Sept. 13, 1949. B. HAYTER 2,481,663

MODULATING CONTROL

Filed Feb. 9, 1945 2 Sheets-Sheet 1

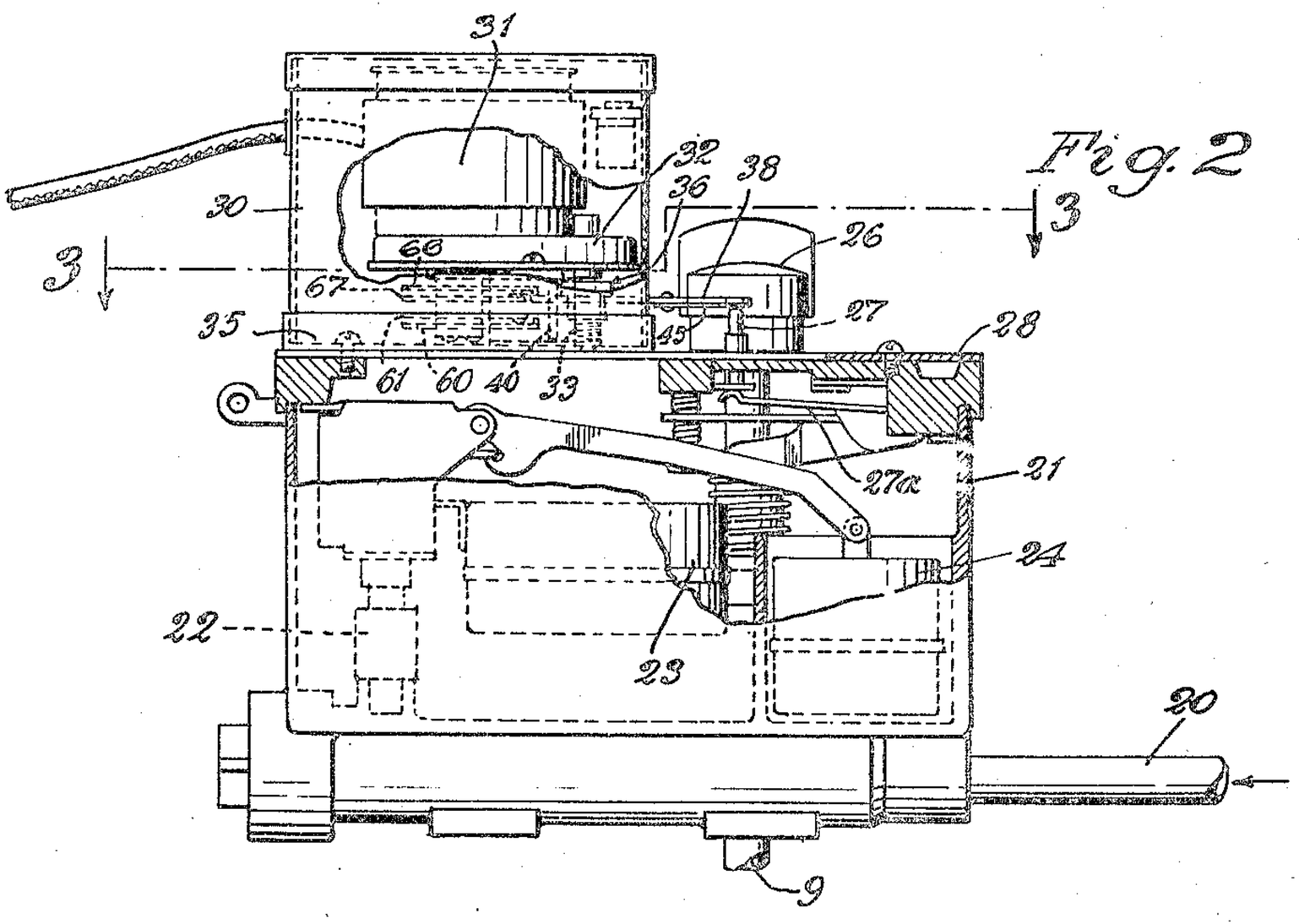


Fig. 2

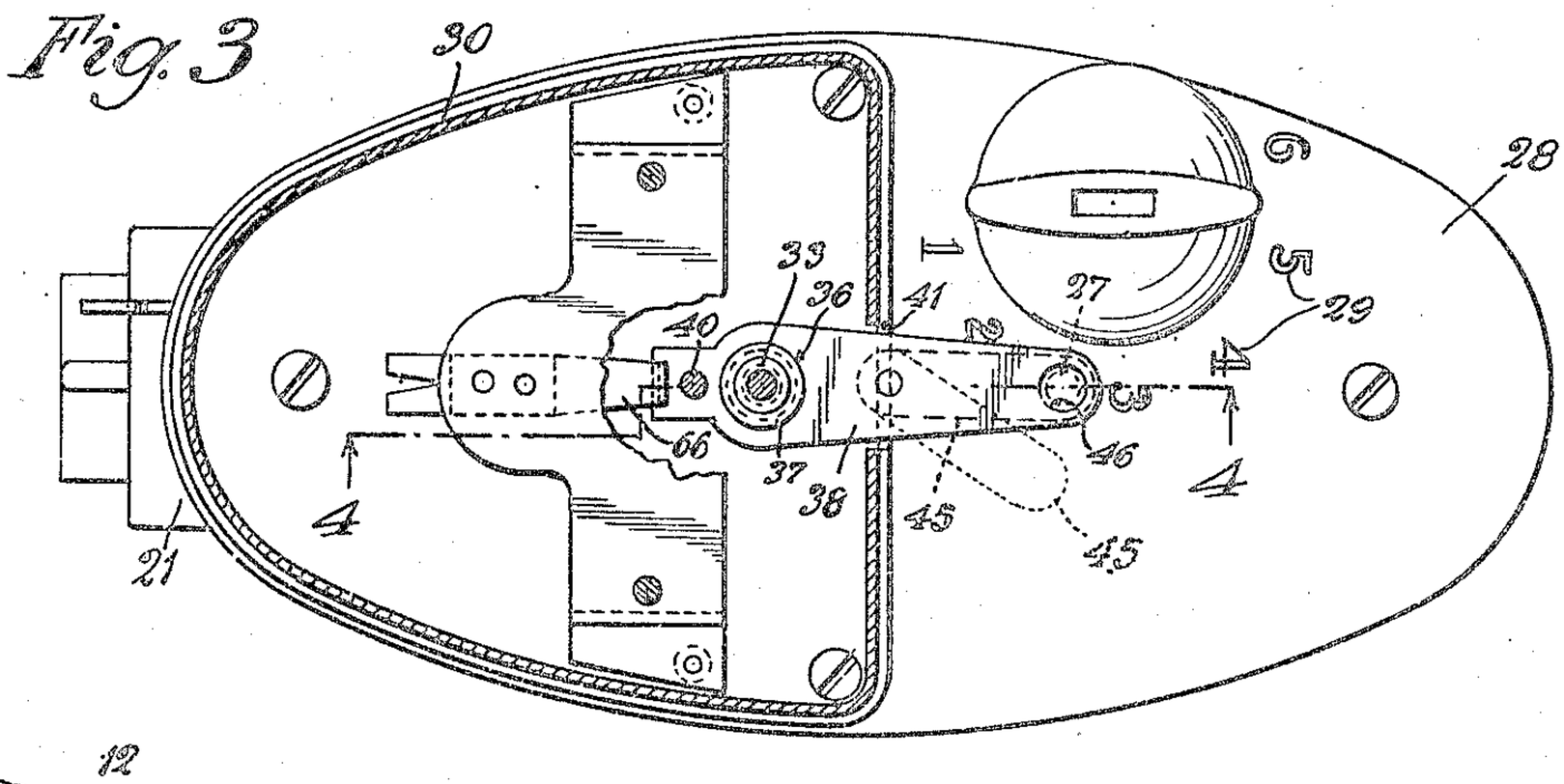


Fig. 3

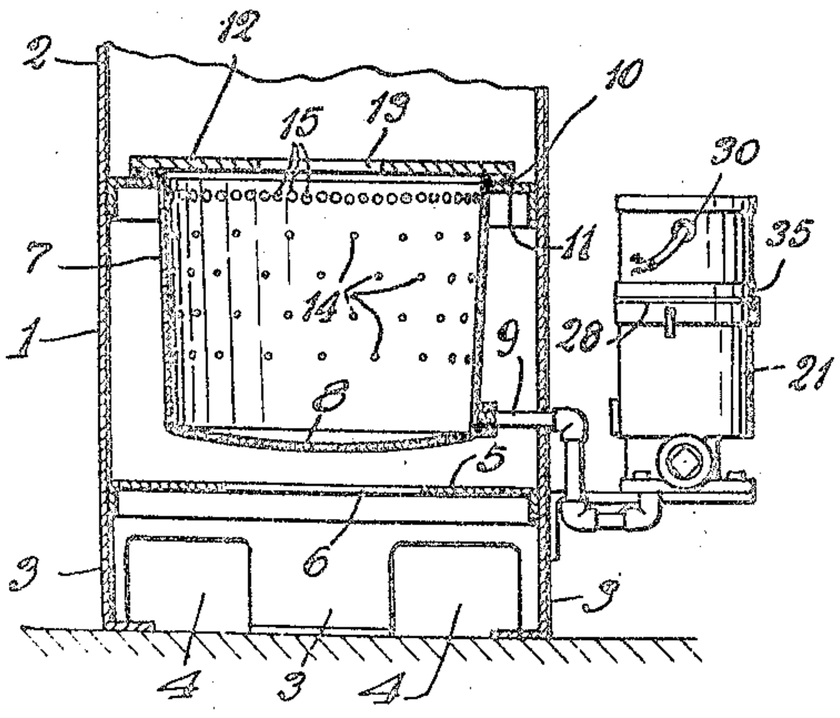


Fig. 1

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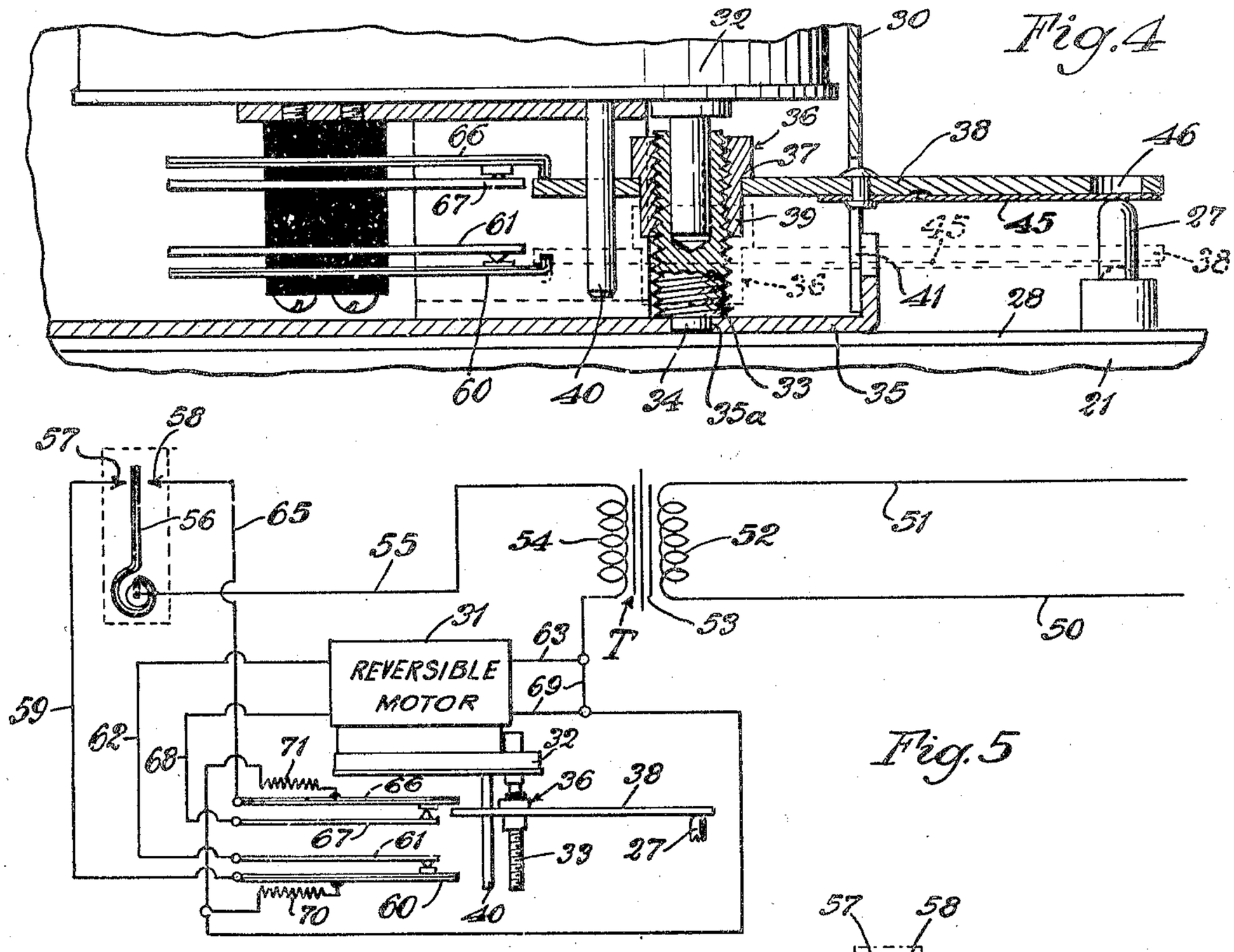


Fig. 4

Fig. 5

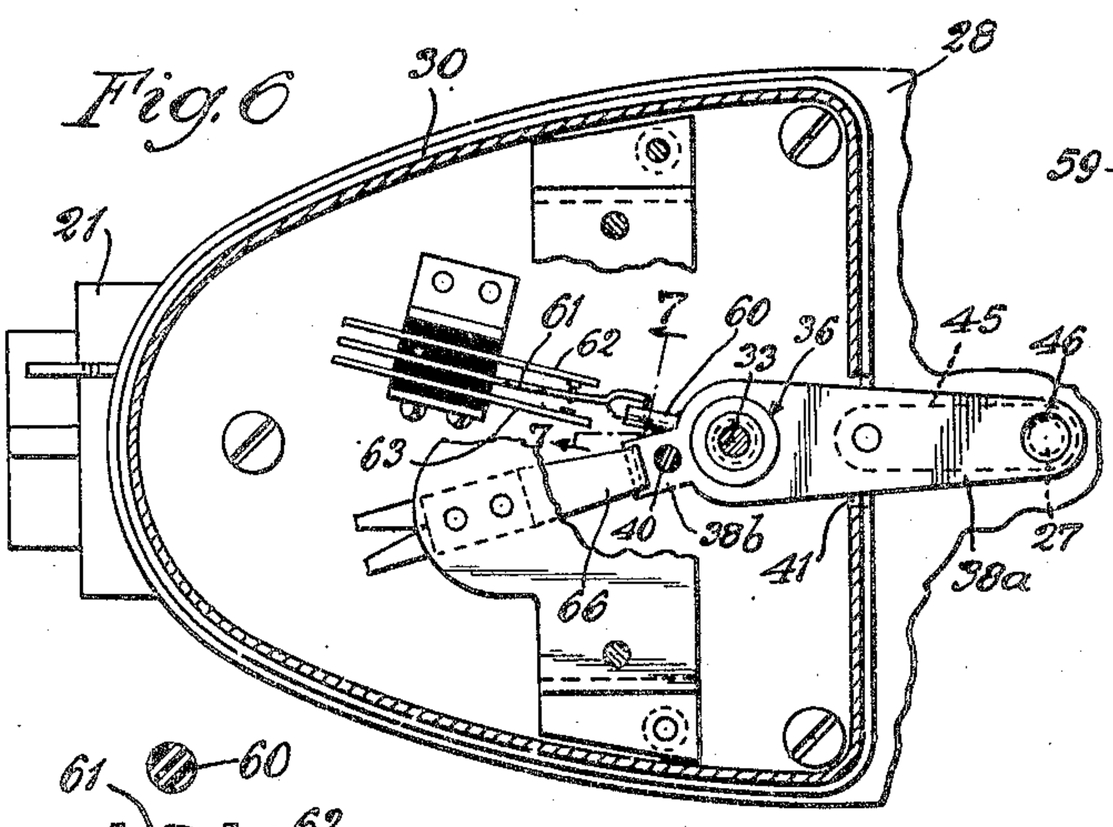


Fig. 6

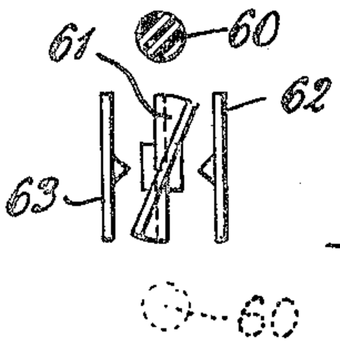


Fig. 7

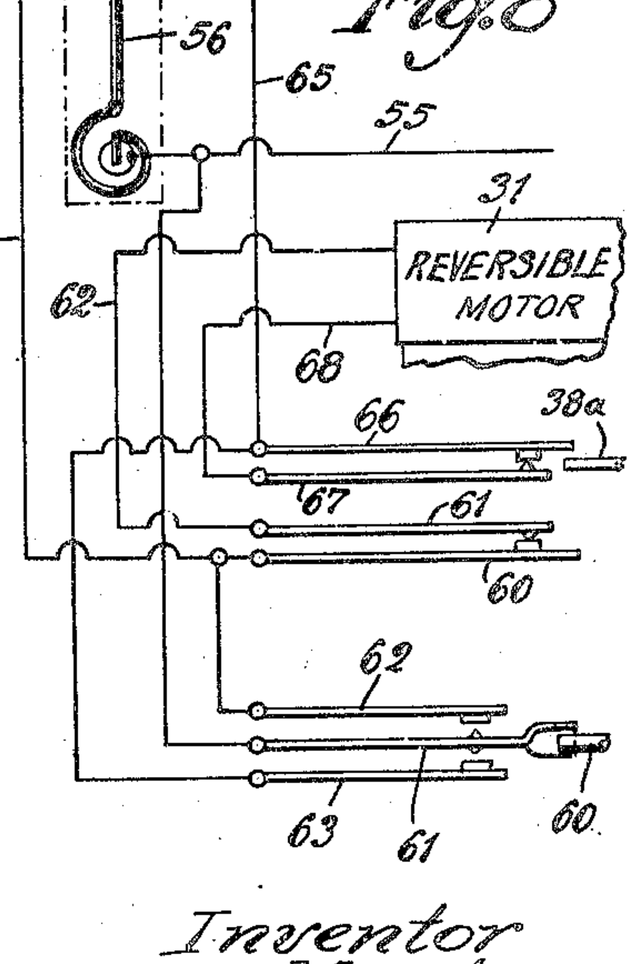


Fig. 8

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UNITED STATES PATENT OFFICE

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MODULATING CONTROL

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Application February 9, 1945, Serial No. 577,084

5 Claims. (Cl. 236—74)

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This invention relates to an improvement in control means for burners and has for one purpose to provide an improved floating or modulating control for liquid fuel burners.

Another purpose is to provide an improved floating or modulating control adaptable for use with pot type liquid fuel burners operated on natural draft.

Another purpose is to provide an improved control means for modulating the rate of flow of liquid fuel to a burner in order to prevent undesired fluctuations of temperature from the space to be heated.

Another purpose is to provide improved floating or modulating heat responsive control means for oil burners.

Another purpose is to provide a floating or modulating control employable in addition to ordinary manual control.

Other purposes will appear from time to time in the course of the specification and claims.

The invention is illustrated more or less diagrammatically in the accompanying drawings wherein:

Figure 1 is a vertical section through a burner illustrating the control structure in side elevation;

Figure 2 is a side elevation of the control unit with parts broken away and parts in section;

Figure 3 is a section on an enlarged scale on the line 3—3 of Figure 2;

Figure 4 is a section on an enlarged scale on the line 4—4 of Figure 3;

Figure 5 is a wiring diagram;

Figure 6 is a horizontal section through a variant form.

Figure 7 is a section on the line 7—7 of Figure 6; and

Figure 8 is a wiring diagram illustrative of the use of the form shown in Figures 6 and 7.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings 1 generally indicates an outer housing the upper portion 2 of which may serve as the combustion chamber of a heater or stove. 3 are downward extensions or supporting legs defining between them air inlet apertures or gaps 4. 5 is a transversely extending partition centrally apertured as at 6 to permit air to enter about the pot 7. The pot 7 has a generally concave bottom 8 through which liquid fuel may be delivered along an inlet duct 9. The pot has an upper flange 10 resting upon a supporting partition or angle ring 11. The otherwise open end of the pot is partially closed by a flame ring

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12 having a central aperture 13. Air is admitted to the interior of the pot through a plurality of primary air inlets 14 circumferentially spaced about the side wall of the pot and arranged at varying distances from the ends of the pot. Secondary air may be admitted by the secondary air inlet apertures 15 which are shown as larger and more closely spaced than the primary air inlets 14. They are preferably upwardly inclined toward the aperture 13 of the flame ring. It will be understood that the invention may be applied to other types of burner but the type herein described and shown in Figure 1 is well adapted for use, with the particular control device or system herein described and shown. It will be understood that liquid fuel is delivered, at varying rates of flow, along the ducts 9 to the interior of the burner pot. In Figure 1 is illustrated a vertically axised pot in which the liquid fuel is delivered to the concave bottom 8 of the pot and is vaporized in response to combustion taking place in or above the pot. As the liquid fuel is vaporized it is mixed with primary air from the apertures 14, which produces a primary or partly combustible mixture. This primary mixture moves toward the apertures 13 of the flame ring and receives secondary air through the apertures 15. The final mixture thus formed is burned at or above the top of the pot. It will be understood that where the pot is horizontally axised or arranged otherwise as shown in Figure 1, any suitable means may be provided for receiving the liquid fuel for vaporization.

The rate of flow of the fuel may vary from a minimum or pilot stage to high fire stage. In order to control the rate of flow of the liquid fuel I illustrate a known type of float valve assembly. It will be understood that liquid fuel from any suitable source may be delivered along an inlet duct 20. It reaches the interior of the float valve housing 21 past any suitable valve diagrammatically indicated at 22. The level of liquid fuel in the housing 21 may be controlled by any suitable floats 23, 24. Since the details of the float valve assembly do not of themselves form part of the present invention it will not be further described except to say that the rate of flow of liquid fuel along the duct 9 of the burner pot may be varied by rotation of the manual knob 26 or of axial movement of the control button 27. The details whereby this control are obtained are not described. 28 indicates any suitable cover plate for the housing 21. It is apertured to permit the upward extension of the control button 27. The oil control knob 26

is also located above the cover plate **28** which may be suitably calibrated as at **29** to permit manual control when necessary or desired. **30** indicates a housing removably positioned on the top of the cover plate **28**. Located within it is a slow moving reversing motor **31** which, through any suitable gear reduction **32**, the details of which do not form part of the present invention, rotates the threaded adjusting member **33** which is rotatably centered as by its lower portion **34** extending into any suitable bearing aperture **35***a* in the bottom element **35** of the housing **30**. Movable along the screw **33** is a nut **36** having an upper enlarged portion **37** forming a ledge bearing against the top of a thrust member **38**. The nut has a portion **39** which extends through the thrust member and is fixed in relation thereto. Rotation of the thrust member and of the nut is prevented by the pin **40** which extends through and into the thrust member. The opposite end of the thrust member extends outwardly through a gap or aperture **41** in the side wall of the housing **30** and overlies the oil flow controlling button **27**. It will be understood that the button **27** is normally moved toward minimum flow position as by any suitable spring means **27***a*. As the button **27** is depressed the rate of flow of liquid fuel along the duct **9** to the burner is increased. It will be understood that as the screw **33** is rotated in one direction it may be employed to move the thrust member **38** downwardly against the button **27**, from the full line to the dotted line position of Figure 4, thus increasing the rate of fuel flow to the burner. Rotation of the reversing motor **31** in the opposite direction will move the member **38** upwardly and the spring **27***a* will raise the pin **27** and decrease the rate of flow of liquid fuel to the burner. If it is desired to operate the device manually the modulating control can be cut out by rotating the pivoted member **45**, from the full line to the dotted line position of Figure 3. This unmasks an aperture **46** in the member **38** through which the button **27** may pass, and modulating control is terminated.

Referring to the wiring diagram of Figure 5, **50**, **51** indicates a line circuit from any suitable source of electric power. T is a transformer having a primary coil **52**, a core **53**, and a secondary coil **54**. The secondary or low voltage circuit may be traced as follows: A conductor **55** extends to any suitable room thermostat, to the thermostatic leaf or warping bar **56**. The thermostat is shown as having two normally fixed contacts **57** and **58**. **59** is a conductor extending from the contact **57** to the limit switch contact **60** opposed to the contact **61**. **62** is a conductor extending from the contact **61** to the reversible motor **31**.

63 is a conductor extending from the reversible motor to the transformer secondary coil **54**. From the thermostat contact **58** is a conductor **65** which extends to the limit switch contact **66**. From the opposite limit switch contact **67** a conductor **68** extends to the reversible motor. The circuit is continued by a conductor **69** extending to the conductor **63** and thus to the coil **54**.

With reference to Figures 4 and 5 it will be noted that the movable limit switch contacts or blades **60** and **66** are in the line of movement of the member **38**. Thus the limit of the adjustment of the button **27** by the member **38** is controlled, and the circuit for the reversible motor is broken, at each limit of movement of the member **38**, by the impingement of the member **38** against the member **66** or **60**.

With reference to the form of Figures 6 to 8 inclusive, the member **38***a* is provided with an offset **38***b* which performs the same function as the corresponding offset in the form of Figure 3, but is inclined to the rest of the member **38**. Secured to the member **38***a* is a pin **60** of insulating material which is adapted to operate the intermediate movable switch member **61** which is movable between the normally fixed switch members **62** and **63**. The switch members **61**, **62** and **63** are connected in parallel with the members **56**, **57** and **58** of the room thermostat. The wiring diagram is otherwise identical with the diagrammatic showing of Figure 5 and like parts are given like indicating symbols. It will be understood that the pin **60** is effective to keep either the switch members **61** and **62** or switch members **61** and **63** in closed position, regardless of the position of the thermostat leaf **56**, when the pin **60** is at the right level in the vertical travel of the member **38***a*. Thus any predetermined range may be cut out, and modulation may be prevented, for example in the range between pilot fire and intermediate fire. The range through which the pin **60** is effective to prevent modulation may be varied to suit particular conditions, by a suitable variation in the size, location and proportion of the pin and the cooperating switch parts.

It will be realized that, whereas, I have described and illustrated a practical and operative device, nevertheless many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of the invention. I therefore wish my description and drawings to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting me to my precise showing.

For instance the system may be employed with a wide variety of oil burners and may also be employed with burners employing a gaseous fuel, where modulation of the rate of fuel delivery is desired.

The use and operation of the invention are as follows:

The invention is illustrated in connection with a natural draft burner of the hydroxylating pot type. The floating or modulating control is superimposed on the normal manually operable oil flow control in which the knob **26** may be used for manual adjustment of any suitable oil flow controlling valve which controls the rate of flow of fuel along the duct **9**. If the user prefers to employ the manual control, or if the modulating control is out of order, the user can move the blade **45** to the dotted line position of Figure 3, thereby permitting the button **27** to extend through the aperture **46** of the member **38**. This entirely interrupts the operation of the actuating connection between the modulating control system and the oil flow supply.

Assume that the device is operating as a floating or modulating control, with the blade **45** masking the aperture **46**, then the modulating system works on the button **27**. As the button **27** is spring thrust upwardly to the limit of its possible upward movement, its downward movement and its return upward movement is entirely controlled by downward and upward movement of the member **38**. Assume that the house thermostat is satisfied and the leaf or contact **56** is in the intermediate position in which it is shown in Figure 5, the reversible motor is not energized and is not rotated, and the

nut **36** is in fixed position, and with it the member **38**. Assume that there is a change in the temperature of the heated space and the thermostat leaf **56** moves to close the cold contact, calling for heat, a circuit is closed through the reversible motor, and its rotor begins to rotate and drive the nut **36**. Rotation of the member **33** is then effective to depress the nut **36** and with it the member **38** and the button **27**. The rate of flow of liquid fuel increases, and the burner burns at a higher stage. Shortly an increase in the temperature of the heated space returns the thermostat leaf **56** to intermediate position. If the result is overheating, then the leaf **56** contacts the opposite or hot contact and the reversible motor rotates in the opposite direction. The result is to raise the member **38** and to permit the spring **27***a* to raise the button **27** and to decrease the rate of flow of the liquid fuel. In practice a balance is shortly reached, with the thermostat satisfied and the leaf **56** in intermediate position, the rate of flow of liquid fuel being properly controlled in relation to the necessary heat delivery to the heated space.

The upward and downward limit of movement of the button **27**, or the maximum and minimum weight of liquid fuel flow, may be controlled by the limit switches shown for example in Figures 4 and 5. When the member **38** breaks the limit switch contact **66**, the button **27** can go no higher, and a minimum possible flow is thus provided. Similarly when the member **38** breaks the limit switch contact **60**, the button **27** can go no lower, and this establishes a maximum fuel flow rate. If desired anticipators such as the resistances **70** and **71** may be associated with the limit switch leaves or contacts **60** and **66** which, in that event, may be bi-metals, spring or warping bars. Any suitable circuit for the anticipators may be employed including the conductors.

The limit switches may be so positioned that there is a small amount of excess travel of the leaf spring, so that in the final position the oil stem button **27** will be all the way up, or all the way down, on the pilot fire. Any excess travel downward may be taken up in the spring action of the leaf spring. In the actual operation of the device, when the thermostat blade **56** stands between the contacts **57** and **58**, the reversible motor **31** is stationary and the oil stem button **27** remains at its point of last setting. The thermostat is effective, after modulation, to set the oil flow to maintain the heat output at just the right amount to keep the thermostat satisfied.

The above described control is suitable not only for new installations but can be adapted to present field installations, since it can be attached to float valve assemblies which are already on the market and in common use. It has the further advantage that in the case of failure, such as current failure, manual control can be resorted to by the use of the manual knob **26**. Whereas in Figure 5 a transformer is illustrated for permitting the above modulating control system to be operated from commercial line current, an ordinary low voltage battery may be employed, since low voltage reversing motors are available.

By employing the switch mechanism **60**, **61**, **62** and **63** of Figure 6, I can also cut out the modulation through any desired range in the travel of the member **38***a* between the limit switches **60** and **66**.

I claim:

1. In a control for oil burner float valve assemblies having a primary manually operable valve

control member and a secondary valve control member, means for controlling the secondary valve control member including a reversible rotary motor, a movable control member adapted to be opposed to said secondary control member, a driving connection between said reversible motor and said movable control member, means for causing said motor to rotate in one direction in response to overheating of the space to be heated and for causing it to rotate in an opposite direction in response to underheating of the space to be heated, limit switch means, in circuit with said reversible motor, adapted to limit the possible excursion of said movable control member in either direction, and means for terminating the actuating connection between the movable control member and the secondary valve control member without otherwise effecting the operation of the control.

2. In a conversion unit adapted to be applied to a float valve assembly for liquid fuel valve assemblies having an exterior manual control knob and an exteriorly extending secondary valve control element, a housing, a reversible rotary motor in said housing, a control arm having a portion aligned with and opposable to said secondary valve control member, means for moving said control arm in response to rotation of said reversible motor in either direction, said control arm being apertured in alignment with said secondary valve control member, means for normally closing said aperture and for thereby maintaining an operative relationship between said control arm and said secondary valve control member, including a closure for said aperture adapted to be moved to aperture opening position, whereby, when said closure is so moved, the actuating connection between the valve control member and the control arm is terminated.

3. In a conversion unit adapted to be applied to a float valve assembly for liquid fuel valve assemblies having an exterior manual control knob and an exteriorly extending secondary valve control element, a housing, a reversible rotary motor in said housing, a control arm having a portion aligned with and opposable to said secondary valve control member, means for moving said control arm in response to rotation of said reversible motor in either direction, means for normally maintaining an operative relationship between said control arm and said secondary valve control, and for interrupting said operative relationship while permitting movement of said control arm and rotation of said motor.

4. In combination with a float valve housing having a flow control member projecting for longitudinal movement, a control housing mounted on the valve housing, a reversing motor and an actuating member in the control housing, a screw and nut connection between them whereby motor rotation displaces the actuating member laterally, a connection between the actuating member and the flow control member whereby movement of the actuating member operates the flow control member, an electric circuit including the motor and having forward and reverse branches, limit switches, one in each branch in opposition to the actuating member whereby at each end of its excursion it operates one of the switches, a room thermostat having contacts adapted selectively to energize one of the motor circuit branches, a by-pass circuit in parallel with the thermostat, a selector switch therein, connections between the selector switch and the limit switch controlled circuits, means carried by the

actuating member for operating the selector switch to connect the by-pass circuit selectively to one of the motor circuit branches.

5. In combination with a float valve housing having a flow control member projecting for longitudinal movement, a control housing mounted on the valve housing, a reversing motor and an actuating member in the control housing, a screw and nut connection between them whereby motor rotation displaces the actuating member laterally, a connection between the actuating member of the flow control member whereby movement of the actuating member operates the flow control member, an electric circuit including the motor and having forward and reverse branches, limit switches, one in each branch in opposition to the actuating member whereby at each end of its excursion it operates one of the switches, a room thermostat having contacts adapted selectively to energize one of the motor circuit branches, a by-pass circuit in parallel with

the thermostat, a selector switch therein, connections between the selector switch and the limit switch controlled circuits, means carried by the actuating member operative intermediate the limits of the excursions of the actuating member for operating the selector switch to connect the by-pass circuit selectively to one of the motor branches.

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