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STOKER CONTROL SYSTEM, INCLUDING DELAYED AIR FEED

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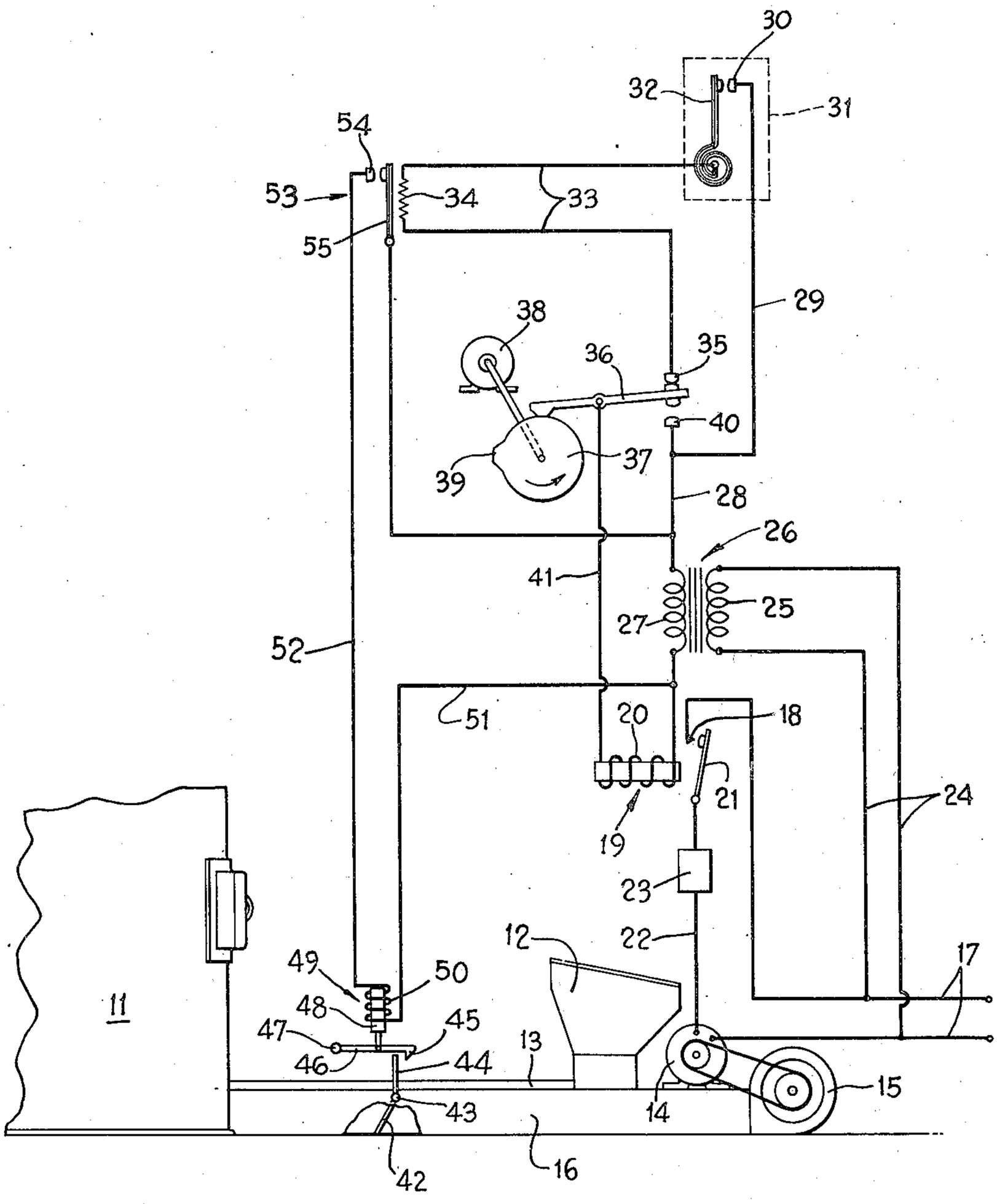

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STOKER CONTROL SYSTEM, INCLUDING DELAYED AIR FEED

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2 Claims. (Cl. 110—101)

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This invention relates to improvements in stoker control systems for coal furnaces.

A coal stoker of the type commonly in use comprises mechanical means for feeding coal to the furnace and a fan for supplying the air necessary for combustion of the coal; an electric motor serving to operate both the coal-feeding means and the fan when the motor is energized under the control of means, such as a room thermostat, in response to demand for acceleration of combustion in the furnace. In order to prevent the possibility of the fire burning to a low level in the furnace when demand for heat is infrequent, an additional, or refueling, control means is usually provided whereby the motor is energized during predetermined periods regardless of the condition of the room thermostat. By supplying the full amount of air to the furnace along with the coal during the refueling operation, a considerable amount of the coal is consumed directly as it is introduced and most of the heat thereby generated is normally wasted. It is therefore an object of this invention to minimize burning of fuel during the refueling operation so as to reduce heat-release, decrease the amount of coal for hold-fire requirements, and to prevent burning of the fire to too low a level during idle periods; this object being accomplished by the provision of means whereby during the refueling periods the supply of combustion air is reduced or entirely excluded.

In connection with the operation of a stoker control system of the character described in the preceding paragraph in response to normal heating demands, it is a further object of this invention to provide means for delaying full supply of air to the furnace for a predetermined period following initiation of feeding of the coal so as to compensate for the coal consumed during idle periods and thereby maintain a relatively uniform level of the fire.

Other objects and advantages of the invention will be found in the description, the drawing, and the claims; and, for full understanding of the invention, reference is to be had to the following detailed description and accompanying drawing, the single figure of which is a diagrammatic view of a stoker control system embodying the invention.

In the drawing, the numeral 11 indicates a furnace into which coal from a hopper 12 can be fed through a conduit 13 which contains suitable conveying apparatus (not shown) operated by an electric motor 14. Operated concurrently by this motor is a fan or blower 15 which is adapted to

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force air through a duct 16 for combustion of the coal in the furnace. Indicated at 17 is a pair of electric service lines, one of which is connected directly to one terminal of motor 14 and the other to the fixed contact 18 of an electromagnetic relay 19. When current is passed through the coil 20 of the relay, the contact arm 21 is attracted from its normally-open position, as shown, into engagement with the fixed contact 18 to complete the motor-energizing circuit through a wire 22, connected to the other motor terminal, and a safety device 23 which, for example, may be a limit control adapted to open the motor circuit upon abnormal rise of temperature in the furnace.

Connected by wires 24 to the service lines 17 (which, it is to be assumed, supply alternating current) is the primary 25 of a step-down transformer 26. One terminal of the secondary 27 of the transformer is connected directly to one lead of relay-coil 20, the other terminal of the secondary being connected by wires 28 and 29 to the fixed contact 30 of a thermostat 31 which, it is to be assumed, is arranged to respond to the temperature of a space or room heated by the furnace 11. The bimetallic contact member 32 of the thermostat is connected by a wire 33, in series with a resistor or heating element 34, to a contact element 35 with which a pivoted contact arm 36 cooperates. This arm is operated by rotation of a disk 37 which is driven at a constant speed by a small electric motor 38 which, it is to be assumed, is continuously energized while the control system is in operation; the disk 37 having a raised or cam portion 39 which is adapted in the rotation of the disk to move the arm 36 out of engagement with the contact element 35 and into engagement with another contact element 40 which is connected to the wire 28. The arm 36 is connected by a wire 41 to the other lead of relay-coil 20.

Within the air-duct 16 is a damper 42, to an outer end of the mounting rod 43 of which is attached an arm 44. The damper is biased by gravity to duct-closing position, as shown, and is adapted to rotate in a clockwise direction toward open position under the pressure of the air supplied to the duct by fan 15. Rotation of the damper toward open position is normally limited to a small angle by means disposed in the path of movement of damper-arm 44. This means comprises the hooked extremity 45 of a member 46, which member is pivoted at 47 and connected intermediate its ends to the plunger 48 of an electromagnetic solenoid 49. When the

solenoid is energized by passage of current through its coil **50**, the resultant attraction of the plunger raises the member **46** so that the damper is then freed for movement to fully-open position. The solenoid-coil **50** is connected across the secondary **27** of transformer **26** by wires **51** and **52**, a thermostatic circuit-controlling device **53** being inserted in series in the wire **52**. The device **53** comprises a fixed contact element **54** and a bimetallic contact blade **55**, the blade being so arranged that under the influence of heat it warps toward engagement with contact element **54** to complete the energizing circuit of solenoid **49**. Associated with the device **53**, so as to constitute the same a thermal time-delay, is the heating element **34**.

With the parts in the positions shown in the drawing the stoker system is idle. When demand for acceleration of combustion in the furnace is evidenced by closing of the contacts of room-thermostat **31**, the energizing circuit of relay **19** is complete; the circuit being traced from the upper low-voltage terminal of transformer **26** through wires **28—29**, fixed contact **30**, contact member **32**, wire **33**, heating element **34**, wire **33**, contact element **35**, contact arm **36**, wire **41**, and relay-coil **20** to the other low-voltage terminal. It will be understood that the resistance of heating-element **34** is low with respect to that of the relay coil and hence does not materially impede the flow of current. The resultant attraction of relay contact-arm **21** effects energization of the motor **14** and operation of the stoking apparatus and fan **15**. However, since the solenoid **49** is at present unenergized and opening movement of damper **42** therefore limited to a small angle, only a small amount of air can pass to the furnace for combustion of the coal now being introduced. The heat produced by the current flowing through the resistor **34** effects warpage of blade **55** so that after a predetermined period the energizing circuit of solenoid **49** is completed and the damper **42** is freed for movement to fully-open position under the air pressure produced in the duct by fan **15**. The construction and arrangement of the elements of the time-delay device determine the delay period, which under average conditions may be of the order of one minute. As was mentioned hereinabove in the statement of invention, the coal initially introduced compensates for that consumed during the idle period so that the fire is maintained at a more uniform level. Under some operating conditions it may be preferable to so arrange the damper latch that no appreciable amount of air can pass through the duct to the furnace until the damper is released. In place of the latched damper arrangement, shown by way of illustration, other convenient means for controlling air passage through the duct can be employed; the feature of the invention in its broadest aspect being to delay the entrance of any substantial amount of combustion air for a definite period after feeding of the coal is begun.

In order to "hold-fire" in the furnace, the stoker is periodically operated under the control of the time-responsive means comprising elements **36—40**. When, by rotation of disk **39**, the contact arm **36** is moved from its position as shown into engagement with contact element **40**, the relay **19** is then energized; the circuit being from the top low-voltage terminal of the transformer **26** through wire **28**, contact element **40**, contact arm **36**, wire **41**, and relay coil **20** to the bottom low-voltage terminal. Concurrent

operation of the stoking apparatus and fan **15** is therefore effected, but since the damper is latched in minimum-flow position by engagement of damper-arm **44** with member **46**, only a small proportion of the air supplied by the fan passes to the furnace. The circuit which includes heating element **34** having been interrupted by the movement of contact arm **36**, energization of solenoid **49** to release the damper is precluded while the cam portion of disk **37** is in engagement with the contact arm **36**, so that substantially only the coal is supplied to the furnace during that period and no wasteful combustion takes place. The disk **37** is conveniently arranged to rotate at a speed of one revolution per hour, and the length of the cam surface **39** may be such that the refueling period is of the order of three minutes under average conditions.

The embodiment of my invention herein shown and described is obviously susceptible of modification without departing from the spirit of the invention, and I intend therefore to be limited only by the scope of the appended claims.

I claim as my invention:

1. In an electrical stoker-control system: a coal furnace; mechanical means for feeding coal to the furnace; means forming a duct for supplying combustion air to the furnace; a fan for forcing air into said duct; an electric motor for concurrently operating said coal-feeding means and said fan; means in said duct normally restricting flow of air therethrough; electrical means for rendering said flow-restricting means ineffective so that full amount of air can pass through the duct; a first electrical circuit-portion including a thermostat, responsive to the demand of a space heated by the furnace, and also including means electrically energizable to effect delayed operation of said electrical means; a second electrical circuit-portion including a source of electrical energy and means for effecting operation of said motor; switching means effective in one position to interconnect said circuit-portions so that operation of said motor and of said delayed-operating means is then under the control of said thermostat, said switching means having another position wherein said circuit-portions are unconnected and said second circuit-portion is closed so that operation of the motor is then effected independently of the control of said thermostat; and time-controlled means for periodically operating said switching means from said one position to said other.

2. In an electrical stoker-control system: a coal furnace; mechanical means for feeding coal to the furnace; means forming a duct for supplying combustion air to the furnace; a fan for forcing air into said duct; an electric motor for concurrently operating said coal-feeding means and said fan; means in said duct normally restricting flow of air therethrough; means for rendering said flow-restricting means ineffective so that full amount of air can pass through the duct; a slow-operating heat-motor for operating said last-named means; a first electrical circuit-portion including a thermostat, responsive to the demand of a space heated by the furnace, and also including an electric heater for operating said heat-motor; a second electrical circuit-portion including a source of electrical energy and means for effecting operation of said electric motor; switching means effective in one position to interconnect said circuit-portions so that operation of said electric motor and of said electric heater is then under the control of said thermostat, said switch-

ing means having another position wherein said circuit-portions are uninterconnected and said second circuit-portion is closed so that operation of the electric motor is then effected independently of the control of said thermostat; and time-controlled means for periodically operating said switching means from said one position to said other.

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