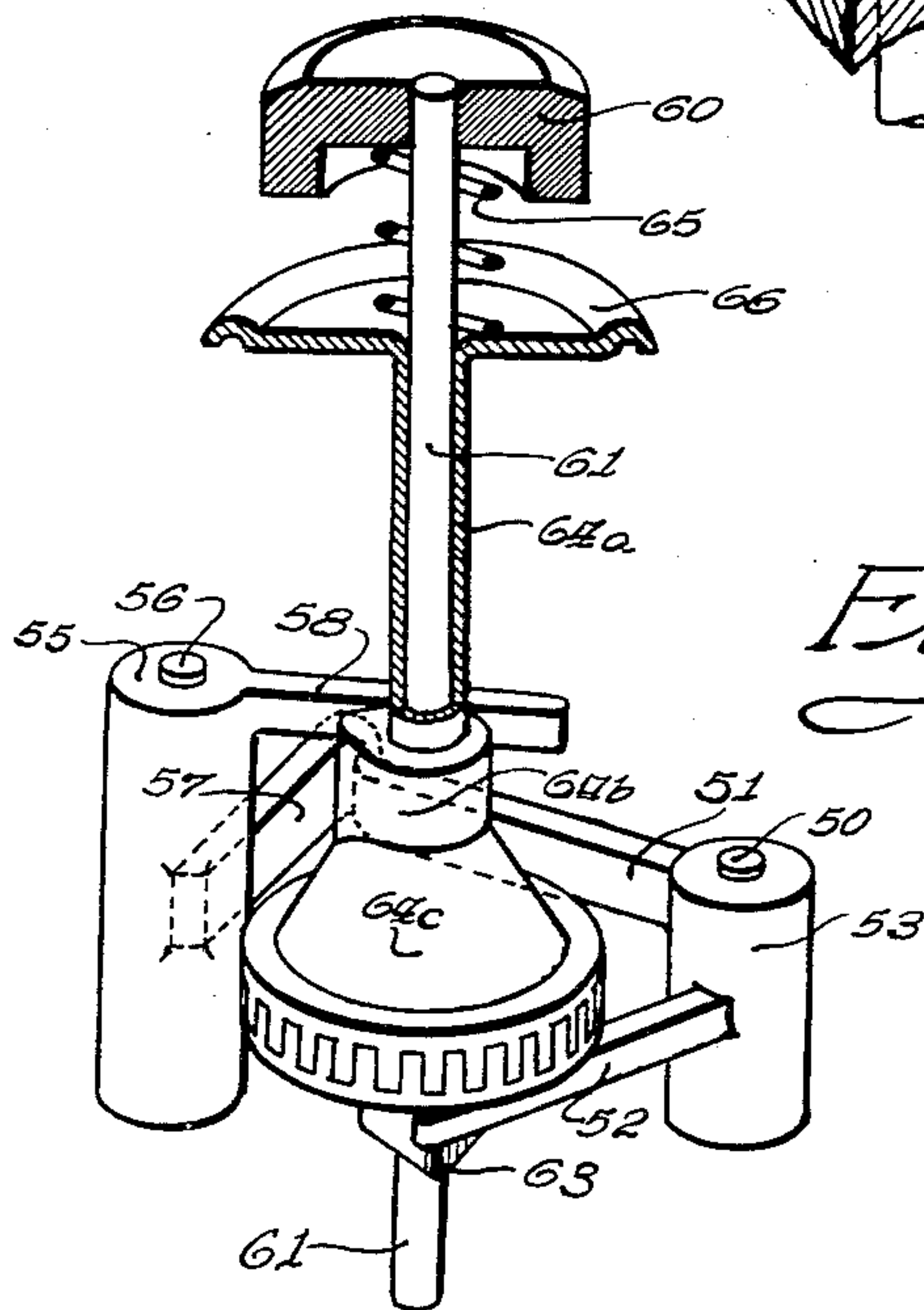
BURNER CONTROL APPARATUS

Filed March 26, 1956

3 Sheets-Sheet 3



*Fig. 5.*



*Fig. 6.*

INVENTOR.  
*Russell B. Matthews*  
BY  
*Seegert & Schwalbach*  
*Attys*

58



1

2,953,197

## BURNER CONTROL APPARATUS

Russell B. Matthews, Wauwatosa, Wis., assignor to Baso Inc., Milwaukee, Wis., a corporation of Wisconsin

Filed Mar. 26, 1956, Ser. No. 573,830

18 Claims. (Cl. 158—131)

This invention relates to burner control apparatus.

While the invention is not necessarily limited thereto, its principal field of utility is in connection with gas burning cooking ranges of the type in which one of the burners, such as the oven burner, is adapted to be placed under automatic time control, but wherein a safety shut-off feature is associated with this burner so that it cannot possibly receive gas if the pilot light associated with the burner is extinguished.

The invention enables a single control device to be employed for controlling the fuel flow, which is responsive to time controlled means and also responsive to safety shut-off means. The automatic timing mechanism can be of the same general type as now commonly employed in time switches for ranges comprising the usual synchronous motor driven clock and the adjustable controls associated therewith which are adapted to be set by the housewife automatically to effect the starting and stopping of the cooking operation at preselected times. The automatic timing mechanism is preferably arranged to actuate a control valve through a mechanical connection, which may be selectively engaged and disengaged by suitable setting means for automatic or manual operation respectively.

One of the main objects of the present invention is the provision in the device of the general character above set forth of improved means for resetting or cocking the device so that with one unitary reset means the safety shut-off means may be actuated to a holding relation with the holding means and the control valve may be put under the control of latching means which is in turn controlled by timing means.

Another object of the invention is to provide a device as above described wherein a single flow control means is operable to interrupt the flow of fluid fuel to the burner during the reset operation of the safety shut-off means said single flow control means also being operable to move between flow-permitting and flow-preventing positions under the control of time controlled means.

Another object of the invention is to provide improved thermoelectric safety shut-off and automatic timing device of relatively simple and inexpensive construction which are in one unitary housing.

While the particular structural features for obtaining a device of the character set forth are important features within the more specific aspects of the invention, it is to be understood that the precise feature shown and described may be varied within the broader aspects of the invention.

In order to acquaint those skilled in the art with the manner of construction and operating a device in accordance with the present invention, the invention will now be described in connection with the accompanying drawings in which:

Figure 1 is a fragmentary sectional view of one embodiment of the invention disposed in a fuel supply line

2

to a burner, portions of the system being shown somewhat semi-diagrammatically;

Figure 2 is a sectional view along lines 2—2 of Figure 1;

Figure 3 is a sectional view along lines 3—3 of Figure 1;

Figure 4 is an enlarged fragmentary perspective view of the device shown in Figures 1—3, the parts being shown with starting knob 66 being lifted for rotation relative to button 60;

Figure 5 is an enlarged fragmentary perspective view of the device depicted in Figures 1—3 with the cam 64, extension 64a, and knob 66 removed to better show the cooperation of the remaining parts; and

Figure 6 is an enlarged fragmentary perspective view similar to Figure 5, with cam 64, extension 64a and knob 66 shown in operative relation to cam 63.

The invention can be embodied in a wide variety of forms for use with a wide variety of devices, but for purposes of illustration the invention has been shown more or less schematically as embodied in connection with a range burner. It is to be understood that the burner may be any other burner with which automatic timer and safety shut-off provided by the present invention is suitable or desired.

In the cooking range adaptation of the invention, the burner 10 represents for example a typical oven burner or broiler burner. A fuel supply pipe 18 leads to the burner for delivery of gaseous or other fuel thereto. Pilot burner 12, which is located in juxtaposition to the main burner 10 to maintain the pilot flame for igniting the main burner, is supplied with gaseous fuel by a pilot supply pipe 13. Interposed in the fuel supply pipes 18 and 13 is a fuel flow control apparatus 9 which provides safety shut-off and time control of the fluid fuel to said burners. A thermostatic range valve 11 is preferably mounted on the downstream side of the device 9 and may partake of any suitable or desired form. The reason for disposition of the thermostatic valve on the downstream side of the control device 9 will appear hereinafter.

The control device 9 is essentially comprised of safety shut-off means for both the main and pilot burner valves, timing means, setting means operable to place one of the valves under the control of the timing means and which is also operable to selectively determine the time intervals causing starting and stopping of the fuel flow through the device.

More particularly, the device 9 comprises a housing 15 having a main inlet 16 and outlet 17, the latter leading to the main burner 10 through supply pipe 18. The housing 15 is also provided with a separate pilot supply pipe inlet 19 and outlet 19a interposed in the fuel supply line 13 for the pilot burner 12. The housing may be formed into three partitioned chambers, namely, the valve chamber 15a, control chamber 15b and motor chamber 15c.

In the valve chamber 15a, interposed between the main inlet 16 and outlet 17, are a pair of spaced back to back valve seats 20 and 21 which are controlled by valve members 22 and 23 respectively. Valve member 22 is biased to a closed relation with seat 20 by a suitable coil compression spring 22a which is interposed between the casing 15 and a valve arm 24. Valve member 23 is adapted to be carried by a stem 26 which is fixedly mounted on a valve arm 25. A coil compression spring 27 is interposed between the valve arm 25 and the valve member 23 to bias the latter against the head of stem 26 so as to provide a lost motion connection between said stem and valve member. A coil compression spring 28 is interposed between the casing 15 surrounding valve seat 21 and valve arm 25 to bias said arm and hence valve



3

member 23 away from the seat 21. Thus valve member 22 is biased closed and valve member 23 is biased open.

Means for controlling the pilot fuel flow may be interposed between the inlet 19 and outlet 19a of the housing 15 and is here shown as a valve seat 41 and a valve member 42. The valve member 42 may be mounted on an elongated stem 34 which sealingly extends through a partition wall for coaction with an electromagnet 35 as will be later explained. A coil compression spring 43 may be interposed between the valve member 42 and the casing 15 surrounding the inlet 19, said spring being adapted to bias the valve member 42 to the right as shown in Figure 1 and into engagement with the seat 41.

The valve member 22 may be called the safety shut-off valve, the safety shut-off actuator therefor being disposed within the control chamber 15b. The actuator and the valve member may be connected as by the valve arm 24 which extends to the left as viewed in Figure 1 to fixedly engage a shaft 30 which extends through a partition wall 15d separating the valve chamber 15a from the control chamber 15b. A pivotal armature lever arm 31 which carries an armature 32 thereon is disposed in the control chamber 15b and fixedly mounted upon the other end of shaft 30. The armature lever arm 31 is fixedly mounted on a suitable shaft for pivotal movement thereon, the shorter end of said lever arm 33 being adapted to be engaged by a reset cam surface 40 and the longer other end of said armature arm extending upwardly as viewed in Figure 1 for coaction with the pilot valve stem 34.

The safety shut-off electromagnet 35 may be suitably mounted upon an outer wall portion of the casing 15 within the control chamber 15b and comprises a core 36 having an energizing winding 37 thereon, the ends of which may be connected in circuit with a thermoelectric generator 14 through conductors 14a and 14b. The electromagnet 35 when energized is adapted to hold the armature 32 and thus the pilot and main valve members 42 and 22 in cocked flow-permitting position when said parts are moved to this position against the bias of springs 43 and 22a. It is to be noted that in the embodiment shown, the electromagnet 35 has insufficient power when energized to move or attract the armature 32 from a retracted position, but it does have sufficient power to hold or retain the parts when moved thereto by some suitable outside means such as reset cam 40.

Means for automatically controlling the fuel flow to the burner is provided by an automatic timer motor 46 which may be of any desired type capable of causing a control valve unit to open and close at different times preselected by the operator. In the embodiment shown, this unit comprises a commercially available synchronous motor 46 powered by an electric source (not shown) which is capable of transmitting rotary motion at a predetermined desired speed to a coupling 47.

Valve member 23 is controlled by the timing motor 46 and is mechanically connected thereto by suitable linking means and cam means as shall now be described. Valve arm 25 carrying valve member 23 at one end extends to the left as shown in Figure 1 and is fixedly connected to shaft 50 at the other end. The shaft 50 extends through the partition wall 15d between the control chamber 15b and the valve chamber 15a and has fixedly mounted thereon a lever 53 of the bell crank type, having axially spaced arms 51 and 52, the latter being at substantially right angles to each other. As viewed in Figure 1, counterclockwise movement of arms 51 and 52 causes closing movement of valve 23 and clockwise movement of said arms allows opening movement of valve 23 under the bias of spring 28. A latching lever 55, here shown as a spring loaded bell crank, is pivotally mounted on a shaft 56 and has a pair of axially spaced substantially right angle arms 57 and 58. Lever 55 is spring loaded by any suitable spring such as the leaf spring 59 which engages arm 57 to bias the latter

4

in a clockwise direction. Arm 57 is formed with a hooked latching surface at the end thereof for latching coaction with valve lever arm 51. Arm 58, the upper arm as viewed in Figure 3, is disposed so as to engage timing cam 64 as will be later explained.

Means for selectively placing the valve member 23 under the automatic control of the timing mechanism is provided by a button 60 which is mounted on the upper extremity of shaft 61 as viewed in Figure 3. The shaft 61 extends through a housing plate 15f, the control chamber 15b and through a partition wall 15e for engagement with the coupling 47 of the timing motor. The motor 46 may have a suitable clutch therein for transmitting rotary motion to the shaft 61 when the latter is pressed inwardly as viewed in Figure 3. Said clutch (not shown) disengaging the timer motor and shaft when the latter is pulled outwardly. In the control chamber, mounted upon and intermediate of the ends of shaft 61, are a pair of timing cams 63 and 64 which are adapted to coact with the latching means and the valve means in a preselected time sequence. As best viewed in Figure 3, the lower cam 63 is fixedly mounted upon shaft 61 for direct coaction with lever arm 52 and hence valve member 23. The upper portion of cam 63 is enlarged and may have formed thereon a suitable toothed clutch surface which is engageable with mating grooves in the enlarged clutch surface of the upper cam 64. Cam 64 is preferably formed with a bevelled lower cam surface 64c and an upper eccentric cam surface 64b. Both cam surfaces 64b and 64c are operable to engage lever arm 58 in a manner as shall later be described. Cam 64 also may be formed with an integral tubular extension 64a which extends through cover plate 15f and terminates in a manually engageable knob 66.

Cam 64 and extension 64a are loosely disposed about the shaft 61, the clutch surface of the cam being biased into engagement with the clutch surface of cam 63 by a coiled compression spring 65 which is interposed between the button 60 and the cam knob 66. The relative positions of cams 64 and 63 may be varied by relative movement of cam knob 66 and button 60 which is permitted when the clutch surface of cam 63 and 64 are separated sufficiently to permit said relative movement. For example, an operator may insert his fingers underneath knob 66 and lift or pull the same outwardly against the bias of spring 65. As shown in Figure 4, this action separates the clutch surfaces of cams 63 and 64 permitting relative rotational movement of the parts as desired. Knob 66 and button 60 may be calibrated to indicate the relative position of cams 64 and 63. It is contemplated that the relative positions of cams 63 and 64 may also be calibrated with respect to a clock dial and further that the timer motor 46 may be used to supply power to a suitable clock works (not shown) which will also be used in conjunction with said dial.

A reset knob 70 is fixedly mounted on a reset shaft 71 which extends inwardly through plate 15f and terminates with cam 72. Cam 72 is formed with two oppositely disposed cam surfaces 73 and 40 so that clockwise rotation of shaft 71 as viewed in Figure 1 causes cam 72 and hence cam surface 73 to engage valve crank arm 51 while cam surface 40 simultaneously engages armature arm 33.

#### Operation

The operation of the device is as follows:

Assume the following initial conditions; valve member 22 seated upon seat 20 preventing all flow of fuel to the main burner; pilot valve member 42 seating on valve seat 41 preventing all flow of fuel to the pilot burner; thermoelectric generator 14 deenergized and hence electromagnet 35 deenergized; and armature 32 spaced away from pole face 36a under the bias of spring 22a as shown in Figure 1.

Assuming that the device is set for manual operation



5

and the housewife wishes to have the oven burner 10 automatically go on and shut off at predetermined pre-selected later times, the housewife follows the following procedures.

First, shut-off knob 60 and starting knob 66 are rotated relative to each other in the manner shown in Figure 4, i.e., knob 66 is lifted against the bias of spring 65 separating the clutch surfaces of cams 63 and 64 to permit relative movement as desired. Thus, the first step is to determine the initial relative positions of the upper or starting cam 64b and lower or shut-off cam 63 with respect to each other and, if desired, with respect to a clock dial (not shown). As will be more apparent later, cam surface 64b determines the starting time of the main burner 10 and cam 63 determines the shut-off time of the main burner 10. Knob 60 is then depressed so that the shaft 61 engages the timer motor through the clutch connection (not shown) so as to retain and rotate shaft 61 and cam members 63 and 64 at a predetermined constant speed to thereby provide the time control of the device as will be explained more fully. It is to be noted that depression of knob 60 does not cause separation of the clutch surfaces of cams 63 and 64 which remain in engagement under the bias of spring 65. In this manner, both cams 63 and 64 move downwardly upon depression of knob 60. In other words, the whole assembly surrounding shaft 61 moves downwardly with the depression of button 60.

Next, reset knob 70 is manually rotated so as to rotate cam 72 in a clockwise direction as shown in Figure 1, said movement causes cam surface 40 to engage armature arm 33 to position the armature 32 in engagement with the pole face 36a. The armature arm extension 31a engages pilot valve stem 34 moving said stem to the left as viewed in Figure 1 to thereby position valve 42 in flow-permitting position. Valve arm 24 and valve member 22 are simultaneously moved to open position.

The clockwise rotation of the cam 72 is such that reset cam surface 73 simultaneously engages lever arm 51 moving said arm counterclockwise as shown in Figure 1 to thereby position valve member 23 in engagement with seat 21 during the cocking operation. Thus, the fuel flow to the main burner is interrupted while flow of fuel to the pilot burner 12 is permitted.

After ignition of the pilot burner 12, thermocouple 14 produces a thermoelectric current which energizes electromagnet coil 37 so that the electromagnet 35 retains the armature in its attracted position against the bias of springs 43 and 22a and cam 72 may be allowed to return to the position shown in Figure 1. The armature 32 and valve members 42 and 22 remain in the cocked flow-permitting position until outage of the pilot burner. The indicator 39 upon the armature arm 33 is then in a position with respect to a suitable window (not shown) to indicate to the housewife that the pilot is burning and that the safety shut-off valve 23 and pilot valve 42 are in cocked flow-permitting position.

Since knob 60 was depressed causing shaft 61 to engage the drive shaft of the timing motor to start the timing sequence, cams 63 and 64 are now rotating under control of the timing motor. The initial inward movement of knob 60 caused the lower bevelled cam surface 64c of cam 64 to be moved downwardly out of engagement with latching release arm 58. At this point it might be noticed that when knob 60 is depressed for automatic timing operation, cam surface 64c which accompanies the movement has no part in the normal operation of the device. Cam surface 64c is operable to engage latching release arm 58 only during manual operation or when button 66 is lifted to get relative setting of cams 63 and 64. Thus the aforementioned movement of valve lever arm 51 to the left as viewed in Fig. 1 by the reset cam surface 73 for flow interruption purposes during the cocking of the safety shut-off armature also moves said lever 51 into position for latching coaction with spring loaded

6

lever arm 57 since cam surface 64c no longer prevents the latching. Valve member 23 is thus latched in engagement with seat 21, and, no fuel can flow to the main burner after the resetting operation until release of the latching lever 57 is effected. Thermostatic valve 11 is now opened and set at the desired temperature for later automatic operation of the oven.

As shaft 61 rotates, the upper eccentric cam surface 64b of cam 64 rotates into engagement with bell crank lever arm 58 to release valve lever arm 51 from latched engagement with spring loaded lever arm 57. The time at which the release is effected is determined by the initial positioning of the cam 64 and hence the eccentric cam surface 64b with respect to arm 58. Release of the latching coaction of arms 57 and 51 allows valve member 23 to move to open position under the bias of spring 28 and fuel may now flow to the main burner 10 through the thermostatic valve 11. The main burner 10 then becomes ignited by the pilot burner 12 and under control of the thermostatic valve 11. The oven remains under the control of valve 11 until lower cam 63 rotating in a clockwise direction rotates into engagement with valve lever 52 which is thereby moved in a counterclockwise direction to directly move the valve member 23 shut against the bias of spring 28, shutting off the fuel flow to the oven and thereby completing the time cycle.

To change the control back over to manual operation from the automatic operation described, the housewife pulls knob 60 outwardly which disengages shaft 61 from the timer motor 46 through the clutch (not shown) in the motor 46. Outward movement of shaft 61 moves cams 63 and 64 along therewith. The axial movement of shaft 61 causes cam 63 to move outwardly and disengage valve lever arm 52. An interlock affording positive opening of valve 23 when the device is changed from automatic to manual operation is provided by the cam surface 64c on cam 64. The frusto-conical bevelled surface 64c engages lever arm 58 upon the outwardly movement of shaft 61 to assure release of the latching engagement of latching arm 57 and valve lever arm 51. Thus when the device is in manual operation, the flow of the fuel is under the control of the thermostatic valve 11 and the safety shut-off valve 22.

Although a specific embodiment of the invention has been shown and described, it is with full awareness that many modifications thereof are possible. The invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

What is claimed as the invention is:

1. In combination, first and second control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling positions, flame responsive holding means for said first control means operable to hold said first control means in one of its said controlling positions when moved thereto against its biasing means, latching means for said second control means operable independently of said holding means to latch said second control means in one of its said controlling positions when moved thereto against its biasing means, and reset means cooperating with both said control means and operable against the bias of both of said biasing means to effect holding cooperation of said first control means with said holding means and to effect simultaneous latching cooperation of said second control means with said latching means.

2. In combination, first, second and third control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling positions, holding means for both said first and said third control means operable to hold each of said first and third control means in one of its said controlling positions when moved thereto against its biasing means, latching means for said second control means operable independently of said holding means to latch said second



control means in one of its said controlling positions when moved thereto against its biasing means, and reset means cooperating with all of said control means and operable against the bias of each of said biasing means to effect holding cooperation of said first and third control means with said holding means and to effect latching cooperation of said second control means with said latching means.

3. In combination, first and second control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling positions, electroresponsive holding means for said first control means operable when energized to hold said first control means in one of its said controlling positions when moved thereto against its biasing means, mechanical latching means for said second control means operable independently of said holding means to mechanically latch said second control means in one of its said controlling positions when moved thereto against its biasing means, and reset means cooperating with both said control means and operable against the bias of both of said biasing means to effect holding cooperation of said first control means with said holding means and to effect simultaneous mechanical latching cooperation of said second control means with said latching means.

4. In combination, first and second control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling positions, holding means for said first control means operable to hold said first control means in one of its said controlling positions when moved thereto against its biasing means, latching means for said second control means operable independently of said holding means to latch said second control means in one of its said controlling positions when moved thereto against its biasing means, reset means cooperating with both said control means and operable against the bias of both of said biasing means to effect holding cooperation of said first control means with said holding means and to effect latching cooperation of said second control means with said latching means, and actuating means operatively associated with said second control means and also operable to effect movement of said second control means against the bias of its biasing means and into latching cooperation with said latching means.

5. In combination, first and second control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling positions, holding means for said first control means operable to hold said first control means in one of its said controlling positions when moved thereto against its biasing means, releasable latching means for said second control means operable independently of said holding means to latch said second control means in one of its said controlling positions when moved thereto against its biasing means, reset means cooperating with both said control means and operable against the bias of both of said biasing means to effect holding cooperation of said first control means with said holding means and to effect latching cooperation of said second control means with said latching means, and timing operator means operatively associated with said latching means and with said second control means for effecting, at a preselected time, release of said latching means for disposition of said second control means in the controlling position toward which it is biased by its biasing means, said operator means also being operable, at a preselected later time, to effect movement of said second control means against the bias of its biasing means and toward latching cooperation with said latching means.

6. In combination, first and second control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling positions, electroresponsive holding means for said first control means operable in response to a predetermined condition to hold said first control means in

one of its said controlling positions when moved thereto against its biasing means, latching means for said second control means operable independently of said holding means to latch said second control means in one of its said controlling positions when moved thereto against its biasing means, reset means cooperating with both said control means and operable against the bias of both of said biasing means to effect simultaneous holding cooperation of said first control means with said holding means and to effect latching cooperation of said second control means with said latching means, and manually operated means for rendering said latching means inoperative to thereby effect disposition of said second control means in the controlling position toward which it is biased by its biasing means.

7. In combination, first and second control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling positions, holding means for said first control means operable to hold said first control means in one of its said controlling positions when moved thereto against its biasing means, releasable latching means for said second control means operable independently of said holding means to latch said second control means in one of its said controlling positions when moved thereto against its biasing means, reset means cooperating with both said control means and operable against the bias of both of said biasing means to effect holding cooperation of said first control means with said holding means and to effect latching cooperation of said second control means with said latching means, timing operator means operatively associated with said latching means and with said second control means for effecting, at a preselected time, release of said latching means for disposition of said second control means in the controlling position toward which it is biased by its biasing means, said operator means also being operable, at a preselected later time, to effect movement of said second control means against the bias of its biasing means and toward latching cooperation with said latching means, and manually operated means for operatively disassociating said timing operator means from said latching means and second control means.

8. A fuel control device comprising a control body having a fluid passage, first and second flow control means in said passage each having open and closed positions with respect to fluid flow through said passage, means biasing said first flow control means toward closed position, flame responsive holding means for said first control means operable to hold said first control means in open position when moved thereto against its biasing means, means biasing said second flow control means toward open position, latching means for said second control means operable independently of said holding means to latch said second control means in closed position when moved thereto against its biasing means, and reset means cooperating with both said control means and operable against the bias of both of said biasing means to effect opening movement of said first control means for holding cooperation thereof with said holding means and to effect simultaneous closing movement of said second control means for latching cooperation thereof with said latching means.

9. A fuel control device comprising a control body having a fluid passage, first and second flow control means in said passage each having first and second flow controlling positions, means biasing each of said flow control means toward one of said controlling positions, holding means for said first flow control means operable to hold said first flow control means in one of its said controlling positions when moved thereto against its biasing means, timing operator means operatively associated with the second of said flow control means only and operable at a preselected time to permit movement of said second flow control means to the position toward which



it is biased by its biasing means, said operator means also being operable at a preselected later time to effect movement of said second flow control means against the bias of its biasing means toward another flow controlling position, and reset means cooperable with said first flow control means and operable to effect movement of said first flow control means against the bias of its biasing means and into holding cooperation with said holding means, said reset means also being operable to overcall said timing operator means and effect movement of said second flow control means against the bias of its biasing means toward said another flow controlling position during a resetting operation.

10. A fuel control device comprising a control body having a fluid passage, first and second valves in said passage each having open and closed positions with respect to fluid flow through said passage, means biasing said first valve toward closed position, holding means for said first valve means operable to hold said first valve in open position when moved thereto against its biasing means, means biasing said second valve toward open position, timing operator means operatively associated with the second of said valve only and operable at a preselected time to permit movement of said second valve toward open position, said operator means also being operable at a preselected later time to effect movement of said second valve toward closed position, and reset means cooperable with said first valve and operable to effect movement of said first valve toward open position and into holding cooperation with said holding means, said reset means also being operable to overcall said timing operator means and effect movement of said second valve toward closed position during a resetting operation.

11. In combination, first and second control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling positions, holding means for said first control means operable to hold said first control means in one of its said controlling positions when moved thereto against its biasing means, releasable latching means for said second control means operable independently of said holding means to latch said second control means in one of its said controlling positions when moved thereto against its biasing means, reset means cooperating with both said control means and operable against the bias of both of said biasing means to effect holding cooperation of said first control means with said holding means and to effect latching cooperation of said second control means with said latching means, and timing operator means operatively associated with said latching means and with said second control means for effecting, at a first preselected time interval, release of said latching means for disposition of said second control means in the controlling position toward which it is biased by its biasing means, said operator means also being operable, at a second preselected later time interval, to effect movement of said second control means against the bias of its biasing means and toward latching cooperation with said latching means, and setting means for said timing operator means movable to one position operatively disassociating said timing operator means from said latching means and second control means and movable to another position operatively associating said operator means with said latching means and second control means, said setting means including means for preselecting said first and second time intervals.

12. A time controlled fuel control device comprising, a control body having a fluid passage, first and second flow control means in said passage each having open and closed positions with respect to fluid flow through said passage, means biasing said first flow control means toward closed position, holding means for said first control means operable to hold said first control means in open position when moved thereto against its biasing means, means biasing said second flow control means toward

open position, releasable latching means for said second control means operable independently of said holding means to latch said second control means in closed position when moved thereto against its biasing means, reset means cooperating with both said control means and operable against the bias of both of said biasing means to effect holding cooperation of said first control means with said holding means and to effect latching cooperation of said second control means with said latching means, and timing operator means operatively associated with said latching means and with said second control means for effecting, at a preselected time, release of said latching means for disposition of said second control means in open position, said operator means also being operable, at a preselected later time, to effect closing movement of said second control means and latching cooperation thereof with said latching means.

13. In combination, first, second and third control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling positions, holding means for both said first and said third control means operable to hold each of said first and third control means in one of its said controlling position when moved thereto against its biasing means, latching means for said second control means operable independently of said holding means to latch said second control means in one of its said controlling positions when moved thereto against its biasing means, reset means cooperating with all of said control means and operable against the bias of each of said biasing means to effect holding cooperation of said first and third control means with said holding means and to effect latching cooperation of said second control means with said latching means, and timing operator means operatively associated with said latching means and with said second control means and operable to effect release of said latching cooperation for disposition of said second control means in the controlling position toward which it is biased, said timing operator means also being operable to effect movement of said second control means against the bias of its biasing means and toward latching cooperation with said latching means.

14. In combination, first and second control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling position, electro-responsive holding means for said first control means operable when energized to hold said first control means in one of its said controlling positions when moved thereto against its biasing means, releasable mechanical latching means for said second control means comprising a pivotally mounted bell crank having an arm operable independently of said holding means to latch said second control means in one of its said controlling positions when moved thereto against its biasing means, reset means comprising rotatably mounted cam means cooperating with both said control means and operable against the bias of both of said biasing means to effect holding cooperation of said first control means with said holding means and to effect latching cooperation of said second control means with said latching means, and timing operator means comprising motor driven cam means operatively associated with said latching means to effect release of said latching means for disposition of said second control means in the controlling position toward which it is biased by its biasing means, said operator means also being operatively associated with said second control means to effect movement of said second control means against the bias of its biasing means and toward latching cooperation with said latching means.

15. In combination, first and second control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling positions, flame responsive holding means for said first control means operable to hold said first con-



11  
 12  
 13  
 14  
 15  
 16  
 17  
 18  
 19  
 20  
 21  
 22  
 23  
 24  
 25  
 26  
 27  
 28  
 29  
 30  
 31  
 32  
 33  
 34  
 35  
 36  
 37  
 38  
 39  
 40  
 41  
 42  
 43  
 44  
 45  
 46  
 47  
 48  
 49  
 50

trol means in one of its said controlling positions when moved thereto against its biasing means, latching means for said second control means comprising a pivotally mounted latching member operable independently of said holding means to latch said second control means in one of its said controlling positions when moved thereto against its biasing means, and reset means including cam means cooperating with both said control means and operable against the bias of both of said biasing means to effect holding cooperation of said first control means with said holding means and to effect simultaneous latching cooperation of said second control means with said pivotally mounted latching member.

16. In combination first and second control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling positions, holding means for said first control means operable to hold said first control means in one of its said controlling positions when moved thereto against its biasing means, timing operator means operatively associated with the second of said control means only and operable to permit movement of said second control means to the position toward which it is biased by its biasing means, said operator also being operable to effect movement of said second control means against the bias of its biasing means toward another controlling position, and reset means cooperable with said first control means and operable to effect movement of said first control means against the bias of its biasing means and into holding cooperation with said holding means, said reset means also being operable to effect movement of said second control means against the bias of its biasing means toward said another controlling position during a resetting operation.

17. A fuel control device comprising first and second control means each having first and second controlling positions, means biasing each of said control means toward one of said controlling positions, holding means responsive to the heat of burning fuel for holding said first control means in one of its said controlling positions when moved thereto against its biasing means, timing operator means operatively associated with the second of said control means only and operable to permit movement of said second control means to the position toward which it is biased by its biasing means, said operator means also being operable to effect movement of said second control means against the bias of its biasing means toward another controlling position, and reset means cooperable with said first flow control means and operable to effect movement of said first flow control means

against the bias of its biasing means and into holding cooperation with said holding means, said reset means also being operable to effect disposition of said second flow control means in its said another flow controlling position irrespective of the operation of said timing operator means during a resetting operation.

18. A fuel control device for main and pilot burners comprising a control body having a fluid passage, first and second flow control means in said passage each having first and second flow controlling positions for control of fuel flow to one of said burners, means biasing said first flow control means toward its first controlling position, holding means for said first flow control means operable in response to the heat of burning fuel at the other of said burners to hold said first flow control means in its said second controlling position when moved thereto against its biasing means, means biasing said second flow control means toward its said second controlling position, timing operator means operatively associated with the second of said flow control means only and operable at a preselected time to effect disposition of said second flow control means in its said second position, said operator means also being operable at a preselected later time to effect movement of said second flow control means against the bias of its biasing means toward its said first controlling position, and reset means cooperable with both said flow control means and operable to effect movement of said first flow control means against the bias of its biasing means toward its said second controlling position and into holding cooperation with said holding means, said reset means also being operable to overcall said timing operator means and effect movement of said second flow control means against the bias of its biasing means toward its said first flow controlling position during a resetting operation.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

1,945,109	Fonseca	Jan. 30, 1934
2,208,956	Allenbaugh	July 23, 1940
2,303,627	Wantz	Dec. 1, 1942
2,564,869	Weber	Aug. 21, 1951
2,642,128	Riehl	June 16, 1953
2,693,232	Hoff et al.	Nov. 2, 1954
2,726,717	Strobel	Dec. 13, 1955
2,779,400	Hollman	Jan. 29, 1957
2,799,454	Rouse	July 16, 1957
2,844,201	Leins	July 22, 1958