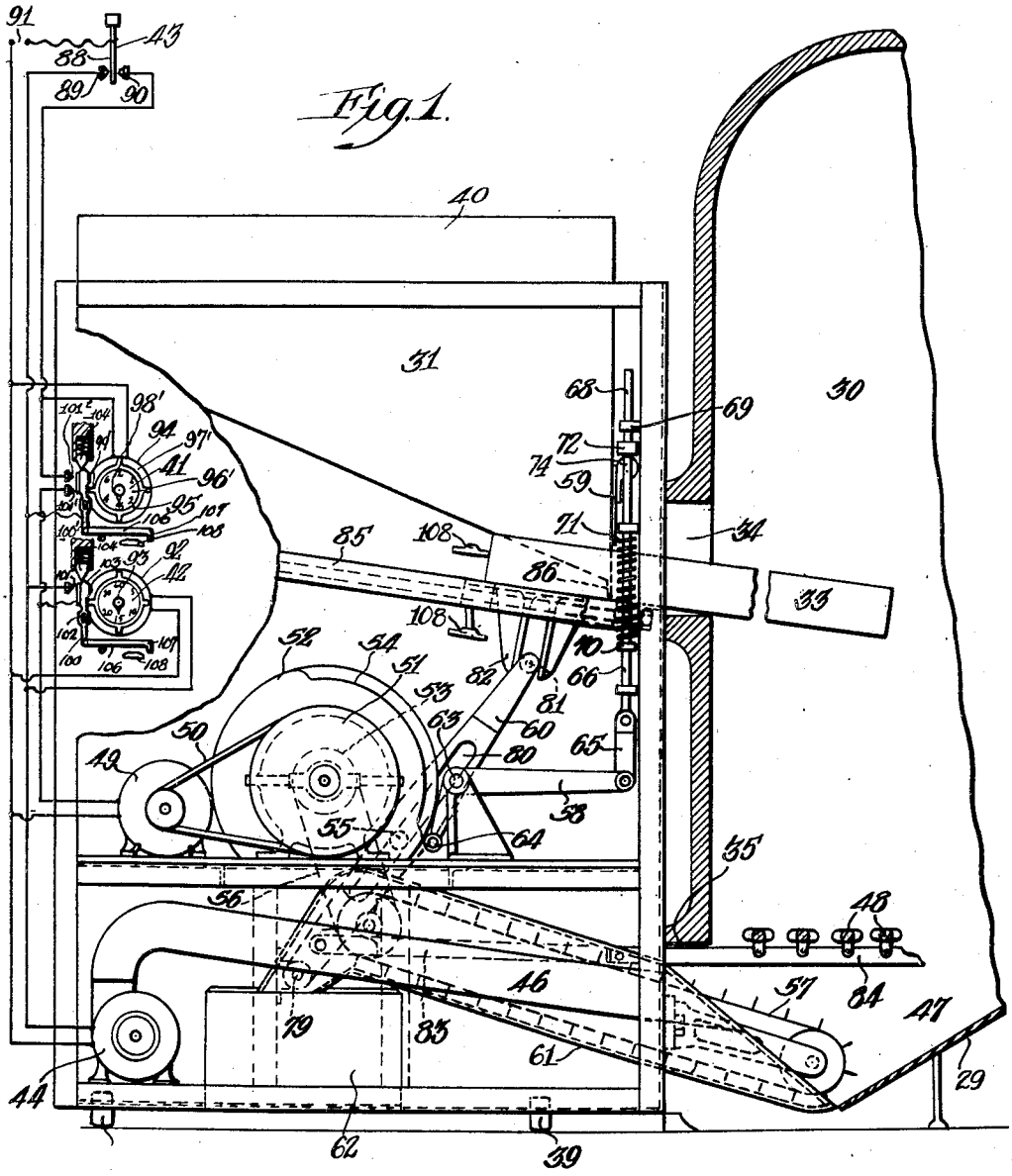
May 28, 1935. F. J. JOHNSON ET AL 2,003,199

AUTOMATIC COAL STOKER

Filed May 31, 1930 5 Sheets-Sheet 1

Fig. 1.



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May 28, 1935. F. J. JOHNSON ET AL 2,003,199

AUTOMATIC COAL STOKER

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Fig. 5.

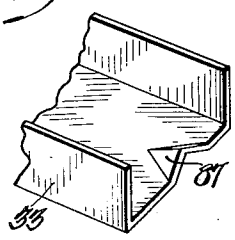


Fig. 2

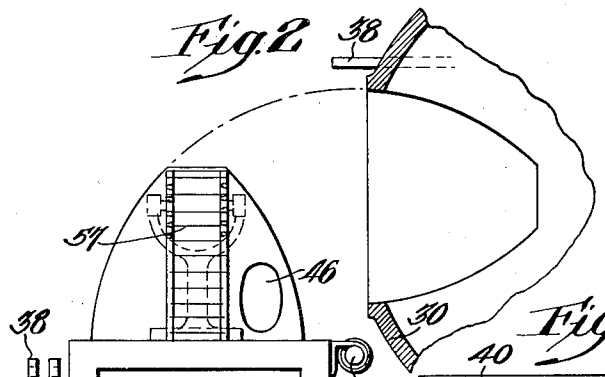


Fig. 3.

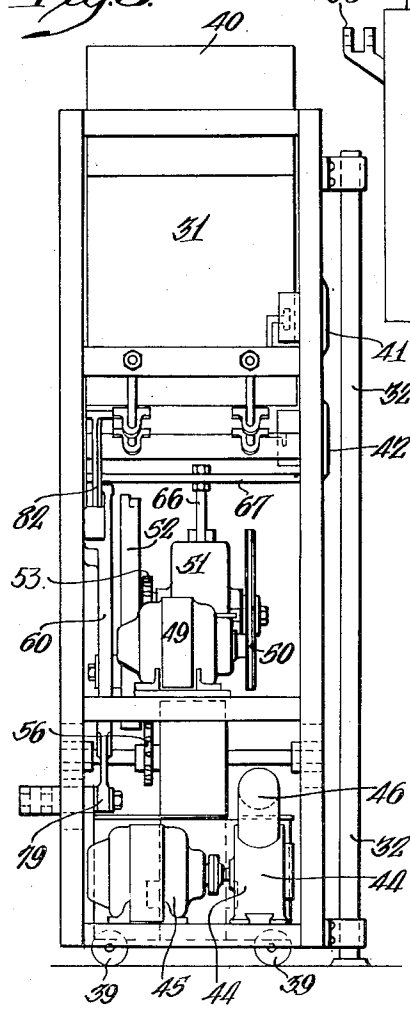
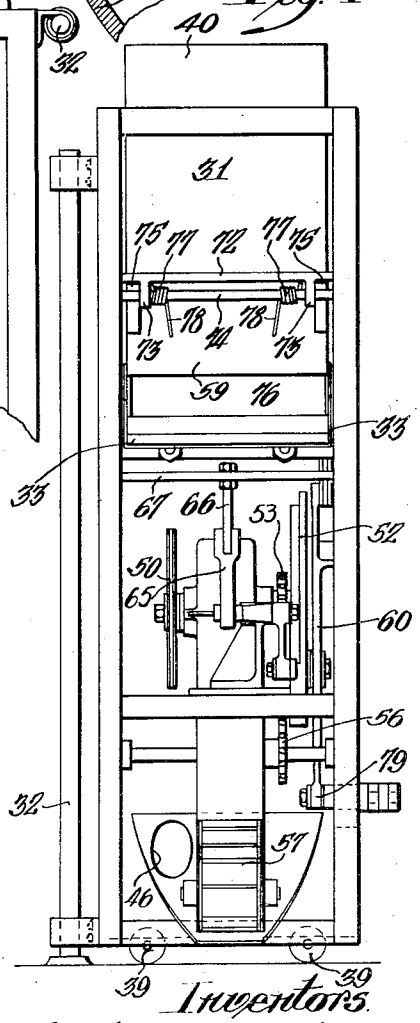


Fig. 4



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AUTOMATIC COAL STOKER

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Fig. 8.

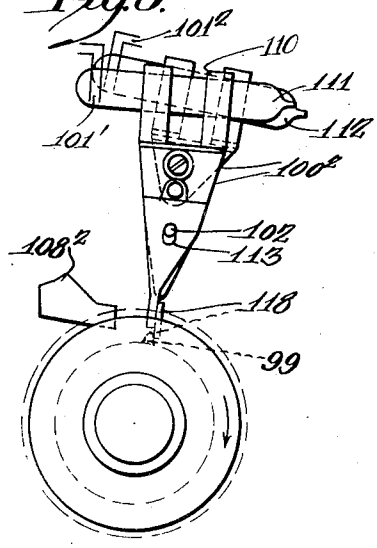


Fig. 9.

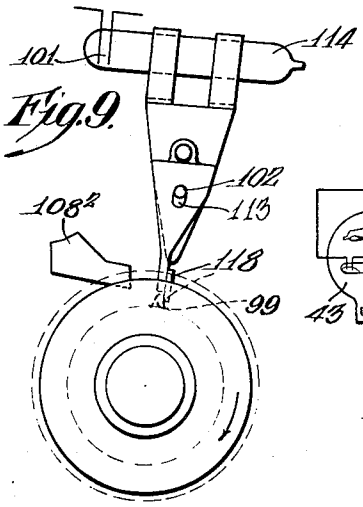


Fig. 6.

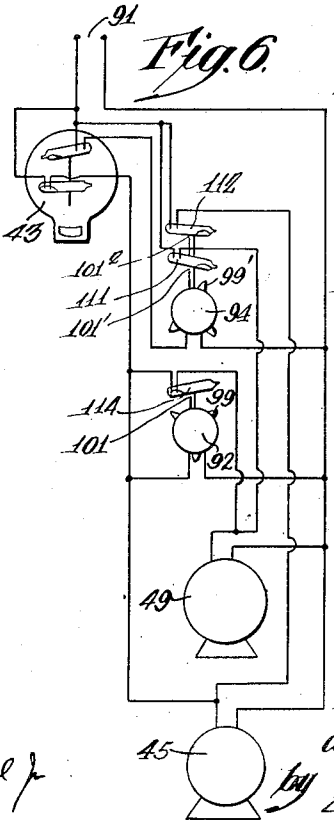
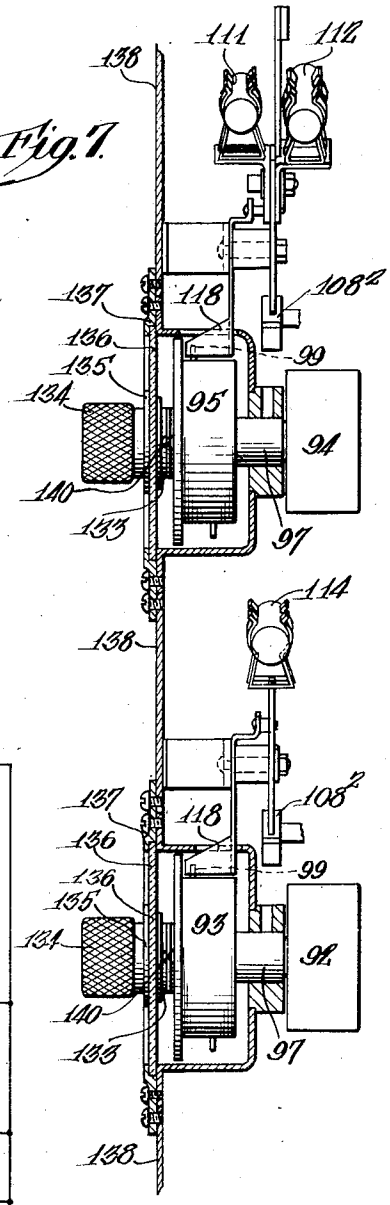


Fig. 7.



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May 28, 1935. F. J. JOHNSON ET AL 2,003,199

AUTOMATIC COAL STOKER

Filed May 31, 1930 5 Sheets-Sheet 4

Fig. 11.

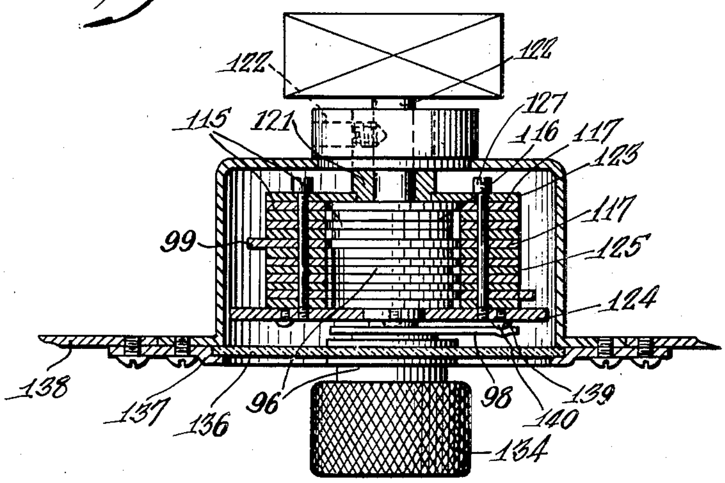
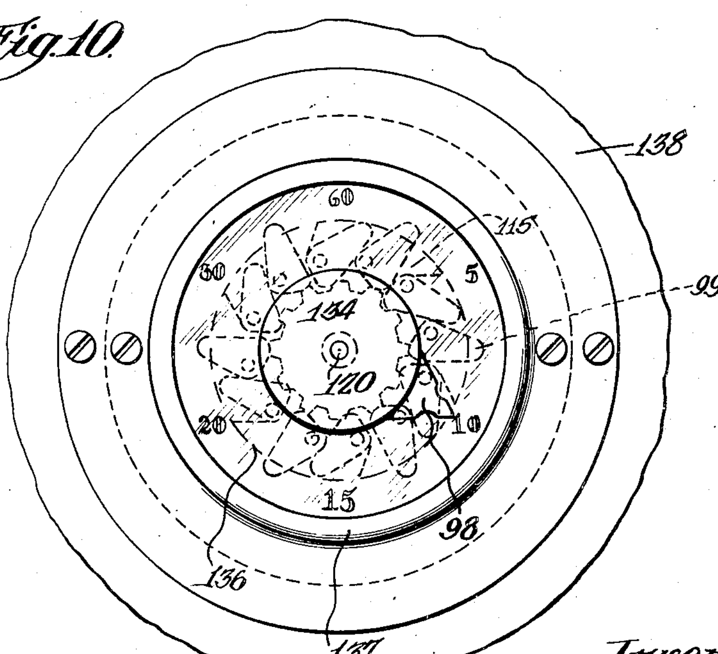


Fig. 10.



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May 28, 1935. F. J. JOHNSON ET AL 2,003,199

AUTOMATIC COAL STOKER

Filed May 31, 1930 5 Sheets-Sheet 5

Fig. 12.

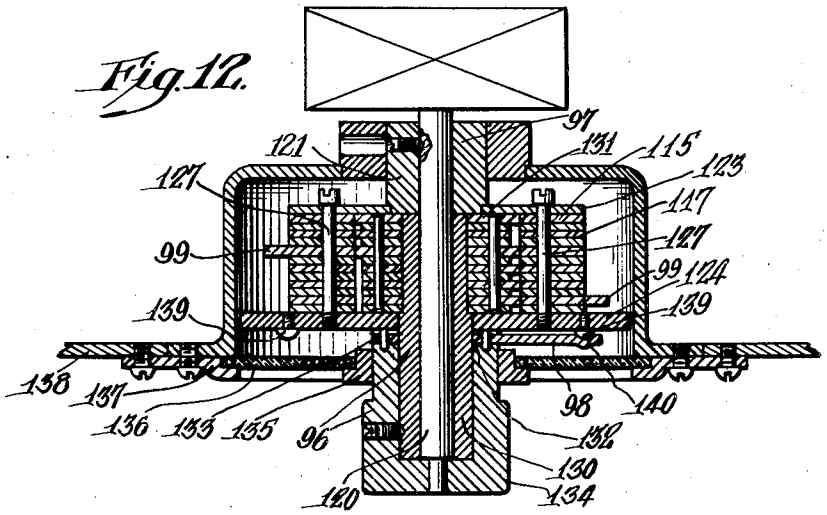


Fig. 13.

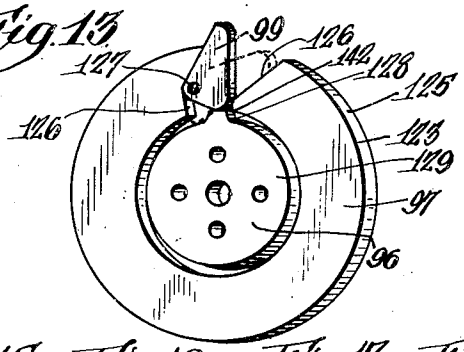


Fig. 14 Fig. 15 Fig. 16 Fig. 17 Fig. 18 Fig. 19.

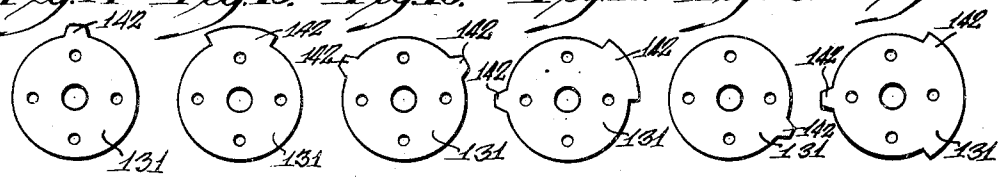
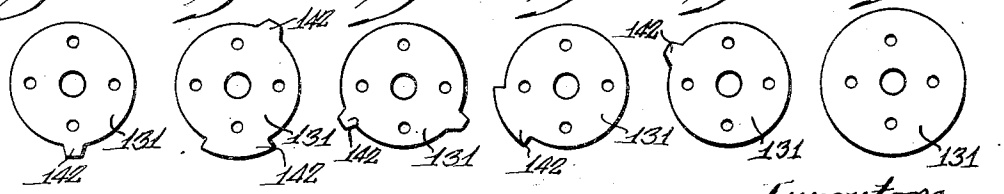


Fig. 20 Fig. 21. Fig. 22. Fig. 23 Fig. 24 Fig. 25.



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Patented May 28, 1935 2,003,199

UNITED STATES PATENT OFFICE

2,003,199

AUTOMATIC COAL STOKER

Frank James Johnson and Gerald Johnson,
Glenside, Pa.

Application May 31, 1930, Serial No. 457,926

5 Claims. (Cl. 236—1)

Our invention relates to heater furnaces, particularly to the furnace of domestic heaters and to a thermostatic control of the fuel supply thereof.

A purpose of our invention is to provide mechanism of the character indicated that is easy and inexpensive to manufacture and well suited to the needs of service.

A further purpose is to effect periodic small deliveries of fuel into a furnace during the continuous operation of a blower supplying the furnace with air, operating a blower motor and a clock motor simultaneously and using the clock mechanism to close the circuit of a coal feed motor for short periods at adjustably timed intervals of the operation of the blower motor.

A further purpose is to close the circuit of a coal feed motor at spaced intervals of the operation of an air supply blower, using an electric clock to throw in the circuit of the coal feed motor at adjustably spaced intervals of the operation of the blower.

A further purpose is to limit the operation of a coal feed motor to that needed to deliver a single charge of fuel into the furnace, preferably by using the retracting movement of the charging member to stop the coal feed motor.

A further purpose is to adjustably switch in the normal operating circuit of an electrically operated furnace for short periods during fire banking at adjustably spaced intervals in order to keep the fire alive, operating an electric blower throughout each period thus switched in and effecting a single feed of coal or other fuel near the end of the period.

A further purpose is to connect a thermostat to selectively operate mechanism for securing respectively a normal operation of a furnace and a banking operation thereof, the normal operation providing simultaneous operation of a blower motor and of an electric clock with means controlled by the operation of the clock for periodically delivering a feed of fuel into the furnace during the continuous operation of the blower motor and the banking circuit including a second electric clock continuously operating as long as the banking circuit is closed and mechanism adapting the banking circuit to close the circuit for the normal operation for adjustably spaced short periods.

A further purpose is to provide a desirable form of rotor member for closing a switch.

A further purpose is to present an adjustable number of contact members as outward extensions from a composite rotor, varying the number of contacts presented during each rotation of the unit by variantly adjusting the relative angular positions of inner and outer rotors, thereby varying the intervals between contacts.

A further purpose is to provide a furnace of the character indicated with a desirable form of fuel hopper and fuel delivery mechanism.

A further purpose is to slowly reciprocate a fuel delivery scoop into and out of the interior of a furnace above the fuel bed thereof, during the forward stroke admitting fuel from a fuel hopper on to a portion of the scoop passing from under the hopper outlet into the furnace interior, preventing fuel admission to the scoop during the retracting stroke, and forcing the fuel received on the forward stroke to fall off the open end of the scoop during retraction by means of a stationary dam across the interior of the retracting scoop.

A further purpose is to forwardly slope a scoop while progressing it forwardly below the open door of a fuel supply hopper and thence across a fuel bed with continuous admission of fuel to the portion of the scoop progressing past the open door, providing a dam across the scoop interior during the retraction of the scoop.

A further purpose is to form the delivery end of a fuel feeding scoop of the character indicated with a plurality of divisions in order to secure more uniform distribution of fuel discharging from the scoop.

Further purposes will appear in the specification and in the claims.

We have elected to show one main form only of our invention, selecting a form that is practical and efficient in operation and which well illustrates the principles involved.

Figure 1 is a broken side elevation, in part section, illustrating a desirable form of mechanism embodying one form of our invention, with electrical control mechanism shown diagrammatically.

Figure 2 is a top plan view, part section, of structure shown in Figure 1 but showing the fuel supply mechanism swung away from the furnace in Figure 2 and at the furnace in Figure 1.

Figure 3 is a front elevation of structure shown in Figure 2 but with a cover plate removed in order to disclose interior mechanism.

Figure 4 is a vertical rear end elevation of the structure shown in Figures 2 and 3.

Figure 5 is a broken fragmentary perspective view of the delivery end of a trough or scoop used in delivering fuel into the furnace.

Figure 6 is a diagrammatic view illustrating

electrical connections for the mechanism shown in Figures 1 to 4 inclusive, the electric switches and thermostat of Figure 6 being a different type from that of Figure 1 and found in practice to be very satisfactory.

Figure 7 is an enlarged vertical section taken upon the line 7—7 of Figure 1, and illustrating in enlarged scale electrical rotor contact mechanism that forms an important detail of our invention and which is shown diagrammatically in Figure 1, and with a front supporting plate, broken away in Figure 1 shown in section in Figure 7.

Figures 8 and 9 are front elevations of details of Figure 7.

Figure 10 is a fragmentary left side elevation of Figure 7.

Figure 11 is a section taken upon the line 11—11 of Figure 10, without sectioning an inner rotor member of the switch mechanism.

Figure 12 is a view corresponding to Figure 11 except that both outer and inner rotor members are shown sectioned in Figure 12 and in Figure 11 the outer rotor is sectioned with inner rotor not sectioned.

Figure 13 is a perspective view illustrating corresponding portions of the inner and outer rotor members of rotor contact mechanism shown in Figures 11 and 12.

Figures 14 to 25 inclusive are plan views of detail plates used in the rotor contact mechanism of Figures 11 and 12.

Like numerals refer to like parts in all figures.

Describing in illustration and not in limitation and referring to the drawings:—

The broader features of our invention are shown in Figure 1.

A furnace 30 may be any suitable domestic heater furnace of the prior art, the illustration being intended for a conventional illustration of any furnace to which our invention is adapted to be applied.

We provide an assembled unit 31 for application to existing commercial domestic heater furnaces, preferably vertically hinging the unit at 32 at one side of the furnace, in position to normally register a fuel feeding scoop or trough 33 with the furnace doorway 34 and air delivery and ash removal mechanism with the ashpit doorway 35.

The unit fastens to place in registry with the furnace by means of a suitable latch or readily loosened mechanism 38, is preferably supported upon suitable wheels or castors 39 and permits easy access to the furnace interior by loosening its furnace connection at 38 and moving it horizontally on its vertical hinge to the open position of Figure 2.

Our unit 31 includes a fuel hopper 40, and mechanism for supplying air and fuel to the furnace, for removing ashes and for periodically shaking the grate, and also includes electric clock operated mechanisms 41 and 42 which cooperate with a thermostat 43, usually distant from the furnace, in controlling the feed of air and fuel to the furnace.

The air supply mechanism includes a blower 44 operated by a motor 45 with which it is directly connected. The blower discharges through an air pipe 46 into the furnace ash pit 47 under the grate 48.

Our coal feed, grate shaking and ash removal mechanisms are operated by a motor 49 which makes belt connection 50 through speed reducing mechanism 51 with a wheel 52 which carries a sprocket wheel 53, is provided with a cam surface 54 and carries a projecting crank pin 55 which respectively make sprocket chain connection 56 with a chain conveyor 57 for removing ashes, angularly reciprocate a rocker 58 for operating the door 59 of the fuel hopper and angularly reciprocate a rocker 60 to operate the coal feeding member 33 and to rock the grate bars 48.

The chain conveyor 57 extends into the ash pit which is preferably provided with a suitably sloping bottom at 29 to effect automatic delivery of the ashes that fall through the grate to the pick-up end of the conveyor. The conveyor sweeps the ashes along a suitable trough 61 which delivers into a removable receptacle 62.

The rocker member 58 for operating the door 59 of the fuel hopper is pivoted at 63 and presents a roller 64 against the cam surface 54 of the wheel 52.

The rocker makes link connection at 65 with a downwardly extending arm 66 from a cross member 67 that carries upwardly extending vertical bars 68, one at each side of the front of the hopper.

Each bar 68 slides in stationary vertically spaced vertical guides 69, carries a collar 70 and a spiral spring 71 compressed between the collar and the lower guide.

The rods 68 are connected together by a transverse member 72 which by means of downward lugs 73 affords support for a transverse rod 74.

The door 59 of the fuel hopper, hooks loosely over the projecting ends of the rod 74 at 75, below the transverse piece 72, swinging on the horizontal pivot rod 74 and is spring pressed against the face of the hopper across the hopper doorway 76 by the spiral springs 77, Figure 4, the springs 77 surrounding the rod 74 and each having at least one end 78 pressing against the face of the hopper door 59.

The door 59 thus loosely pivots at 75, is strongly spring pressed against the face of the doorway at 78 and strongly spring pressed to downward closure by the springs 71. It is opened positively by the action of the rocker 58 and is closed resiliently by the side springs 71.

The rocker 60 which operates the reciprocation of the coal feed member 33 and of the grate bars 48 is pivoted at 79, has a slot connection 80 with the crank pin 55, a slot and pin connection 81 with a downward extension 82 from the coal feed member 33 and has a horizontal link connection 83 with the rocker bar 84 of the grate bars 48.

It will be seen that each rotation of the wheel 52 effects a longitudinal reciprocation of the coal feed member 33, a positive opening and a resilient closing of the hopper door 59, an advance of the ash conveyor 57 and a single reciprocation of the grate bars 48.

The coal delivery trough 33 is shown in Figure 1 in its advanced position, about to retract.

The trough has a forward downward slope into the furnace, sliding back and forth in a suitable sloping guideway 85, and sliding into the furnace from a point immediately below the delivery doorway of the hopper.

The bottom of the hopper is extended downwardly at 86 to loosely fit the interior of the trough, this downward plate or lip 86 blocking coal that has been delivered from the hopper into the trough during the forward movement of the trough into the furnace from being carried back out of the furnace during the retraction of the trough.

The forward and downward slope of the de-

livery trough **33** is preferably one to give most even distribution of coal over the fuel bed, the slope being usually less than that for free sliding.

We may desirably provide the delivery end of the trough **33** with one or more upward bends or guiding ridges **87** in order to secure a more uniform distribution of the coal as it leaves the scoop.

For small furnaces this upward guiding bend may be omitted and with very large furnaces there may be two or more of such bends. They preferably should not extend any great distance inwardly from the end of the trough unless made as intermediate vertical walls of the length of the trough which then register with suitable vertical slots in the block or dam plate **86**.

We desirably control the operation of the furnace thermostatically and in Figure 1 illustrate diagrammatically our connections.

A thermostat **88** located at any place at which the temperature is to control the operation of the furnace is connected to selectively close two electric circuits at **89** and **90**, one contact being closed and open when the other is respectively open and closed.

The first circuit in addition to a source of current **91** and thermostat **88** includes the blower motor **45** and a motor **92** that may desirably comprise a commercial clock motor, with the shaft of the minute hand directly connected to a rotor contact unit **93** which therefore rotates during the closure of the first circuit at a uniform rate, suitably the rate of the minute hand of a clock.

The second circuit includes the source **91**, thermostat **88**, contact **90** and an electric motor **94** that operates a rotor contact member **95**, the motor **94** and rotor **95** being desirably like the motor and rotor members **92** and **93** except that the rotor **95** is connected to the hour-hand shaft of its motor.

The first circuit, closed at the contact **89**, operates the blower motor **45** and turns the contact rotor **93** at the rate suitably of a clock minute hand, and the second circuit, open when the first is closed and closed when the first is open, turns the second rotor contact member **95** at the rate suitably of a clock hour hand.

The furnace is supplied with air by the operation of the blower motor and with coal from the hopper **31** by the reciprocation of the scoop or trough **33** which is operatively connected to the motor **49**, the motor **49** being thrown into circuit periodically by the operation of the rotor contact member **93** and out of circuit by the retraction of the trough **33**.

The furnace is thus controlled by the thermostat **88** in cooperation with the electric clocks **92** and **94** which respectively rotate switch operating contact members **93** and **95**.

The clock **92** functions to periodically close the circuit of the coal feed motor **49** during the operation of the blower, and the clock **94** in circuit during periods of fire banking and preferably out of circuit at other times operates to throw in the first circuit, that is the normal operating circuit of the blower and of the first clock, for short periods at suitably spaced intervals to keep the furnace fire alive.

During normal operation with the first circuit closed at the contact **89** the clock **92** effects periodic deliveries of individual scoops of coal into the furnace while the blower motor effects a continuous air supply to the furnace.

The clock **94** may or may not also run during the normal operation of the blower but should always run during periods of fire banking in order to effect suitable firing of coal for the maintenance of the fire.

The two clocks and the contact mechanisms operated by the clocks are substantially the same except with respect to the rates of uniform rotation of the contact rotors **93** and **95**, which correspond respectively to minute and hour hand rates of movement by reason of the rotors being operatively connected respectively to the minute and hour hand shafts of the clocks.

Each of the contact members **93** and **95** includes coaxial inner and outer members **96** and **97** or **96'** and **97'** which rotate as a unit but are relatively angularly adjustable, a hand **98** or **98'** fastened to the inner rotor showing different definite angular positions of the inner member with respect to the outer member.

Mechanism is provided whereby the number of contacts **99** or **99'** presented by the composite rotor **96** and **97** or **96'** and **97'** is adjustable by changing the angular setting of the hand **98** or **98'** with respect to the outer member **97** or **97'**.

Thus on the clock operated mechanism **42** the figures **5**, **10**, **15**, **20**, **30** and **60** indicate that the corresponding number of minutes will elapse between the successive operations of the coal feed during normal operation of the blower.

When the hand **98** is set to **5** the composite rotor unit **93** will present twelve contact members **99** at uniformly spaced intervals around the outer circumference so that there will be one contact made every five minutes, and in the same way the number of contact members **99** presented when the hand **98** is set at the numbers **10**, **15**, **20**, **30** and **60** will be respectively **6**, **4**, **3**, **2** and **1**.

The numbers upon the dial of the rotor contact member **95** indicate the number of hours between successive closures of the first circuit by the composite contact member **95** when the dial hand **98'** is set at the different numbers.

Thus the hand **98'** is set selectively at the dial numbers **1**, **2**, **3**, **4**, **6** and **12**. Assuming the composite rotor to turn once in twelve hours, the number of contacts presented by the rotor at the different positions of the hand will correspond respectively to **12**, **6**, **4**, **3**, **2** and **1**.

Each clock runs when the other is shut down, one clock being always running and each carrying a setting hand **98** or **98'** adapted to be set to different numbers around a dial in order to give different predetermined intervals during the operation of the clock between the reciprocation strokes of the coal delivery trough **33**.

In Figure 1 the hand **98** of the lower clock is set to the number **15**, indicating that once every fifteen minutes during the simultaneous operation of the lower clock **92** and of the blower motor **45** the lower clock will throw outwardly a contact lever **100** to close at contacts **101** a circuit through the motor **49** which as already explained operates the mechanism for removing ashes, shaking the grate in addition to opening the hopper door **59** and moving the feed trough **33** into the furnace and then back to an initial position of retraction.

The switch mechanism at contacts **101** may be any suitable mechanism adapted to snap the contacts together when engaged by one of the contacts **99** and to snap the contacts **101** apart when engaged by a suitable latch member positioned by the retracting movement of the coal trough **33**.

As illustrated in Figure 1 the rocker **100** piv-

oted at 102 presents an upwardly directed wedge surface 103 to a downwardly directed wedge surface of a spring pressed plunger 104, placed so that the apices of the angular surfaces register with one another when the rocker is in its mid position, so that the rocker 100 is pressed into the rotor member 93 when to the right of its mid position and outwardly to the left to close the contacts 101 when to the left of its mid position.

Similar switch mechanism is provided at the rotor contact member 95, with an additional switch 101^2 closed to start the blower motor 45 before the rocker member 100' is pushed outward to mid position at which point it closes the switch 101' to start the coal feed motor 49.

When the rotor contact member 93 brings one of its projecting contacts 99 into engagement with an inward projection 103 from the rocker, the rocker is deflected outwardly against the pressure of the spring member 104 until at mid position the apex of the rocker passes the apex of the spring member after which the spring member 104 snaps the rocker outwardly, desirably effecting closure of the contacts 101 to complete the circuit of the motor 49 just before the rocker snaps outward, so that the outer contact of the switch 101 is carried somewhat outwardly when the rocker passes its mid position.

When the trough is in its retracted position the latch member 108 is to the left of the downward projection 107 of the link 106.

As soon as the contacts 101 close the circuit the trough 33 begins to move into the furnace, the latch member 108 passing under and lifting the end of the link 106, the frictional engagement between the latch member and link being in a direction to merely tighten the engagement between the contacts 101.

On the return stroke of the trough the latch member 108 passes back under the down turned end 107 of the link 106, with a frictional engagement that retracts the rocker 100, with a snap retraction after it has passed its mid position, the contacts 101 preferably maintaining resilient engagement until the rocker has been retracted to its mid position so as to insure a snap opening of the contacts by moving the rocker 100 suitably beyond its mid position, further movement of the latch member stopping when the contacts open to stop the motor 49.

During the period between closing and opening the contacts 101 the contact 99 has progressed sufficiently to permit inward retraction of the rocker member beyond its mid position, and to insure this we may give the rocker 100 a short slot connection with its pivot 102, the contact member 99 then causing the rocker to lift until stopped by the pivot engaging the bottom of the slot, then moving outwardly as already described.

If the first circuit remains closed at the thermostat the blower motor 44 and the clock 92 will both keep on operating and after fifteen minutes the next contact member 99 will engage the nose 105 on the rocker turning on the motor 49 to effect another feed of coal, the retraction of the trough 33 throwing out the circuit of the motor 49 as before.

The upper clock in Figure 1 is set to 3 indicating that the upper clock once every three hours of its operation will close the first circuit to start up the blower motor 44 and incidently the clock 92 until there has been a single reciprocation of the coal feed trough 33 which in retracting opens the closed contacts 101' at the upper motor 95, and if closed also opens the contacts 101 at the lower motor 93.

When during fire banking the clock 94 starts up the blower motor 44 it also starts the clock 93 which will, at the end of a suitable short period that is variant according to the setting of its hand 98, switch in the coal feed motor 49.

We desirably however provide the rocker 100' with two switches, one of which 101^2 closes earlier than the other 101'.

When one of the projections 99' of the rotor 95 pushes out the rocker 100' the switch 101^2 closes before the rocker reaches its mid or snap position, the blower motor and clock 92 starting up with the closure of the switch 101^2.

We have found the mercoid type of switch particularly suitable for use at the thermostat and at our rotor contact members 93 and 95, and preferably use a double mercoid switch at the thermostat, a double mercoid switch at the rotor contact member 95 and a single mercoid switch at the rotor contact member 93.

These are commercial switches and therefore need be illustrated merely diagrammatically in connection with our device.

Figure 8 shows a double mercoid switch 110 as used at the upper contact member 95.

The mercoid tube 111, carrying the switch 101' that switches in the blower motor is given a lesser slope than the tube 112 carrying the switch 101^2 that switches in the coal feed motor so that the blower motor may start some little while before the rocker 100^2 carrying both tubes is toppled over by the forward movement of the contact member 99.

The rocker is vertically slotted for a short distance at the pivot 102 at 113 so that the dog or latch member 108^2 fastened to the trough 33 lifts the rocker when passing under it from the left during the forward stroke of the trough, and on the retracting stroke of the trough again passes under and beyond the rocker, this time from the right lifting and carrying the bottom of the rocker to the left, well beyond the travelling contact member 99.

Figure 9 shows a single mercoid switch 114 at the rotor 93. It carries the switch 101 which is closed by being toppled to the left, the rotor turning in the direction of the arrow bringing one of the contacts 99 against the rocker, slowly moving it about the pivot 102 until its center of gravity passes over the axis when the rocker topples to the left bringing a flood of mercury to close the contact switch 101.

Important detail features of our invention include the rotating contact switch-throwing mechanism operated by the electric clocks.

This mechanism is substantially alike at the two clocks 92 and 94 except that one revolves much more slowly than the other, the rotor 93 being desirably operatively connected to the minute hand shaft of the clock 92 while the rotating mechanism 95 is operatively connected to the hour hand shaft of the clock 94.

Each rotating contact mechanism 93 or 95 comprises a composite rotor unit 115 that presents outwardly extending contacts 99 uniformly spaced around the circumference of the composite member and that are of variant spacing and number according to the relative angular positions of inner and outer rotor members 116 and 117 that together make up the composite member 115.

The contacts 99 comprise rockers, each adapted to project from or lie flat with the outside

circumference of the outer cylinder 117, according to the relative angular positions of the inner and outer rotor members.

The rockers 99 set to project from the cylinder 117 successively engage suitable throw mechanism such as the downward projections 118 of the rocker switch members already described.

The hour hand or minute hand shaft 120 of the electric clock carries rigidly fastened to it a collar 121 which journals in a stationary bearing 122 and carries rigidly fastened to it a composite outer cylinder 117 made up of end plates 123 and 124 and twelve intermediate plates 125.

The intermediate plates 125 are alike except as to angular spacing and each comprises an incomplete ring as is best seen in Figure 13.

Each of the plates 125 houses one of twelve contact rockers 99 at the cutaway portion 126 of the ring.

The contact rockers 99 have a thickness slightly less than that of the plates 125 and pivot upon screws 127, there being twelve of these screws, one for each of the contact rockers, each screw firmly clamping the end plates 123 and 124 upon the intermediate plates 125 and pivoting one of the rockers 99 in the space between the ends of one of the open rings as best seen in Figure 13.

The rockers 99 project inwardly at 128 to engage the outside surface of individual plates 129 that form part of the inner cylinder 116 which is a cylinder cam member for determining which rockers 99 shall project firmly from the outer cylinder 117.

The composite inner cylinder 116 comprises a sleeve 130 loosely mounted upon the shaft 120 and twelve plates 131 mounted on the sleeve 130 and that are respectively inside and in the plane of the ring plates 125 and between an inwardly directed shoulder 132 of the sleeve 130 and the inner end of the collar 121 to which the outer cylinder 117 is rigidly fastened.

The sleeve 130 fits a central bore through the end plate 124 of the outer cylinder 117, being adapted to turn with respect to this end plate, and carries a ring 133, the setting hand 98 comprising a resilient lateral projection from the ring 133.

The ring 133 carrying the setting hand 98 is fastened to the inner end of an adjustment knob 134 which is fastened to the sleeve 130 and journals inside a ring 135 which provides an inner seat for a ring-shaped glass 136 that is clamped at 137 to the casing structure 138.

The end plate 124 of the outer cylinder 117 is provided with projections 139 at angularly spaced intervals to register selectively in an indentation 140 at the outer end of the setting hand 98.

The knobs 139 are conveniently the heads of screws.

The adjustment knob is turned to scale figures marked at 141 on the plate 124 and is in proper set position when the indentation on the hand registers with the screw heads 139.

The resilient engagement of any one of the projections 139 with the setting hand 98 effects a coupling between the inner and outer cylinders adapting them to turn as a unit, the number of contact members that project from the outer cylinder being determined as already explained by the setting of the hand 98 with respect to the scale on the plate 124.

Each of the twelve plates 131 of the inner cylinder has one or more cam projections 142 adapted to engage and outwardly project the rocker 99 of one of the outer plates 125 adapting the composite cam in positions 1, 2, 3, 4, 6 and 12 respectively of the hand 98 to present 12, 6, 4, 3, 2 or 1 of the rockers to project outwardly from the cylinder 117.

If the hand 98 is set to present outwardly two rockers 180° apart the operation of the coal feed will take place twice during the rotation of the clock shaft 120 while if all the rockers are set to project, the coal feed will take place twelve times during each rotation of the clock shaft 120.

The clock 94 is on continuous circuit during periods of furnace shut-down, that is, when the fire is banked and during this period operates at suitably long intervals, as once every three or four hours to switch in the blower motor and the other clock, with or without a direct switching in of the coal feed motor 49, these circuits being closed for a period merely long enough to effect a delivery of a single scoop of coal following a proper accompanying operation of the blower, the circuit being opened by the retraction of the coal scoop.

The clocks 92 and 94 are on different circuits of the thermostat, the clock 92 operating when the temperature is low enough to make normal operation of the furnace desirable and the clock 94 operating when the temperature is high enough to make it desirable to bank the fire.

One clock is on when the other is off and vice versa.

Each clock operates a switch throwing rotor, that of one clock 92 being connected to the minute hand shaft of the clock and that of the other to the hour hand shaft.

Each of the rotating contact members 93 and 95 includes angularly adjustable outer and inner composite cylinders presenting a selectively variant number of contact projections 100 according to the relative angular position of one cylinder with respect to the other, as determined by the position of a setting hand 98 on one of the cylinders with respect to a scale 141 on the other.

It will be understood that in operation the thermostat operates to control the furnace for substantially uniform temperature at the thermostat and that the circuits of the two clocks may be turned off and on repeatedly before the clock 94 operates to effect a turning on of the blower and coal feed motors.

In view of our invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of our invention without copying the structure shown, and we, therefore, claim all such in so far as they fall within the reasonable spirit and scope of our invention.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. The combination in a stoker of a fuel storage hopper, an opening in the front of said hopper for admitting fuel to a scoop located under the said opening, means for advancing and retracting the scoop, a fixed apron projecting downwardly into the scoop under the said opening, the said apron retarding the fuel from returning with the retracting movement of the scoop, whereby the said fuel is dropped from the end of scoop and fed over the fuel bed during its retracting movement.

2. In a stoker for a heating furnace, the combination of a draft operating means and a fuel feeding means, the draft operating means comprising an electric motor, a circuit therefor, a

double acting thermostatic switch in said circuit adapted to close the circuit when heat is required, a branch circuit for the fuel feeding means, an electric clock connected in parallel with the blower motor, an adjustable circuit closing device operable by the clock to close the fuel feeding circuit at adjustably spaced intervals of time during the heat requirement, means carried by the fuel feeding device to open the circuit to the fuel feeding means after one feed of fuel, the said double acting thermostat being adapted to open the circuit to the draft operating means and clock when there is no heat required, and to close a circuit to a second electric clock, a second adjustable circuit closing device operable by the second clock to close the blower circuit and the fuel feed circuit at adjustably spaced intervals of time during the period of no heat requirement, means carried by the fuel feeding device to open both the blower and fuel feeding circuits after one fuel feed during the period of no heat requirement.

3. In a stoker for a heating furnace, the combination of a draft operating means, a fuel feeding means and an ash removal means, the draft operating means comprising an electric motor, a circuit therefor, a double acting thermostatic switch in said circuit adapted to close the circuit when heat is required, a branch circuit for the fuel feeding and ash removal means, an electric clock connected in parallel with the blower motor, an adjustable circuit closing device operable by the clock to close the fuel feeding and ash removal circuit at adjustably spaced intervals of time during the heat requirement, means carried by the fuel feeding device to open the circuit to the fuel feeding and ash removal means after one feed of fuel, the said double acting thermostat being adapted to open the circuit to the draft operating means and clock when there is no heat required, and to close a circuit to a second electric clock, a second adjustable circuit closing device operable by the second clock to close the blower circuit, the fuel feed and ash removal circuit at adjustably spaced intervals of time during the period of no heat requirement, means carried by the fuel feeding device to open both the blower, the fuel feed and ash removal circuits after one fuel feed during the period of no heat requirement.

4. In a stoker for a heating furnace, the combination of a draft operating means and a fuel feeding means, the draft operating means comprising an electric motor, a circuit therefor, a double acting thermostatic switch in said circuit adapted to close the circuit when heat is required, a branch circuit for the fuel feeding means, an electric clock connected in parallel with the blower motor, an adjustable circuit closing device operable by the clock to close the fuel feeding circuit at adjustably spaced intervals of time during the heat requirement, means carried by the fuel feeding device to open the circuit to the fuel feeding means after one feed of fuel, the said double acting thermostat being adapted to open the circuit to the draft operating means and clock when there is no heat required, and to close a circuit to a second electric clock, a second adjustable circuit closing device operable by the second clock to close the blower circuit and the fuel feed circuit at adjustably spaced intervals of time during the period of no heat requirement, the said second adjustable circuit closing device being adapted to close the blower circuit a fraction of time before closing the fuel feed circuit, means carried by the fuel feeding device to open both the blower and fuel feeding circuits after one fuel feed during the period of no heat requirement.

5. In a combination control device the combination of a draft supply, a fuel feed, means automatically operative when heat is required to provide for continuous operation of the draft supply and intermittent operation of the fuel feed at adjustably spaced intervals, and means automatically operative when heat is not required to intermittently supply both draft and fuel at timed intervals.

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