Sept. 3, 1940. C. CHAPIEWSKY 2,213,269

STOKER

Filed July 5, 1938 2 Sheets-Sheet 1

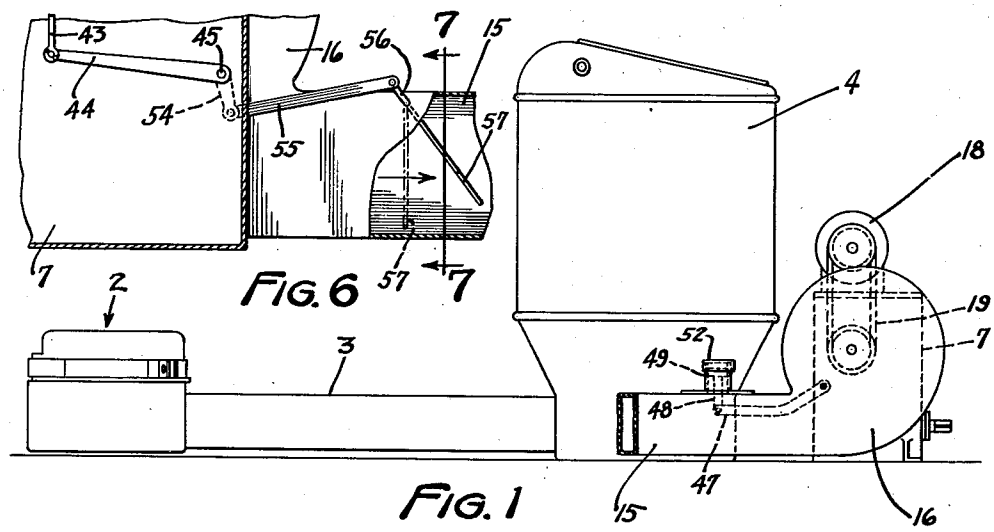


FIG. 6

FIG. 1

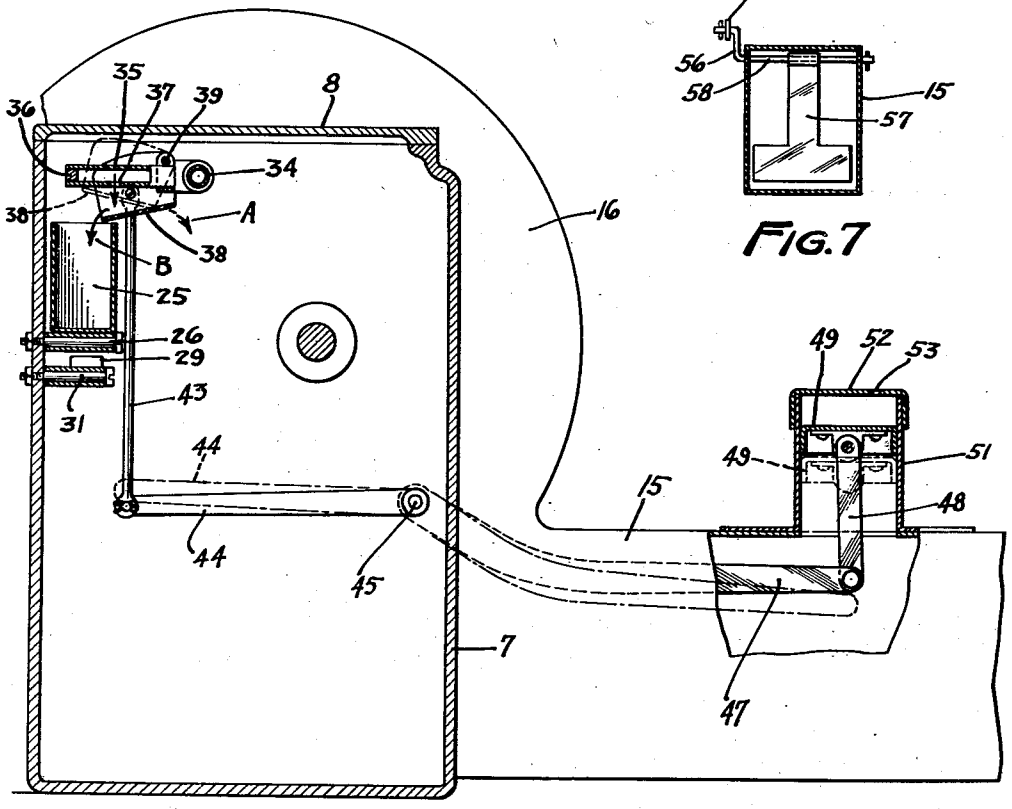


FIG. 7

FIG. 2

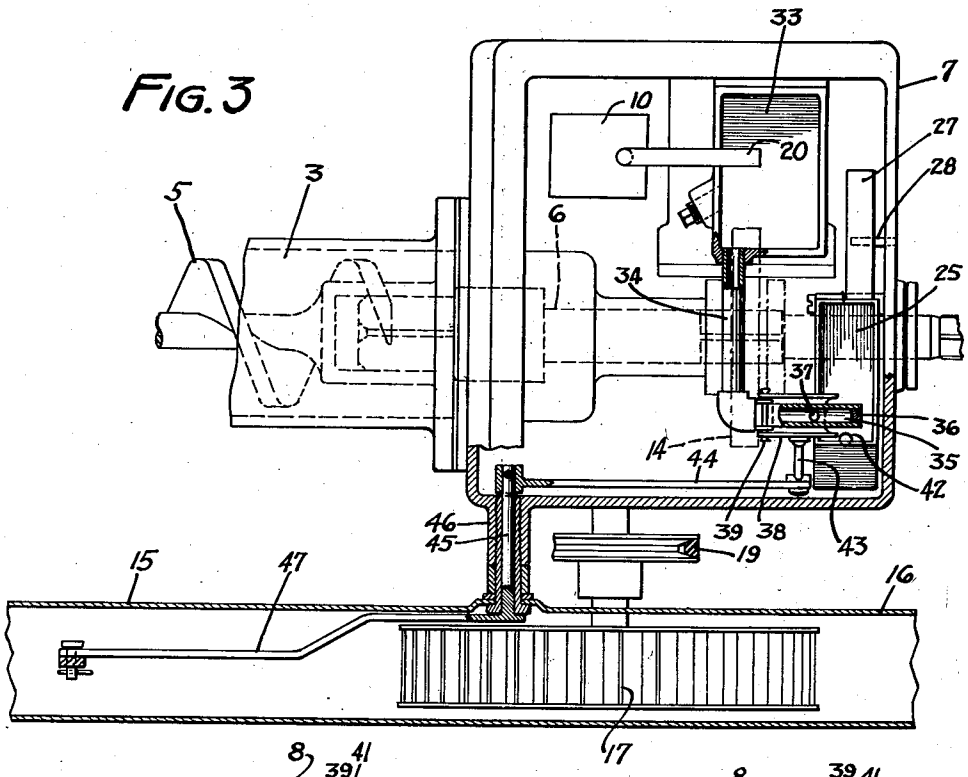
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STOKER

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FIG. 3



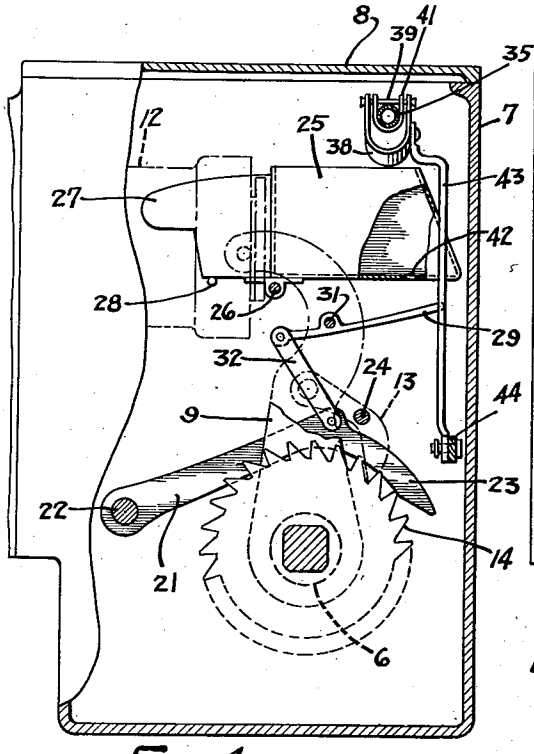


FIG. 4

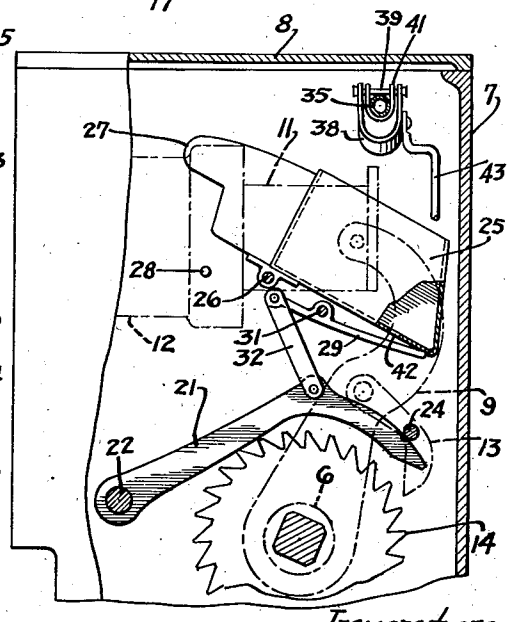


FIG. 5

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STOKER

Charlie Chapiewsky, Bangor, Wis.

Application July 5, 1938, Serial No. 217,435

6 Claims. (Cl. 110—45)

This invention relates to new and useful improvements in stokers and more particularly to the control means thereof.

An object of the present invention is to provide a control means for stokers, whereby should an abnormal condition develop in the fuel bed on the retort, which might interrupt air circulation through the air supply conduit of the retort, the fuel feeding means is temporarily interrupted until normal combustion is resumed, thereby preventing unburned fuel from accumulating in the combustion chamber and clogging it.

A further object of the invention is to provide an automatic control for stokers which, in addition to automatically interrupting the supply of fresh fuel to the fuel bed, in the event of an abnormal condition arising in the retort, may also be so adjusted as to automatically control the depth of the fuel bed.

A further object is to provide in combination with a stoker comprising a ratchet mechanism for driving the fuel feeding means, a pressure responsive device which is in direct communication with the usual air supply conduit of the retort, whereby it may be actuated by variations in the pressure or velocity of the air passing through the conduit, thereby to automatically control the operation of the fuel feeding means in such a manner that, should an abnormal condition arise in the fuel bed on the retort which would affect the circulation of air through the air supply conduit, the fuel feeding means will be automatically temporarily interrupted until normal combustion is restored in the combustion chamber.

A further object is to provide a stoker comprising a mechanism for driving the fuel feeding means, which mechanism includes a ratchet wheel and a drive pawl which is normally in driving engagement with the ratchet wheel, and a pressure responsive device being in direct communication with the air conduit which supplies air to the fuel bed on the retort, and which pressure responsive device is operatively associated with the drive pawl and adapted, upon abnormal air flow through the conduit, to automatically move the drive pawl out of driving engagement with the ratchet wheel, whereby the fuel feeding means is interrupted, and which fuel feeding means will be retained in inoperative condition until the fuel bed has been restored to normal operation to permit normal air flow through the air supply conduit, whereupon the drive pawl is automatically moved into driving engagement with the ratchet wheel, whereby the feed screw will resume operation.

Other objects of the invention reside in the unique construction and arrangement of the control means which is such as to readily lend itself for use in connection with conventional stokers of the type comprising a ratchet mechanism for driving the fuel feeding means; in the arrangement of the oil deflector within the transmission case of the stoker, which deflector has an operative connection with a pressure responsive device located within or in direct communication with the air conduit or trunk for supplying air to the retort; and which deflector is positioned to receive oil or liquid circulated within the transmission case; and, in the provision of a pivoted bucket within the usual casing of the stoker transmission, which bucket has an operative connection with the usual drive pawl of the transmission, whereby when the deflector is positioned to direct liquid into the bucket, the bucket will eventually be tilted upon its axis, by the weight of the oil therein, whereby the drive pawl is moved out of driving engagement with the ratchet wheel secured to the usual drive shaft of the stoker feed screw, thereby interrupting feeding operation of the feed screw without interrupting the operation of the means for supplying air to the retort.

Other objects of the invention will appear from the following description and accompanying drawings and will be pointed out in the annexed claims.

In the accompanying drawings there has been disclosed a structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not confined to the exact features shown as various changes may be made within the scope of the claims which follow.

In the drawings:

Figure 1 is a side elevation of a conventional or well-known type of stoker showing the invention applied thereto;

Figure 2 is an enlarged detail sectional view showing the connection between the pressure responsive device and the oil deflector;

Figure 3 is a plan view of the stoker transmission and the blower, with some of the parts omitted and partially in section, to more clearly illustrate the application of the invention thereto;

Figure 4 is a detail sectional view showing the tiltable bucket and the means associated therewith for moving the drive pawl out of driving

engagement with the ratchet wheel, said parts being shown in inoperative position;

Figure 5 is a view similar to Figure 4, showing the parts operated to move the drive pawl out of driving engagement with the ratchet wheel;

Figure 6 is a view showing a control device of slightly different construction, which is actuated by the velocity of the air through the air trunk; and

Figure 7 is a cross-sectional view on the line 7—7 of Figure 6.

In the selected embodiment of the invention here shown, there is illustrated in Figure 1, for purposes of disclosure, a stoker of more or less conventional design comprising a retort 2 having a fuel supply pipe 3 connecting it to a hopper 4 and provided with the usual feed screw 5 for feeding fuel from the hopper to the retort.

The feed screw 5 is shown coupled to a drive shaft 6, indicated in dotted lines in Figure 3. The drive shaft is shown mounted in the lower portion of a transmission case 7 provided with a suitable cover 8.

The transmission which operates the drive shaft 6 is of the hydraulic type, and is well known in the art and it is therefore thought unnecessary to herein illustrate and describe the same in detail.

Briefly, the transmission comprises the shaft 6, which is provided with an arm 9 indicated in dotted lines in Figures 4 and 5. This arm has its upper end suitably connected to a piston 11 mounted for reciprocal movement within a suitable cylinder 12. A suitable pump, generally designated by the numeral 10 in Figure 3, is provided for circulating the fluid within the transmission case 7 through the usual ports provided in the cylinder 12 and piston 11, thereby to reciprocate the piston in the cylinder to impart oscillatory movement to the arm 9. The arm 9 is loosely mounted on the drive shaft 6 and carries a drive pawl 13, which is normally constantly in driving engagement with a ratchet wheel 14, secured to the drive shaft 6. By the above arrangement, it will be understood that when the arm 9 is oscillated by reciprocal movement of the piston 11, intermittent motion will be imparted to the shaft 6 through the pawl 13 and ratchet wheel 14, whereby a similar motion will be imparted to the feed screw 5. The above described mechanism is conventional in certain types of stokers, as illustrated, for example, in Patent No. 1,994,800, and it is therefore thought unnecessary to further describe the same in detail.

Means is provided for supplying air under pressure to the retort 2, and comprises an air conduit or trunk 15 having one end connected to the retort 2 and its opposite end to a blower housing 16 having a suitable blower 17 mounted therein, as best shown in Figure 3. The blower may be operated from a suitable motor 18 through a belt 19. This motor may also operate the oil circulating pump, previously referred to.

In the operation of a stoker, it is essential, in order to obtain efficient combustion, that a supply of fresh air be constantly supplied to the retort 2. If the circulation of air through the fuel bed on the retort is partially or wholly interrupted, combustion is impaired and may eventually cease, in which case, the raw, unburned fuel may pile up on the retort and completely fill and clog the combustion chamber. When this occurs, the combustion chamber must be manually emptied of the unburned fuel which has accumulated therein, before combustion can again be resumed. This requires labor and also necessitates complete interruption of the plant before heat can again be furnished.

It is therefore desirable that means be provided in connection with the driving means for the feed screw for automatically temporarily interrupting the operation of the feed screw, in the event that an abnormal condition arises in the combustion chamber. By thus temporarily interrupting the operation of the feed screw, when an abnormal condition arises in the combustion chamber, and at the same time, permitting the blower 17 to continue to operate, the supply of air to the retort may eventually clear the obstruction by increasing combustion, after which the transmission may again be rendered operative to feed fresh fuel to the retort.

A feature of the present invention therefore resides in the provision of means for thus automatically interrupting operation of the feed screw, should the fuel tend to accumulate or pile up on the retort without being consumed.

The means provided for thus interrupting the operation of the screw comprises an arm 21 mounted upon a suitable pivot 22 within the transmission case 7 and having an arcuate end portion 23 positioned adjacent to the drive pawl 13 and adapted to engage a pin 24 on the pawl 13, as shown in Figure 5, whereby the pawl is moved out of driving engagement with the ratchet wheel 14.

The arm 21 is adapted to be actuated by movement of a bucket, generally indicated by the numeral 25, and shown mounted for rocking movement on a suitable pivot 26. See Figures 4 and 5. A suitable counter-weight 27 is secured to one end of the bucket 25. The counterweight 27 is heavier than the empty bucket, so that it normally holds the bucket in the horizontal position shown in Figure 4. The weight is adapted to engage a suitable stop 28 which may be fixed to one of the walls of the transmission case 7, as best illustrated in Figure 3.

One end of the bucket 25 is adapted to engage one end of a lever 29 supported on a suitable pivot 31 and having a link 32 connecting it to the arm 21, as shown in Figures 4 and 5. When the bucket is in its normal horizontal position, as shown in Figure 4, it will be out of engagement with the lever 29, whereby the arm 21 will assume its normal position, shown in Figure 4. When thus positioned, the end portion 23 of the arm 21 is out of engagement with the pin 24 of the pawl 13, whereby the latter may intermittently drive the ratchet wheel 14, when the arm 9 is oscillated by the piston 11.

A suitable reservoir 33 is provided in the upper portion of the transmission case 7. The pump 10 is suitably connected to the reservoir 33, as by a connection 20, and maintains constant flow of oil or liquid into said reservoir. An overflow pipe 34 is connected to the upper portion of the reservoir 33 and is shown provided with an L-shaped end portion 35 whose terminal is closed by a suitable plug 36. A discharge opening 37 is provided in the L-shaped end portion 35 of the overflow pipe 34, through which the oil discharges onto a deflector 38, pivotally mounted on a suitable pivot 39, shown secured to a U-shaped bracket 41 secured to the end portion 35 of the overflow pipe 34.

When the deflector 38 is in the dotted line position shown in Figure 2, the oil or liquid delivered thereto from the discharge opening 37 of the overflow pipe 34 will discharge into the transmis-

sion case, as indicated by the arrow A in Figure 2. When the deflector is in the full line position shown in Figure 2, the oil discharging from the overflow pipe 34 will be deflected into the bucket 25, as indicated by the arrow B. When the bucket 25 receives sufficient oil to overbalance the weight of the counterweight 27, the oil in the bucket will tilt it to the position shown in Figure 5, whereby the bucket will actuate the lever 29 and thereby move the arm 21 into operative position with respect to the drive pawl 13, so that the latter is out of driving engagement with the ratchet wheel 14. A small drain aperture 42 is provided in the bottom wall of the bucket 25 to permit the oil to drain therefrom, when the deflector is returned to the dotted line position, shown in Figure 2, following resumption of normal air flow through the air conduit 15. When the bucket 25 has been drained of its contents, it will return to its normal position, shown in Figure 4.

The operation of the deflector 38 is controlled by variations in the flow of air through the air supply conduit or trunk 15. To thus control the deflector, it is shown provided with a connecting rod 43 whose lower end is connected to one end of an arm 44 secured to a shaft 45, shown mounted in a suitable bearing 46 in a wall of the transmission case 7. To the opposite end of the shaft 45, there is secured one end of an arm 47 which may, as shown in Figure 3, be located within the air trunk 15. The other end of the arm 47 is shown having a link 48 connecting it to a suitable diaphragm or piston-like member 49, mounted for reciprocal movement in a cylindrical housing or casing 51, shown mounted on the air conduit 15. The lower end of the housing 51 is open and in direct communication with the interior of the air trunk 15. The upper end of the casing 51 is shown closed by a suitable cap 52 which has a breather opening 53 therein to permit free movement of the diaphragm 49 within the housing 51.

In the operation of the structure, as illustrated in Figure 2, when the flow of air through the air trunk 15 is normal, the diaphragm will be in the position indicated by dotted lines in this figure, whereby the deflector 38 will be positioned to direct the oil from the overflow pipe 34 back into the transmission case, as indicated by the arrow A.

If, for some reason, the flow of air through the fuel bed on the retort becomes partially or wholly obstructed, whereby a pressure develops in the air trunk 15, then the diaphragm 49 is moved upwardly to the full line position, shown in Figure 3, whereby the deflector 38 is moved from the dotted to the full line position, shown in Figure 2, whereby it will direct the oil discharging through the orifice 37 of the overflow pipe 34 into the bucket 25, as indicated by the arrow B. It is to be understood that the flow of oil from the overflow pipe 34 into the bucket 25 is relatively faster than the oil drains from the bucket through the opening 42, so that the bucket 25 will gradually fill with oil until the weight of the oil overcomes the counterweight 27 and tilts the bucket to the position shown in Figure 5.

When the bucket assumes the tilted position shown in Figure 5, the drive pawl 13 is moved out of driving engagement with the ratchet wheel 14, as a result of the linkage 29—32 being actuated to swing the arms 21 upwardly from the position shown in Figure 4 to that shown in Figure 5. Such disengagement of the pawl 13 from the ratchet 14 will automatically temporarily interrupt rotation of the feed screw 5. The mechanism is so arranged that temporary interruption of the feed screw does not interrupt the operation of the blower 17, whereby air is constantly being supplied to the fuel bed, and may eventually restore it to normal combustion. When the fuel bed is again restored to normal combustion, normal air flow is resumed through the conduit 15, whereby the diaphragm 49 returns to its lowered position, as shown in dotted lines in Figure 2, whereby tilting the deflector so as to divert the oil back into the transmission case, as indicated by the arrow A. When the deflector thus diverts the oil from the overflow pipe 34 back into the transmission case, the oil in the bucket 25 will gradually drain therefrom until the weight 27 tilts the bucket back to its normal horizontal position, as shown in Figure 4. When the bucket is thus positioned, the drive pawl 13 is automatically returned to normal driving engagement with the ratchet wheel 14, and normal operation of the stoker is automatically resumed.

In Figures 6 and 7, there is shown a control means of slightly different construction wherein the velocity of the air through the conduit 15 controls the operation of the deflector 38, whereas, in Figure 2, variations in the pressure of the air in the conduit 15 controls the operation of the deflector 38.

In the form shown in Figures 6 and 7, a small arm 54 is shown secured to one end of the shaft 45 and has a connecting link 55 connecting it to a crank arm 56, shown mounted for rocking movement in the walls of the conduit 15, as clearly illustrated in Figure 7. A plate-like element 57 is secured to the shaft 58 of the crank arm 56, and is positioned in the path of the flow of air through the conduit 15.

Under normal operation, the element 57 may be positioned substantially as shown in full lines in Figure 6, whereby the deflector 38 will be in the dotted line position shown in Figure 2. When, however, the velocity of the air through the conduit 15 is interrupted, as when the retort becomes congested with fuel, the element 15 may resume a vertical position, as shown in dotted lines in Figure 6, thereby tilting the deflector 38 to the full line position shown in Figure 2. Such operation of the deflector will cause the oil discharging from the overflow pipe 34 to be directed into the bucket 25, whereby the bucket is subsequently tilted to the position shown in Figure 5 and thereby renders the feed screw 5 inoperative, as hereinbefore stated.

From the foregoing, it will be noted that the operation of the feed screw may continue uninterruptedly as long as normal combustion prevails within the combustion chamber. Should the fuel bed or retort, however, become congested with fuel or clinkers, sufficiently to partially or wholly interrupt air flow through the air conduit 15, whereby a pressure or variation in the air velocity develops therein, then the control means shown in Figures 2 and 6 will automatically move the deflector 38 to the full line position shown in Figure 2, whereby the bucket 25 is gradually filled and subsequently tilts to the position shown in Figure 5, and thereby moves the driving pawl 13 out of driving engagement with the ratchet wheel 14. The same automatic control is accomplished by the structure disclosed in Figures 6 and 7, except that the member 57 is actuated

by variations in the velocity of the air passing through the conduit 15.

When normal combustion is restored to the combustion chamber, the pawl 13 is automatically moved into driving engagement with the ratchet wheel 14, whereupon the stoker resumes its normal operation and automatically supplies the retort or fuel bed with fresh fuel in direct proportion to the consumption thereof by the products of combustion within the combustion chamber of the furnace.

The control apparatus, as herein disclosed, is extremely simple, and has been found very efficient in actual operation. Its construction is such that it may readily be embodied in the construction of conventional stokers of the type comprising a ratchet mechanism for operating the feed screw, regardless of whether said mechanism is operated by hydraulic or other means. When embodied in such a stoker, the control renders it automatic in operation, and positively prevents the combustion chamber from becoming overloaded or clogged with raw, unburned fuel, in the event of combustion failure. The depth of the fuel bed may also be automatically controlled by the use of this novel control apparatus, by simply varying the size of the breather opening 53 in the upper wall or cap 52 of the casing 51, or by varying the size or arrangement of the counterweight 27 with respect to its associated parts.

I am aware that the linkage between the deflector 38 and the diaphragm 49 or the velocity control member 57, may be varied or differently arranged from that shown in the drawings, and the same results accomplished, and I, therefore, do not wish to be limited to the exact structure shown.

In the drawings I have shown the automatic control used in connection with a stoker of the hydraulically operated type, but it is to be understood that it may be used in connection with any type of stoker driving mechanism employing a ratchet-operated feed screw.

I claim as my invention:

1. In a stoker, a retort adapted to have a bed of fuel thereon, a conduit for supplying air to the fuel bed, a fuel feed screw, a hydraulic transmission for operating the feed screw including a ratchet wheel having a drive pawl and a pressure pump for circulating the liquid in the transmission to operate the pawl, means for moving said pawl out of driving engagement with the ratchet wheel including a gravity operated bucket normally positioned to permit the drive pawl to drive the ratchet wheel, a deflector adjacent to said bucket and normally positioned to prevent liquid from entering the bucket, and a pressure responsive device in communication with the air conduit and having an operative connection with said deflector, whereby when the air flow through the conduit becomes abnormal, said pressure responsive device will automatically actuate the deflector and cause a portion of the liquid in the transmission to be deflected into the bucket, whereby the bucket is subsequently tilted upon its axis and thereby moves the pawl out of driving engagement with the ratchet wheel to interrupt operation of the feed screw.

2. In a stoker, a retort, a conduit for supplying air to the retort, a fuel feed screw, a hydraulic transmission including a piston, means for circulating liquid within the transmission to operate said piston, a ratchet wheel operatively coupled to the feed screw, and an arm connected to the piston and carrying a drive pawl which is normally in driving engagement with the ratchet wheel, a reservoir within the transmission into which a portion of the liquid is constantly circulated, an overflow for the reservoir, a gravity operated bucket mounted adjacent to the deflector and operatively associated with said drive pawl and adapted, when in one position, to disengage the drive pawl from the ratchet wheel, a deflector mounted for rocking movement and positioned to receive liquid from said overflow, and a pressure responsive device in communication with the air conduit and having an operative connection with said deflector, whereby when the pressure or velocity of the air in said conduit becomes abnormal, the deflector is actuated to divert the overflow oil from the reservoir into the bucket, whereby the latter is subsequently operated to move the pawl out of driving engagement with the ratchet and thereby interrupt the fuel feed screw.

3. The combination with a stoker, comprising a retort, a fuel feed screw, an air supply conduit, and a hydraulic transmission comprising a ratchet wheel secured to the feed screw, a piston, an arm connected to the piston and having a pawl thereon adapted to engage and drive the ratchet wheel when the piston is operated, and pump means for circulating liquid in the transmission, of a gravity operated bucket, a lever connected to said pawl and positioned to be actuated by the bucket, when the latter is tilted to a certain position, and means made operable by variations in the pressure in the air supply conduit, thereby to divert a portion of the liquid in the transmission into said bucket, whereby the bucket is subsequently tilted to a position to engage said lever and thereby move the pawl out of driving engagement with the ratchet, whereby the operation of the feed screw is temporarily interrupted.

4. The combination with a stoker, comprising a retort, a fuel feed screw, an air supply conduit, and a hydraulic transmission comprising a ratchet wheel secured to the feed screw, a piston, an arm connected to the piston and having a pawl thereon adapted to engage and drive the ratchet wheel when the piston is operated, and pump means for circulating liquid in the transmission, of a gravity operated bucket, a lever connected to said pawl and positioned to be actuated by the bucket, when the latter is tilted to a certain position, and means made operable by variations in the pressure in the air supply conduit, thereby to divert a portion of the liquid in the transmission into said bucket, whereby the bucket is subsequently tilted to a position to engage said lever and thereby move the pawl out of driving engagement with the ratchet, whereby the operation of the feed screw is temporarily interrupted, and means permitting the liquid in the bucket to drain therefrom, upon resumption of normal air flow through the conduit, whereby the bucket will subsequently return to its normal position and release the pawl and thereby permit it to again drive the feed screw.

5. The combination with a stoker comprising a retort, a fuel feed screw, an air supply conduit, and a hydraulic transmission for driving the feed screw, comprising a ratchet wheel secured to the feed screw, and an arm mounted for oscillatory movement and carrying a pawl adapted to engage and drive the ratchet wheel,

of a control mechanism for the stoker comprising a pivotally mounted gravity-operated bucket, a deflector adapted to divert a portion of the liquid in the transmission into said bucket, and means for operating said deflector comprising a pressure responsive device in communication with the air supply means and connected to said deflector, said pressure responsive device being adapted to be actuated by variations in the pressure in the air supply conduit, thereby to operate the deflector and cause it to divert a portion of the liquid into the bucket, upon abnormal air flow through the conduit, whereby the bucket is subsequently tilted to a position to operate said lever and move the pawl out of driving engagement with the ratchet wheel, thereby to temporarily interrupt operation of the feed screw.

6. The combination with a stoker comprising a retort, a fuel feed screw, an air supply conduit, and a hydraulic transmission for driving the feed screw, said transmission comprising a ratchet wheel secured to the feed screw, and an arm mounted for oscillatory movement and carrying a pawl adapted to engage and drive the ratchet wheel, of a control mechanism for the stoker comprising a pivotally mounted gravity-operated bucket having a restricted drain opening therein, a deflector mounted for pivotal movement adjacent to the bucket and adapted to divert a portion of the liquid in the transmission into said bucket, and means for operating said deflector comprising a pressure responsive device in communication with the air supply conduit and connected to said deflector, said pressure responsive device being adapted to be actuated by variations in the pressure in the air supply conduit, thereby to operate the deflector and cause it to divert a portion of the liquid into the bucket, upon abnormal air flow through the conduit, whereby the bucket is subsequently tilted to a position to operate said lever and move the pawl out of driving engagement with the ratchet wheel, thereby to temporarily interrupt operation of the feed screw.

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