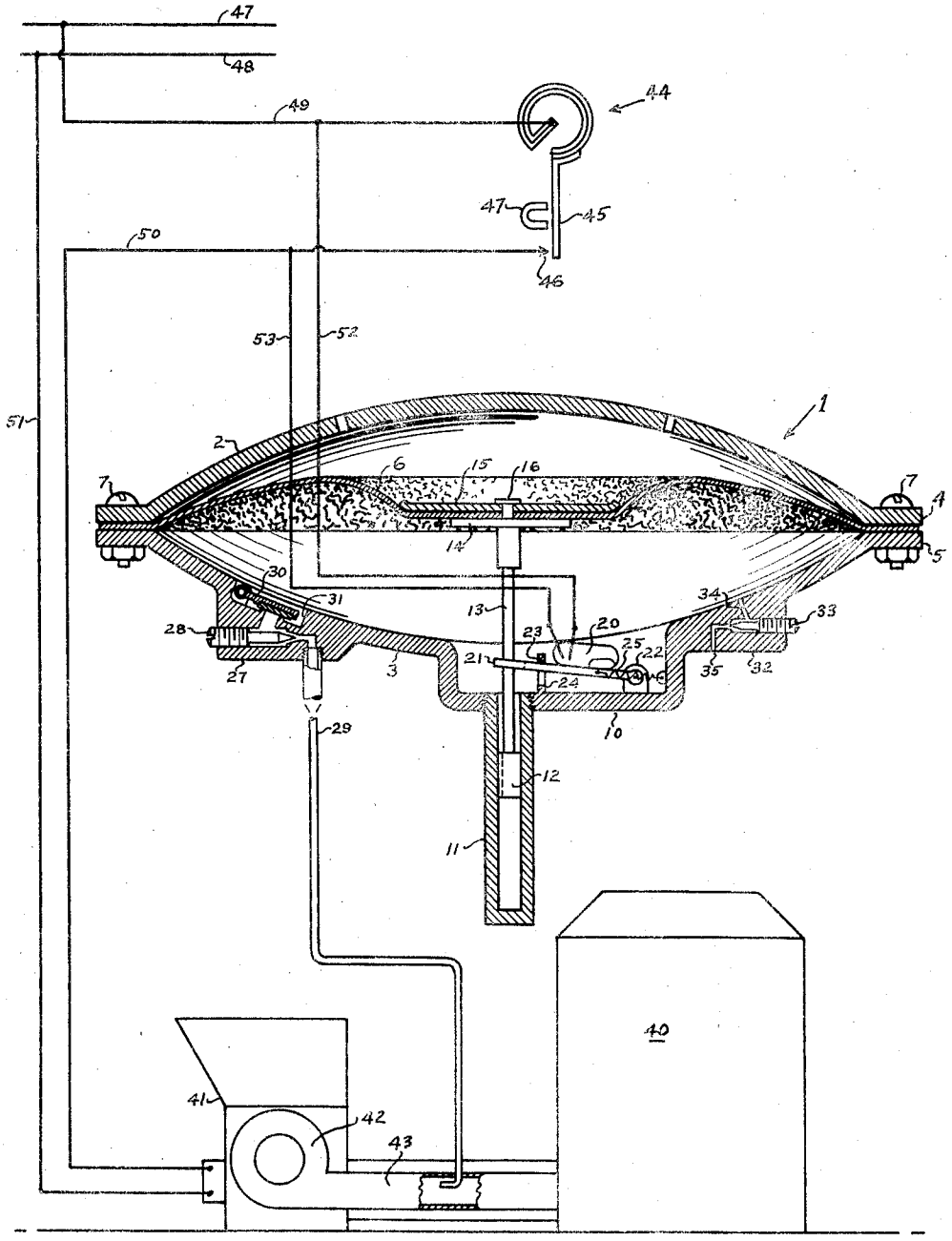
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STOKER CONTROL SYSTEM

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Inventor

Frederick S. Denison

By

George H Fisher

Attorney

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STOKER CONTROL SYSTEM

Frederick S. Denison, Minneapolis, Minn., assignor to Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., a corporation of Delaware

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My invention relates to automatic control of solid fuel feeding devices in heating systems and is more particularly concerned with a novel timing apparatus for periodically operating the fuel feeding device for short intervals to maintain a fire when no heating is being required.

In the past it has been necessary to employ clock mechanisms to satisfactorily time the operation of automatic fuel feeding devices such as stokers so as to prevent furnace fires from going out during mild weather when the periods between thermostatic calls for heat are relatively long. Clock movements and electrical clock timers and the like while satisfactory for the purpose are also relatively expensive and are more or less delicate in construction. I have invented a pneumatic timing device of very rugged and inexpensive construction whereby I can accurately and automatically time stoker operation without the need of clocks or the like and therefore resulting in a substantial reduction in first cost of apparatus of this type while at the same time securing increased reliability.

The objects of my invention are:

The provision of a timing device comprising a pneumatic chamber having pressure release means and whereby time may be measured by the exhausting of pressure from within the chamber.

The provision of a timing device comprising a pneumatic chamber having a collapsible portion and a releasing port for air or the like so arranged that time may be measured by the position of the collapsible portion as it collapses due to release of air through the port.

The provision of a timing device comprising a diaphragm chamber adapted to contain pressure and means for releasing the pressure relatively slowly, the diaphragm sinking upon release of pressure and arranged to actuate a switch or the like after a predetermined time depending on the pressure.

The provision, in combination with an automatic stoker, of a pneumatic timing device comprising a pneumatic chamber having means responsive to the pressure therewithin and means for controlling the stoker actuated by the pressure responsive means, the said means being operable to measure time based on the rate of exhaustion of air or the like from the chamber.

The provision, in combination with an automatic stoker system and a furnace draft fan, of a pneumatic timing device comprising a diaphragm chamber having a diaphragm adapted to be lifted by draft from the fan, and a switch in control of the stoker and actuated at the expiration of predetermined time intervals determined by the rate of release of air from below the diaphragm.

It will be understood that my invention is not limited to stoker control systems but may be employed in various other timing capacities. The exact nature of my invention will become clear as my specification proceeds, the invention residing in the construction, and arrangement of parts, as well as in the various combinations upon which I desire protection by Letters Patent of the United States and towards which I have directed the claims appended hereto.

Referring to the drawing I have indicated my improved timing device generally at 1. In a preferred embodiment of the invention I have shown the device comprising a diaphragm chamber formed of an upper circular, more or less dome shaped member 2 and a lower member 3 also circular and having a cross sectional configuration as shown. The members 2 and 3 have peripheral flanges 4 and 5, respectively. Numeral 6 indicates a flexible diaphragm made of leather or other similar material and having its peripheral portions interposed between the flanges 4 and 5, the flanges being secured together by bolts 7 with edge portions of the diaphragm in sealing engagement therebetween.

The member 3 has a depressed portion 10 in screw threaded relation with which is a guide 11 for a plunger 12. The plunger 12 is connected by a stem 13 with a diaphragm 6. The stem 13 may have an integral disc 14 disposed adjacent the diaphragm 6 and connected to a disc backing member 15 disposed on the opposite side of the diaphragm 6. Preferably the end of stem 13 extends through the diaphragm 6 and disc 15 and has a retaining washer 16 or the like secured to its end adjacent the disc 15.

Within the depressed portion 10 is a mercury switch 20 mounted on a lever arm 21 pivoted to a lug 22 upstanding from the lower surface of the depressed portion 10. The lever arm 21 is movable between stops 23 and 24 formed integrally with the portion 10 and is biased towards either one stop or the other by an overcenter coil spring 25 attached to the lever arm and to a side wall of the depressed portion 10 as shown. The left end of the lever arm 21 is forked or bifurcated and the stem 13 is engaged between the prongs or bifurcations. The diaphragm 6 of my device is adapted to rise and fall moving the stem 13 and plunger 12 vertically. The diaphragm 6 may lift the stem 13 until the plunger 12 engages the end of the lever arm 21 raising it until the overcenter spring 25 snaps the lever arm against the stop 23 into the position shown on the drawing. In this position the mercury switch is open as shown. The diaphragm 6 may settle until the portion of stem 13 of larger diameter adjacent disc 14 engages the end of lever arm 22 moving it downwardly until the overcenter spring 25 snaps the lever arm against the

stop 24 in which position the mercury switch 20 is closed.

The member 3 has a boss 27 having needle valve 28 therein. A tube 29 communicates with the inlet of the needle valve and the outlet of the needle valve communicates with the space below the diaphragm 6 through a swing check valve 30 disposed in a recessed portion 31 on the inner side of the member 3. The swing check valve cooperates with a shoulder forming a seat at the inner end of the outlet port of the needle valve 28. When air pressure is supplied through the tube 29 in a manner which I will later describe it passes through the needle valve 28, the swing check valve 30 and into the diaphragm chamber lifting the diaphragm 6 to a raised position.

The member 3 has a second boss 32 having a needle valve 33 disposed therein. The needle valve 33 forms a release for fluid pressure from below the diaphragm 6, the needle valve having a port 34 communicating with the interior of the member 3 and a port 35 communicating with the atmosphere. Both the needle valves 28 and 33 may be manually adjusted so as to vary the rate of pressure flow therethrough.

My invention is particularly adapted to but not limited to the control of an automatic stoker of the type conventionally used in heating systems employing solid fuel. I have disclosed my invention incorporated in a system of such type. Referring again to the drawing, numeral 40 indicates a furnace fed with a solid fuel by an automatic electrically driven stoker indicated at 41. The stoker 41 may be of conventional construction and I have chosen to disclose it as of the type including a forced draft fan 42 driven by the same motor which drives the stoker. The draft fan 42 communicates with the combustion chamber of the furnace through a forced draft duct 43. One end of the tube 29 previously referred to communicates with a duct 43 as shown.

The system may be primarily controlled by a room thermostat or like device generally indicated at 44. The thermostat 44 may be of the conventional bimetallic element type having a movable switch arm 45 cooperating with a fixed electrical contact 46 and a permanent magnet 47 whereby the thermostat acts with a snap action to make and break engagement between the blade 45 and contact 46. Power for the system may be supplied from line conductors 47 and 48 connected to an external source of power, not shown. In the particular system which I have disclosed I employ line voltage in all circuits but it is to be understood that I may use relays as often employed in thermostatically controlled electric circuits and the like.

The manner of control of the stoker 41 and blower 42 by the thermostat 44 will be obvious to those skilled in the art. Whenever the temperature to which the thermostat 44 is responsive falls to a predetermined value for which it is set, blade 45 will engage fixed contact 46 completing a circuit through the stoker and blower motor as follows: from line conductor 47 through a wire 49 to the thermostat, through blade 45, fixed contact 46, wire 50, the stoker and blower motor and wire 51 back to line conductor 48. Whenever blade 45 disengages from fixed contact 46 the above circuit is broken and the stoker and blower motor stops.

In systems of the type disclosed, especially during mild weather there will be relatively long intervals between thermostatic calls for heat and consequent operations of the stoker. During these intervals provision must be made to keep the fire alive, otherwise upon the next thermostatic call for heat the fire may be out and raw coal will be fed onto a cold fuel bed. The function of my invention is to intermittently operate the stoker at timed intervals to supply sufficient fuel to keep the fire alive during the above described relatively long intervals when the thermostat is not calling for heat.

Whenever the stoker 41 and blower 42 are operated pressure will be forced through the duct 43 and tube 29 to the interior of the diaphragm chamber causing diaphragm 6 to be lifted, tilting the mercury switch into the position shown, in the manner which I have already described. The needle valve 28 may be adjusted so that a period of, for example, two or three minutes may be required to lift the diaphragm 6 the entire amount necessary to tilt the mercury switch 20 into the position shown. As long as the blower 42 is operated the diaphragm is maintained in its lifted position inasmuch as the bleed of fluid pressure through the needle valve 33 is considerably slower than the rate at which air pressure is forced through the needle valve 28. As soon as the blower 42 stops the swing check valve 30 is pressed firmly against its seat by reason of the pressure within the diaphragm chamber and the pressure now bleeds off through the needle valve 33. As the pressure bleeds off the diaphragm 6 gradually starts moving the stem 13 and plunger 12 downward accordingly. After a predetermined time of, for example, thirty minutes which may be adjusted by adjusting the position of the needle valve 33, the portion of the stem 13 of larger diameter will engage lever arm 21 and the mercury switch will be tilted to closed position in the manner already described. As soon as the mercury switch 20 is closed a circuit for the stoker and blower motor will be completed as follows: from line conductor 47 through wire 49, a wire 52 through the mercury switch 20, a wire 53, wire 50 to the stoker and blower motor and wire 51 back to the line conductor 48. As soon as the motor starts air pressure will again be forced through the tube 29 lifting the diaphragm 6. After a predetermined time as mentioned above which may be two or three minutes for example according to the adjustment of needle valve 28 the diaphragm 6 will have been lifted sufficiently to open the mercury switch 20 stopping the motor. Thus it will be seen that when the thermostat 44 does not call for heat the stoker and blower motor are operated for short periods at predetermined intervals of time so as to keep the fire in the furnace alive.

From the foregoing it should be apparent to those skilled in the art that I have provided a unique timing device and have combined it with the other elements of my disclosure in a novel manner for producing results having manifest utility and value. My device is not of the delicate construction characteristic of most heretofore known timing devices but on the other hand is of very sturdy construction and is comprised of parts none of which are likely to get out of order or adjustment. Adjustments of the duration of firing periods and also the interval of time between them may be satisfactorily made and with the utmost simplicity merely by adjusting the needle valves 28 and 33 with a screw driver.

My device is of extremely economical construction and is of such a nature that it may be installed, operated, and adjusted by anyone, there-

fore dispensing with the need of skilled service men.

I have disclosed one preferred embodiment of my invention and one application thereof which in this particular instance is a stoker control system. There are many other forms and modifications which my invention may take and many changes therein and applications thereof will occur to those skilled in the art. I therefore intend that my disclosure be interpreted only as illustrative and that the scope of my invention be limited only as determined by the appended claims.

I claim as my invention:

1. In a heating control system, in combination, an automatic stoker and forced draft means, a thermostat controlling said stoker and forced draft means, a timing device for intermittently operating the stoker for maintaining the fire when no heating is needed comprising a diaphragm chamber having a diaphragm therein, means for forcing draft air underneath the diaphragm to lift it when said forced draft means is operating, means for relatively slowly releasing the pressure below the diaphragm permitting it to settle when said forced draft means is not operating, and a switch actuated by said diaphragm and controlling said stoker and forced draft means.

2. In a temperature control system, in combination, an automatic stoker and forced draft means for a furnace, temperature responsive means for controlling said stoker and forced draft means, a timing device for controlling said stoker and forced draft means to maintain a fire when no heating is necessary, said device comprising a chamber having a movable wall portion operable to actuate a switch controlling said stoker and forced draft means, means including an adjustable valve whereby forced draft moves said movable wall portion in a direction to stop said stoker and forced draft means, and means including an adjustable release valve whereby said movable wall moves in a direction to start said stoker and forced draft means when fluid is not being forced by said last means.

3. In a heating system, in combination, an automatic stoker and forced draft means, temperature responsive means for controlling the stoker and forced draft means comprising a fan, said forced draft means stopping whenever the stoker is stopped by the temperature responsive means, a timing device for operating the stoker irrespective of the temperature responsive means, said device comprising a chamber having an expansible wall member adapted to be expanded by draft from the fan whenever the fan operates, said chamber having a release port for releasing air therefrom permitting the chamber to contract when the fan stops, and means operably associated with the expansible wall member for controlling the stoker.

4. In a combustion system, in combination, an automatic stoker and forced draft means, automatic means for controlling the stoker and forced draft means, said forced draft means supplying air for combustion of fuel supplied by said stoker, said automatic means comprising a timing device for controlling said stoker, said device comprising a chamber having an expansible wall member adapted to be expanded by draft from the forced draft means, said chamber being adapted to contract upon release of air therefrom, and means operably associated with the expansible wall member for controlling the stoker.

5. In a combustion system, in combination, means adapted to form a combustion chamber, means for supplying fuel to said combustion chamber and means for supplying draft air thereto, automatic means in control of said fuel supply means comprising a device forming an expansible chamber, means whereby draft air may be communicated to said expansible chamber, said chamber having a movable wall member adapted to be expanded by draft from the forced draft means, said chamber being adapted to contract upon release of air therefrom, and means actuable by the movable wall member for controlling the fuel supply means, said chamber having a restricted air passage communicating therewith so that a relatively long period of time is required for said movable wall member to move sufficiently to actuate said means controlling the fuel supply means.

6. In a heating system, in combination, an automatic stoker and forced draft means comprising a fan, temperature responsive means controlling the stoker and forced draft means, said forced draft means stopping whenever the stoker is stopped by the temperature responsive means, a timing device for operating the stoker irrespective of the temperature responsive means, said device comprising a chamber having an expansible wall member adapted to be expanded by draft from the fan whenever the fan operates, said chamber having a release port for releasing air therefrom permitting the chamber to contract when the fan stops, and means operably associated with the expansible wall member for starting the stoker when the said wall member has assumed a predetermined position upon contraction of the chamber.

7. In a combustion system, in combination, an automatic stoker and forced draft means, condition responsive means for controlling the stoker and forced draft means, and automatic means for operating the stoker at intervals to maintain limited combustion during periods when combustion is not demanded by the condition responsive means, said automatic means comprising a pneumatic timing device operated by draft air supplied by said forced draft means, said device being in the form of a chamber having an expansible wall portion and means having a restricted orifice for slowly releasing air from said chamber.

8. In a heating system, in combination, an automatic stoker and forced draft means, condition responsive means for controlling the stoker and forced draft means, a device for controlling the operation of the stoker, said device comprising means forming a chamber having an expansion wall portion, means having a restricted orifice whereby draft pressure supplied by said forced draft means is communicated to said chamber, means actuable by said expansible wall portion to initiate operation of said stoker after a variable interval of time following stoppage thereof, which interval is dependent upon the length of time that draft pressure is communicated to said chamber.

FREDERICK S. DENISON.