July 31, 1934. V. G. LEACH 1,968,407

DRIVE CONTROL DEVICE FOR STOKERS

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Fig. 1

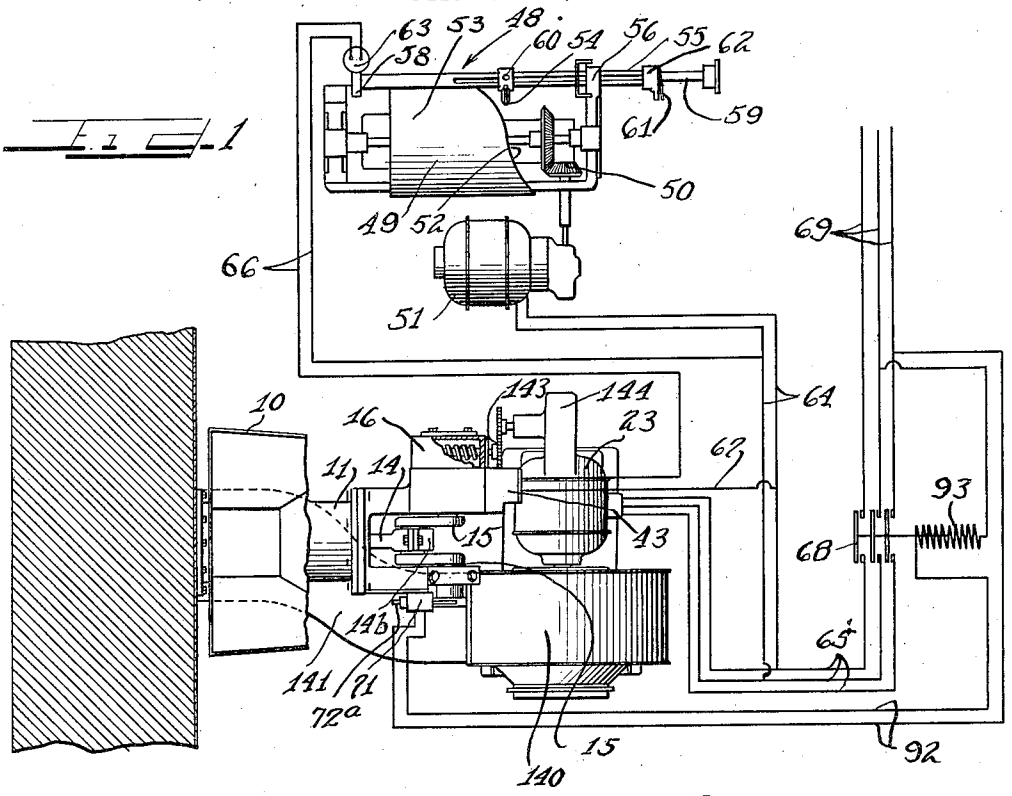
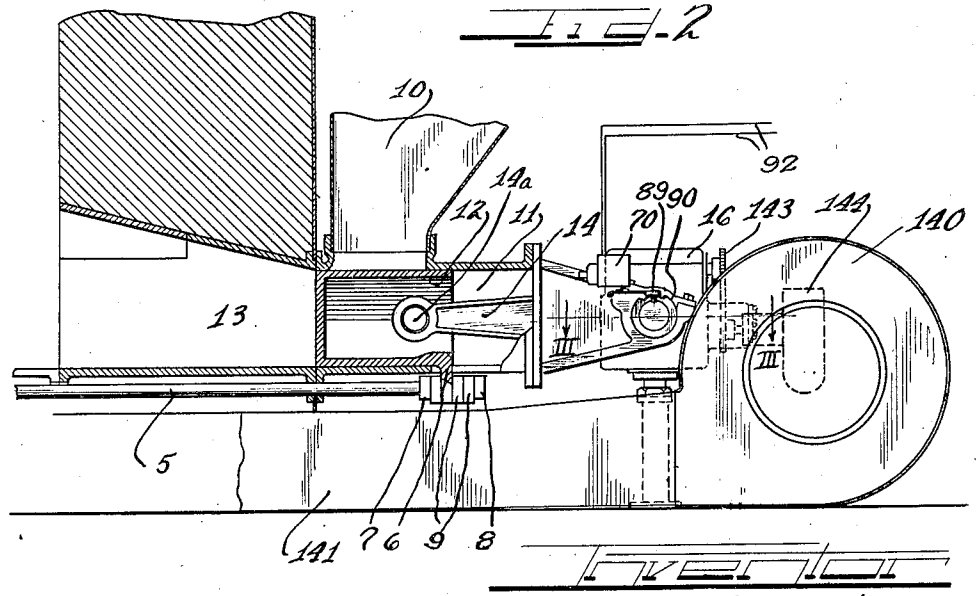


Fig. 2



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DRIVE CONTROL DEVICE FOR STOKERS

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FIG. 4

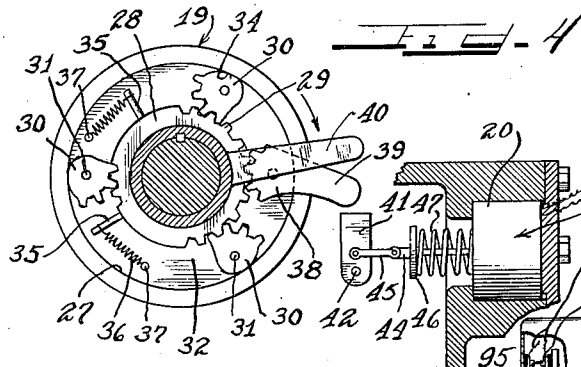


FIG. 5

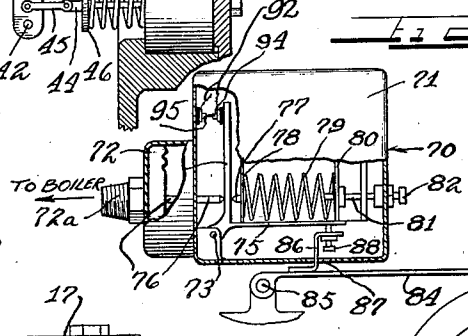


FIG. 3

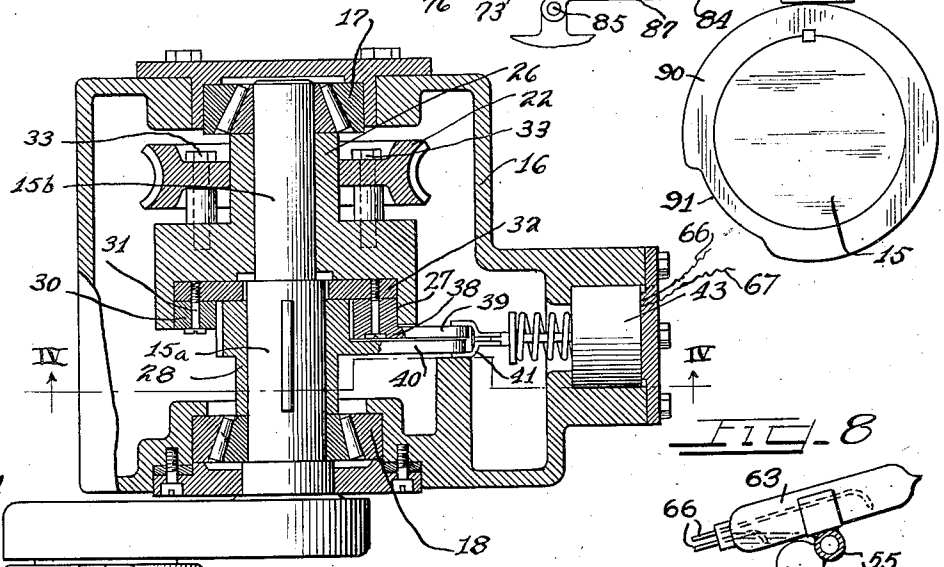
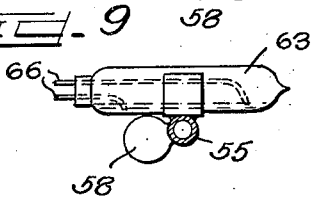
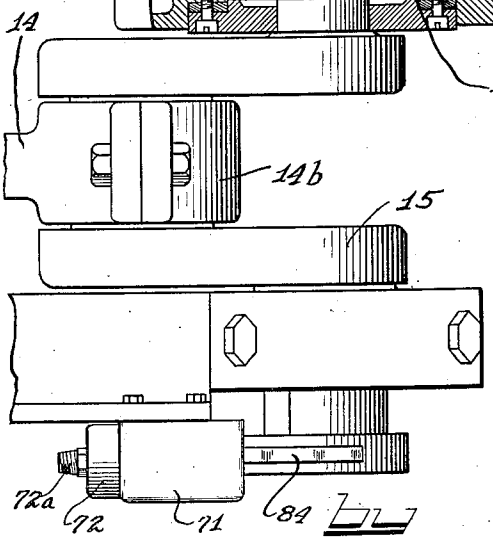


FIG. 8

FIG. 9





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DRIVE CONTROL DEVICE FOR STOKERS

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Fig. 6

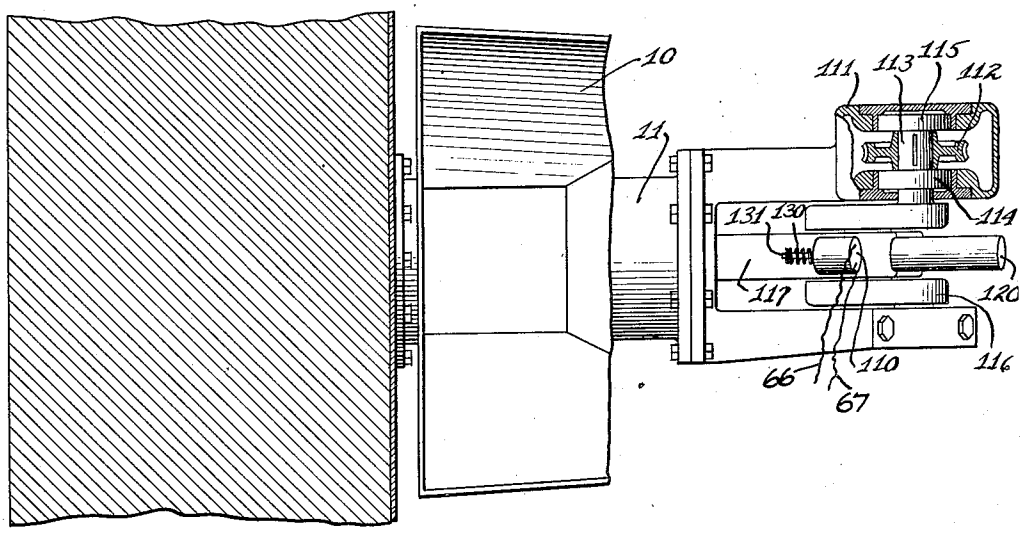
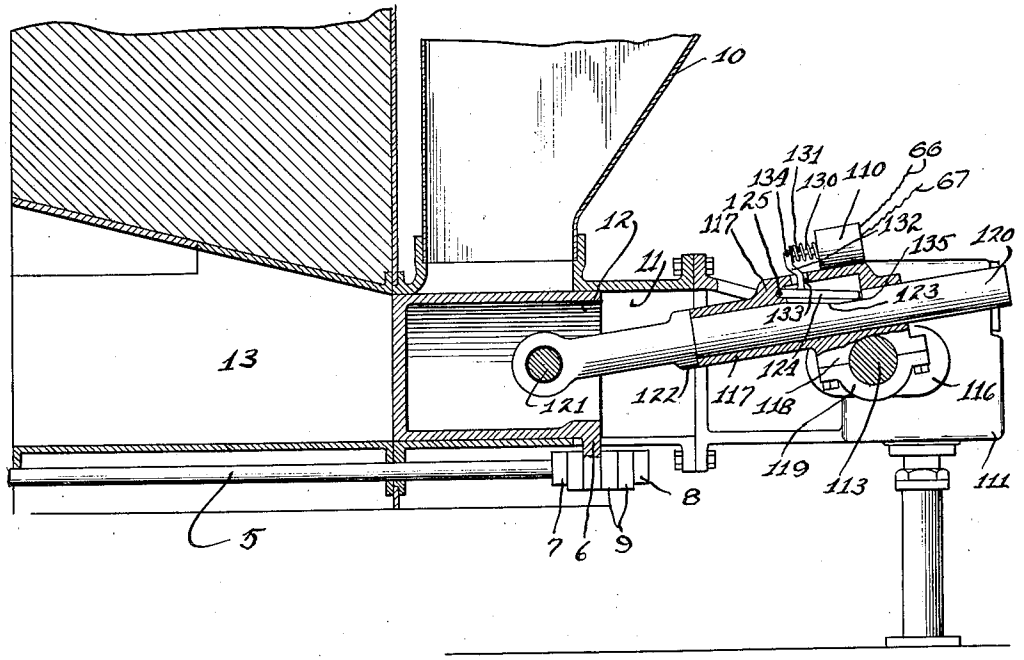


Fig. 7



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Patented July 31, 1934 1,968,407

UNITED STATES PATENT OFFICE

1,968,407

DRIVE CONTROL DEVICE FOR STOKERS

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Application January 9, 1932, Serial No. 585,744

10 Claims. (Cl. 110—44)

This invention relates to a drive control device for controlling the combustion of fuel, more particularly in an under feed type of stoker.

In the plunger type of under-feed stoker, coal is fed into the throat of a retort from a hopper by means of a reciprocating ram which may be driven at a variable speed or with a variable stroke, or both. It has also been proposed in the art to control the operation of the reciprocating ram by means of mechanical timing devices and the like. The different types of drive for plunger types of under feed stokers may be broadly divided in two classes: the first in which the drive is continuous but in which the rate of feed is controlled either by changing the speed of the drive or the length of the stroke, or both; and the second in which the speed remains constant, or substantially so, and the time or period of reciprocation of the ram is varied. In both classes, the air pressure at the tuyères is lowered as the rate of fuel burning is decreased. The operation of the first class of drive control is unsatisfactory with certain fuel since the slow feeding of the fuel to the fire bed fails to provide sufficient agitation to keep the fuel bed in the desired fragmentary condition for uniform air distribution. Instead, fissures occur in the fuel bed between large lumps of coke. This results in inefficient combustion. The present invention falls under the second class.

My present invention contemplates feeding the fuel by means of a ram that is reciprocated at a constant speed when it is in operation but operating the ram only at adjustable, predetermined intervals. When the ram is in operation, it therefore always travels at the high speed rating and subjects the fuel bed to the same sudden surges at low ratings as at the higher ratings thus keeping the bed properly sliced and therefore in a uniformly fragmentary condition. The intervals at which the ram is operated are subject to further modifications introduced by main control means, such as by variations in steam pressure of the boiler, in the temperature of rooms or of the furnace or in any other conditions desirably regulated by the burning of the fuel.

My invention further contemplates the provision of means for causing the ram to stop always at the extreme end of its stroke toward the throat of the retort whenever operation is interrupted. In this position the ram seals the retort from the hopper so as to prevent the fuel from burning back into the hopper. Also, when operation of the ram is again resumed, the motor starts up under substantially no load, since the return stroke of the ram is free from incumbrances.

It is therefore an object of this invention to provide an adjustably and intermittently operable ram for an under feed type of stoker which can only stop at the extreme end of its stroke toward the throat of the retort.

The means for accomplishing this object comprise a cam operated electrical make and break device for throwing in and out a clutch connection between the main driving medium and a driven shaft carrying the crank through which the ram is reciprocated. Independent of such means are also provided additional means for preventing the driven shaft from stopping except when the ram is at the retort end, independent of whether or not the make and break device calls for the clutch to be thrown out or whether the ram motor switch is to be opened to stop the driving medium because of excessive boiler pressure or other main cause.

Another object of this invention is to provide an automatically operated under feed type of stoker in which the reciprocating feed ram is always operated at full speed and in which low rating feeds to the retort are accomplished by adjustably and intermittently stopping the operation of the ram at the retort end of its stroke.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention in a preferred form is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a plan view of a stoker drive mechanism embodying the principles of my invention and including a wiring diagram illustrating the hook up of the drive control device with the stoker driving mechanism.

Figure 2 is a side elevational view of the stoker drive mechanism with parts in section.

Figure 3 is an enlarged fragmentary horizontal section taken substantially along the line III—III of Figure 2 with parts in plan.

Figure 4 is a sectional view taken substantially along the line IV—IV of Figure 3 with parts broken away.

Figure 5 is an enlarged detail view of one element of the drive control device with parts broken away.

Figure 6 is a fragmentary top plan view with

parts in section of an alternative form of my drive control device.

Figure 7 is a side elevational view with parts in section of the alternative form of stoker driving mechanism.

Figures 8 and 9 are side elevations of the mercury switch employed in this invention, the same being shown in open and closed positions, respectively.

As shown on the drawings:

Reference numeral 10 indicates a conventional type of fuel hopper such as is used in connection with mechanical under feed stokers. Said hopper 10 is provided at its base with a cylinder or chamber 11 in which is reciprocally mounted a ram 12 for feeding fuel from the hopper 10 into the throat 13 of a retort. Said ram 12 is connected by means of a connecting rod 14 to a driven crank shaft 15 by means of a wrist pin 14*a* and bearing 14*b* in Figures 1, 2, and 3. The crank shaft 15 and other parts of the stoker driving mechanism are suitably housed within a casing 16, the side walls of which support roller bearings 17 and 18 as shown in Figure 3.

A connection 6 integral with the ram 12 and extending therefrom moves a pusher rod 5 (Figures 2 and 7). The pusher rod extends into the fuel bed of the retort and aids in evenly distributing the fuel throughout the bed. The travel of the pusher rod can be regulated relative to the movement of the ram 12 by means of a lost motion device comprising washers 9 and nuts 7 and 8. Upon removing one or more of the washers 9 the extension connection 6 may be moved for any desired length of travel between the nuts 7 and 8 without moving the pusher rod 5.

In the form of my invention illustrated in Figures 1, 2, and 3 the crank shaft 15 is driven through a clutch indicated as a whole by the reference numeral 19 in Figure 4.

As shown in Figure 3 the portion 15*a* and the reduced portion 15*b* of the crank shaft 15 are rotatably mounted on the side walls of the casing 16 in roller bearings 17 and 18. A clutch member 26 driven by a gear 22 secured thereto by bolts 33 is freely rotatable on the reduced crank shaft portion 15*b*. Said clutch member 26 is provided with an integral annular flange portion 27. A driven member 28 is splined to the portion 15*a* of the crank shaft 15. Said driven member 28 is provided with peripheral teeth 29 (Figure 4) for engagement with pawls 30 which are pivotally mounted upon pins 31 extending from a disc 32. The teeth 29 need not extend around the complete periphery of the driven member 28 since there is only limited relative movement between said driven member 28 and the disc 32 carrying the pawls 30. Each of the pawls 30 is cam shaped so that in one position the outer surfaces of said pawls frictionally engage, as at 34 (Figure 4), the inner surface of the peripheral flange portion 27 of the clutch member 26.

The driven clutch member 28 carries a plurality of pins 35 which are connected by means of springs 36 to pins 37 on the face of the disc 32. The springs 35 tend to hold the pawls 30 in engagement with the teeth 29 in such position as to frictionally engage the flange 27 with a point contact of the cam shaped outer periphery of the pawls. The disc 32 carrying the pawls 30 is loosely mounted near the end of portion 15*a* of the crank shaft 15 between the driving clutch member 26 and the driven member 28. It will thus be seen that rotation of the gear 22 imparts rotary movement to the clutch member 26, and thru the medium of the pawls 30 and the flange portion 27 of the clutch member 26 to the clutch member 28 which is splined to the portion 15*a* of the crank shaft 15 thereby driving said crank shaft.

The means for disengaging the clutch members 26 and 28 comprise a gear segment 38 pivotally mounted on the disc 32 including an actuating arm 39, and an elongated stop member 40 extending radially from the clutch member 28. The elongated stop member 40 lags slightly behind the pawl arm 39 during the rotation of the driven member 28. A stop member 41 pivotally mounted as at 42 (Figure 4) on the casing 16 (Figure 3) is operated by means of a solenoid indicated as a whole by the reference numeral 43, and comprising a solenoid winding 20 and a plunger 44 pivotally connected by means of a link 45 to said stop member 41. The plunger 44 carries a fixedly secured collar 46 between which and the solenoid winding 20 is mounted a coiled spring 47 that serves to urge the plunger outwardly into the position shown in Figures 3 and 4. When the solenoid is energized the plunger 44 is pulled into the solenoid to tilt the stop member 41 out of the path of the rotating pawl arm 39 and stop member 40.

As shown in Figures 3 and 4 the stop member 41 lies in the path of the rotating arm 39 and the stop member 40, the solenoid 43 being deenergized and the spring 47 holding the plunger rod 45 in extended position. As the driven member 28 continues to rotate in the direction of the arrow (Figure 4) first the arm 39 comes into contact with the stop member 41 and by virtue of its tooth engagement with the driven member 28, causes the disc 32 to turn relative to said driven member, thereby throwing the cam shaped pawls out of frictional engagement with the peripheral flange 27 on the clutch member 26. There is, then, at this point no frictional engagement between the driving and driven members of the clutch 19, so that when the stop member 40 also comes into contact with the stop member 41 rotation of the driven member 28 is immediately stopped. Consequently, the crank shaft 15 is stopped thereby stopping the reciprocation of the ram 12. The energizing and deenergizing of the solenoid mechanism 43 is automatically controlled as will hereinafter be described.

When the solenoid 43 is energized however, the stop 41 is pulled out of the path of the pawl arm 39 and the stop member 40 so that the springs 36 can act to relatively rotate the disk 32 to cause the cam shaped pawls 30 to become wedged against the inner surface of the peripheral flange 27. Thereupon engagement of the clutch members 26 and 28 is again effected and the ram is again reciprocated.

Energization of the solenoid winding 20 is controlled by an electrical device, indicated as a whole by the reference numeral 48 (Figure 1). Said electrical control device 48 is preferably a device such as disclosed in my United States Patent No. 1,881,719 issued October 11, 1932 to which reference is made for a detailed disclosure and description. The device 48 comprises in general a cam drum 49 driven through bevel gears 50 by means of a motor and reduction gear unit 51. Said cam drum 49 has a portion of its periphery cut away to provide an edge 52 which is substantially helical in contour and which defines

the edge of a cylindrical bearing surface 53 upon which a finger 54 may be borne.

The finger 54 is mounted on a rotatable supporting sleeve 55 suitably journalled in bearings 56. The sleeve 55 is weighted by means of weights 58 secured thereto, so that when the finger 54 is not riding on the bearing surface 53 of the drum 49 it will be tilted downwardly. As the drum 49 revolves the finger 54 will be borne on the surface 53 for a certain period of time during each revolution of the drum 49 and will be tilted downwardly during a certain other period of rotation.

The finger 54 is secured to a rod 59 slidable in the sleeve 55, so that the finger may be slid along the sleeve and held against turning thereon by a screw 60 that enters a slot in the sleeve 55. A clamping member 61 secured at one end of a collar 62 on the sleeve 55, is urged by a spring to bear against the rod 59 to lock it against movement. The rod may be released from movement by the operator pressing against the clamping member 61 and a finger rest that is formed integral with the collar 62.

The sleeve 55 has mounted thereon a switch 63 of the conventional tiltable mercury contact type best illustrated in Figs. 8 and 9. The switch 63 is arranged to close the circuit connected to the solenoid 43 when the finger 54 is riding on the surface 53 of the drum 49 and to interrupt the circuit when the finger is tilted inwardly beyond the peripheral surface of said drum 49, or the reverse.

It is possible by variously positioning the finger 54 along the sleeve 55 to vary the periods during which the circuit is closed per revolution of the drum by exceedingly small increments.

The motor and reduction gear unit 51 are energized through wires 64 that are connected to two of the three phase wires 65 that lead to the motor 23. The mercury switch 63 is connected by means of wires 66 to one of the wires 64 and to the solenoid winding 20 in the solenoid 43. The solenoid winding 20 is connected by another wire 67 to the other of the pair of wires 64. The main wires 65 are connected through a relay operated switch 68 to the main lead wires 69. It is thus obvious that when the switch 68 is closed the motor 51 is energized to drive the drum 49. Whenever the finger 54 rides off of the cam surface 53 the mercury switch 63 is tilted to interrupt the current in the wire 66, the solenoid 43 is thus de-energized. Under such circumstances, the pawl-arm 39 will act in the manner already hereinbefore described to throw out of engagement the clutch members 26 and 28.

When, however, the finger 54 is riding on the cam surface 53 the circuits comprising the wires 66 and mercury switch 63 will be energized and the solenoid winding correspondingly energized to withdraw the stop member 40 so as to permit the clutch members 26 and 28 to remain in engagement and drive the crank shaft 15.

The period of reciprocation of the ram is thus controlled by the positioning of the finger 54 along the sleeve 55. In this way the proportion of time that the ram is being recipricated can be varied at will by merely setting the finger 54 by means of the rod 59. It should be noted that when the ram is being operated it is always operated at a constant speed or rate of reciprocation.

The main driving motor 23 is directly connected to a fan or blower 140 as shown in Figures 1 and 2 so that whenever the motor 23 is energized the blower 140 is being operated at a constant speed to supply air through a conduit 141 to the fuel bed in the retort.

Since the blower 140 must be operated at a relatively high speed compared to the speed at which the crank shaft 15 is operated the motor 23 must be a comparatively high speed motor since it is preferably directly connected with the blower fan. The crank shaft 15 is driven through the clutch members 26—28 by means of a gear 22 (Figure 3). This gear 22 is driven by means of a worm which worm is rotated by means of a chain 143 (Figures 1 and 2). The chain is energized through a reduction gearing incased in the housing 144, directly attached to the motor 23. Thus any ratio of reduction of speed from the motor 23 to the crank shaft 15 may be selected by varying the size of the gears driving the chain or by varying the worm and gear units.

Since it is obviously unnecessary to feed a fuel into the stoker when the boiler pressure is beyond the desired maximum, means are provided for opening the main switch 68 when the boiler pressure reaches that maximum. Such means are indicated generally by the reference numeral 70 (Figure 2).

As best shown in Figure 5 the means 70 comprises a casing 71. Integral with the casing 71 is a diaphragm casing 72 in which is located a diaphragm. The casing 72 is equipped with a nipple 72a for connection to the boiler.

Within the casing 71 there is pivotally mounted as at 73 a right angle lever having an upright arm 74 and a horizontal arm 75. The upright arm 74 extends between opposed points or pins 76 and 77. The pin 76 is connected to a diaphragm in the casing 72, the diaphragm being subjected to the boiler steam pressure. The pin 77 is carried by a slidable plate 78 that is pressed by means of a coil spring 79 toward the upright arm 74. Said coil spring 79 is positioned between the slidable plate 78 and a plate 80 secured on the end of an adjustable rod 81. An end 82 of said rod 81 extends outside of the casing 71 to permit manual adjustment of said rod to vary the compression of the spring 79 and thereby vary the point at which the lever is actuated by the boiler steam pressure.

A lever 84 is mounted beneath the casing 71 on a pivot pin 85 and is provided with an angle piece 86 that extends upwardly through an opening 87 in the lower wall of said casing 71. Said angle member 86 carries an adjustable screw 88 adapted to make contact against the lower surface of the horizontal arm 75. The arm 84 carries at its free end a shoe 89 that rides upon a cam disc 90 keyed upon the extended end of the crank shaft 15 as shown in Figure 2.

When operating, using boiler pressure as the control, if the boiler pressure upon the diaphragm in casing 72 exceeds the pressure exerted by the spring 79, the horizontal arm 75 is tilted downwardly and would normally act through the screw 88 and angle piece 86 to depress the arm 84. This can only occur, however, when the shoe 89 rides off the outer cylindrical periphery of the cam 90 into the depressed portion of the periphery indicated at 91. Other controlled conditions, such as temperature of rooms, furnace or the like can be used as the basis for control in place of boiler steam pressure and in a similar manner.

The depressed portion 91 is so positioned with respect to the crank on the crank shaft that whenever said portion 91 registers with the shoe 89, the ram 12 is at the extreme end of its travel toward the retort throat 13 as shown in Fig. 2.

Consequently, the boiler steam pressure is operative to break the circuit comprising the wires 92 and relay 93 only when the ram 12 is at its extreme position toward the retort throat. At all other positions, the shoe 89 is riding on the outer periphery of the cam 90, with the arm 84 and angle piece 86 acting through the screw 88 to hold the lever arm 75 in horizontal position and the upright arm 74 in vertical position so that the contact 94 thereon will be in contact with the contact point 95 (Fig. 5). The circuit in the wires 92 is interrupted by a disengagement of points 94 and 95, the relay 93 is de-energized and the switch 68 (Fig. 1) is thrown open to shut off the main motor 23.

In a similar way, the stop member 39 (Figures 3 and 4) is so positioned relative to the throw of the crank shaft 15 that when the stop member 39 is in engagement with the stop member 41, the ram 12 is at the extreme end of its travel toward the retort throat as shown in Figure 2. It is therefore apparent that whether the main motor 23 is stopped because of excessive boiler pressure or whether the clutch 19 (Figure 4) is thrown out of engagement because of the operation of the control device 48 (Figure 1), in either case the ram 12 is stopped at this particular point of its travel. This is important, since with the ram in this position, it acts as a seal between the retort throat and the hopper to prevent the escape of hopper gases and to prevent the combustion of the fuel from backing up into the fuel contained in the hopper. Also, when the motor 23 starts up, it starts under substantially no load since the ram 12 is being withdrawn on its backward stroke.

Figures 6 and 7 disclose a slightly modified form of my invention, especially with respect to the construction of the device controlling the operation of the ram 12. In this modified form a solenoid winding, indicated generally by the reference numeral 110, is connected in the circuit shown in Figure 1 in the same manner as the solenoid 43 shown therein. This solenoid winding 110 acts in a similar capacity, namely as a stop device controlled by the control device 48 for the operation of the ram 12.

As shown in Figures 6 and 7 the reference numeral 111 indicates a housing in which are mounted a worm gear 112 and a worm (not shown) driven by means of the chain 143 from the motor 23 as shown in Figure 1. The gear 112 is keyed to a crank shaft including a drive portion 113 which shaft is suitably mounted in bearings 114 and 115 within the housing 111. A crank shaft also including a crank portion 116 integral with the drive portion 113 drives a clutch sleeve member 117 connected thereto by means of a bearing 118 and bearing strap 119. Said clutch sleeve member 117 is adapted to slide on a connecting rod 120 connected to the ram 12 through a wrist pin 121. The connecting rod 121 is provided with an abutment 122 against which the sliding clutch member 117 contacts to impart motion to the connecting rod 120 and thus drive the same on the load stroke of the ram 12.

The connecting rod 120 contains a notched portion 123 for receiving an arm 124 pivoted at 125 on the sliding clutch member 117. When said solenoid 110 is de-energized the spring 130 acting on the plunger rod 131 of the solenoid causes said plunger rod to be thrown outward. An offset arm 132 integral with said arm 124 extends through an opening 133 in the sliding clutch member 117 and is pivotally connected at 134 to the plunger rod 131. When the solenoid 110 is energized the plunger rod 131 is drawn into the solenoid winding compressing the spring 130 and moving the arm 124, through arm 132. The arm 124 is thus contacted with the notched portion 123 of the connecting rod 120 at 135. With the arm 124 in this position it is readily seen that there can be no substantial relative motion between the sleeve member 117 and the crank shaft 120 so that any reciprocating driving action imparted from the crank shaft 116 to the member 117 is also imparted to the connecting rod 120 and causes the ram 12 to operate.

When the solenoid 110 is de-energized the spring 130 throws the plunger rod 131 outwardly which causes the arm 124 to rise out of the notched portion 123 of the connecting rod. The movement of the sliding clutch member 117 is now only exerted upon the connecting rod 120 at 122 on the downstroke until the ram assumes its furthermost position toward the retort throat 13. On the return stroke of the sliding clutch member 117 the ram 12 remains in this position and the member 117 merely slides along the connecting rod 120. It is obvious, of course, that this relative movement between the sliding member 117 and the now stopped connecting rod 120 will continue until the solenoid 110 is again energized whereupon the arm 124 is thrown downwardly to again contact with the connecting rod 120 at 135 and thus cause the ram 12 to be driven backwardly on its no load stroke. The power or load stroke is then imparted to the ram 12 by the member 117 at the abutment 122. In this manner the arm 124 merely operates to draw back the ram on its no load stroke so that the driving member or clutch member 117 may move the ram on its load stroke by contact therewith at the abutment 122.

By means of this drive mechanism the ram 12 can only stop at the retort throat end of its stroke irrespective of the point at which the solenoid 110 becomes de-energized since the driving member 117 will always be forced against the abutment 122 unless said abutment is at the retort throat end of its travel. As stated above the solenoid 110 is merely substituted for the solenoid 43 in the wiring diagram disclosed in Figure 1. The other electrical connections are identical with those disclosed in Figure 1.

It is apparent that in each form of my invention the ram 12 is reciprocated intermittently for predetermined periods of time and during operation is being reciprocated at a relatively high constant rate of speed although, of course, any operating speed may be utilized. During the intermittent operation of the ram the pusher rod 5 is also operated to thoroughly agitate and distribute the fuel within the retort. When operation of the ram is stopped, either through the make and break mechanism controlled by the device indicated at 48 or through the device 71 controlled by the boiler steam pressure or other factor to be regulated, the ram is always stopped at the extreme end of its travel to seal the retort from the hopper. This feature is important both as a preventative from allowing the combustion to travel into the hopper or allowing escape of gases from the retort through the hopper and is a further desirable feature because it permits the stoker motor 23 to start up under no load conditions and assume full operating speed before subjected to the heavy load on the loading stroke of the ram 12. Since the fan is also operated by the same motor the motor used must be of a com-

paratively high speed winding. The use of a chain drive 143 from the reduction worm and gear unit in the motor case 144 to the worm and gear within the housing 16 (Figs. 1 and 2) or housing 111 (Figs. 6 and 7) is an additional safety feature since the gears around which the chain 143 is entrained may be secured to the worm by means of a shearing pin made of soft iron or other metal so constructed that the pin will shear off under excess pressure caused, for example, by an obstruction in the hopper 10 jamming the ram 12. When the pin has become sheared off the motor of course operates freely and will not become subjected to an overload. The shearing pin can of course be replaced in a few moments. The chain 143 is preferably of the roller bearing type and may be incased in a housing to protect it from dirt and to promote safety.

It will be understood that the term "motor" as used in the claims, unless specifically limited to an electric motor, is intended to include all suitable sources of motive power. Likewise, although boiler steam pressure is utilized in conjunction with my invention as control medium, it will be understood that any factor that is to be regulated, such as a room or furnace temperature, or the like, may serve as the control medium.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. In combination with an underfeed stoker, including a retort, a hopper for fuel connected thereto and a reciprocable ram for positively displacing coal from said hopper into said retort, means for reciprocating said ram at constant speed for predetermined operating periods, means for varying the length of said operating periods, means responsive to boiler steam pressure generated from the stoked fuel and independent of said last mentioned means for stopping the reciprocation of said ram and means normally operative to cause said ram when stopped to stop at the extreme point of its travel toward said retort.

2. In an underfeed stoker, a retort for burning fuel within a furnace, a reciprocable ram for feeding fuel to said retort, a motor for driving said ram, a clutch for releasably connecting said motor with said ram, an electric circuit for said motor, means responsive to boiler steam pressure generated from the stoked fuel to open and close said circuit, means for causing engagement and disengagement of the clutch connecting said motor and ram to cause said ram to be driven at constant speed for predetermined intervals of time, the intervals of driving being spaced by predetermined intervals and means operative to prevent said clutch from being disengaged except when said ram is at extreme retort end of its stroke.

3. In an underfeed stoker including a retort, a hopper for fuel and a ram for feeding fuel from said hopper into said retort, driving means for operating said ram comprising an electric motor, means including a clutch operably connecting said motor and ram, an electric circuit for said motor, means adapted to be controlled by the boiler steam pressure for opening and closing said electric circuit, independent control mechanism for said clutch for engaging and disengaging said clutch at predetermined intervals including means operatively associated with the driven side of said clutch for stopping said ram at the retort end of its stroke when the clutch is disengaged.

4. In an underfeed stoker including a retort, a fuel hopper and a reciprocable ram for feeding fuel from said hopper into said retort, driving means for operating said ram comprising a prime mover, a crank shaft connected thereto, a driving clutch member freely rotatable on a portion of said crank shaft, a driven clutch member secured to another portion of said crank shaft, a connecting rod for connecting said ram to said crank shaft, means responsive to the boiler steam pressure generated from the stoked fuel to control the operation of said prime mover, stop mechanism operably associated with the driven clutch member including means for periodically disengaging said clutch for predetermined intervals of time, and other means operably associated with said crank shaft for causing the crank shaft to stop with the ram at the retort end of its stroke whenever the prime mover is stopped.

5. In an underfeed stoker including a retort, a hopper and a reciprocable ram for charging fuel from said hopper into said retort, a drive control device comprising an electric motor, and an electric circuit therefor, a crank shaft connected to said ram, a clutch having a driving member driven by said motor and a driven member fixed on said crank shaft, means adapted to be controlled by boiler steam pressure for opening and closing the motor circuit, a secondary electric circuit, means in said secondary circuit cooperating with said driven member to disengage said lutch, a tiltable mercury switch in said secondary circuit to open and close said circuit, and means for tilting said switch at predetermined intervals of time.

6. In an underfeed stoker including a retort, a hopper and a reciprocable ram for charging fuel from said hopper into said retort, a drive control device comprising an electric motor and an electric circuit therefor, a crank shaft connected to said ram, a clutch having a driving member driven by said motor and a driven member fixed on said crank shaft, means adapted to be controlled by boiler steam pressure and operative only when the ram is at the retort end of its stroke for opening and closing the motor circuit, a secondary electric circuit, means in said secondary circuit cooperating with said driven member to disengage said clutch, a tiltable mercury switch in said secondary circuit to open and close said circuit, and power activated cam means adapted to tilt said switch at predetermined intervals of time.

7. In an underfeed stoker including a retort, a hopper and a reciprocable ram for charging fuel from said hopper into said retort, a drive control device comprising an electric motor, a crank shaft connected to said ram, a clutch having a driving member driven by said motor and a driven member fixed on said crank shaft, means adapted to be controlled by boiler steam pressure and operative only when the ram is at the retort end of its stroke, for opening and closing the motor circuit, a secondary electric circuit, means in said secondary circuit cooperating with said driven member to disengage said clutch, a cam actuated switch in said secondary circuit to open and close said circuit, cam means for actuating said switch at predetermined intervals of time, and stop means for stopping said driven member when said clutch is disengaged.

8. In an underfeed stoker including a retort, a hopper and a reciprocable ram for charging fuel from said hopper into said retort, a drive control device comprising an electric motor, a crank shaft connected to said ram, a clutch having a driving member driven by said motor and a driven member fixed on said crank shaft, means adapted to be controlled by boiler steam pressure and operative only when the ram is at the retort end of its stroke for opening and closing the motor circuit, a secondary electric circuit, means in said secondary circuit cooperating with said driven member to disengage said clutch, cam means cooperatively associated with said crank shaft normally locking the clutch members together and operable to permit said clutch to be released only when said ram is at the retort end of its stroke, a cam actuated switch in said secondary circuit to open and close said circuit, cam means for actuating said switch at predetermined intervals of time and stop means for stopping said driven member when said clutch is disengaged.

9. In an underfeed stoker including a retort, a hopper and a reciprocable ram for charging fuel from said hopper into said retort, a drive control device comprising an electric motor, a crank shaft connected to said ram, a clutch having a driving member driven by said motor and a driven member fixed on said crank shaft, means adapted to be controlled by boiler steam pressure and operative only when the ram is at the retort end of its stroke for opening and closing the motor circuit, a secondary electric circuit, means in said secondary circuit cooperating with said driven member to disengage said clutch, cam means cooperatively associated with said crank shaft normally locking the clutch members together, and operative to permit said clutch to be disengaged only when said ram is at the retort end of its stroke, a cam actuated mercury switch in said secondary circuit to open and close said circuit, cam means for actuating said switch at predetermined intervals of time, adjustable means associated with the last said cam means for varying the intervals of time said secondary circuit is opened and closed and hence the time interval during which the ram is reciprocated and stop means for stopping said driven member when said clutch is disengaged.

10. In combination with an underfeed stoker including a retort, a fuel hopper and a reciprocable ram for charging fuel from said hopper into said retort, a motor, a crankshaft connected to said ram, reduction gear means for driving said shaft from said motor, a fan driven by said motor, an air duct extending from said fan to said retort to supply air thereto, a clutch interposed between said crank shaft and said reduction gear for disengaging the shaft from the motor, means adapted to be controlled by boiler steam pressure and operative only when the ram is at the retort end of its stroke for starting and stopping said motor, independent control means for said clutch operable to permit said clutch to be released only when said ram is at the retort end of its stroke whereby said fan and said ram are actuated by a single driving means and said ram may be stopped independent of said fan but both said fan and said ram are controlled directly by the boiler steam pressure.

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