Jan. 18, 1927. 1,614,456

H. M. CROSSETT

METHOD OF AND MEANS FOR QUENCHING COKE

Filed March 6, 1922

Fig. 1.

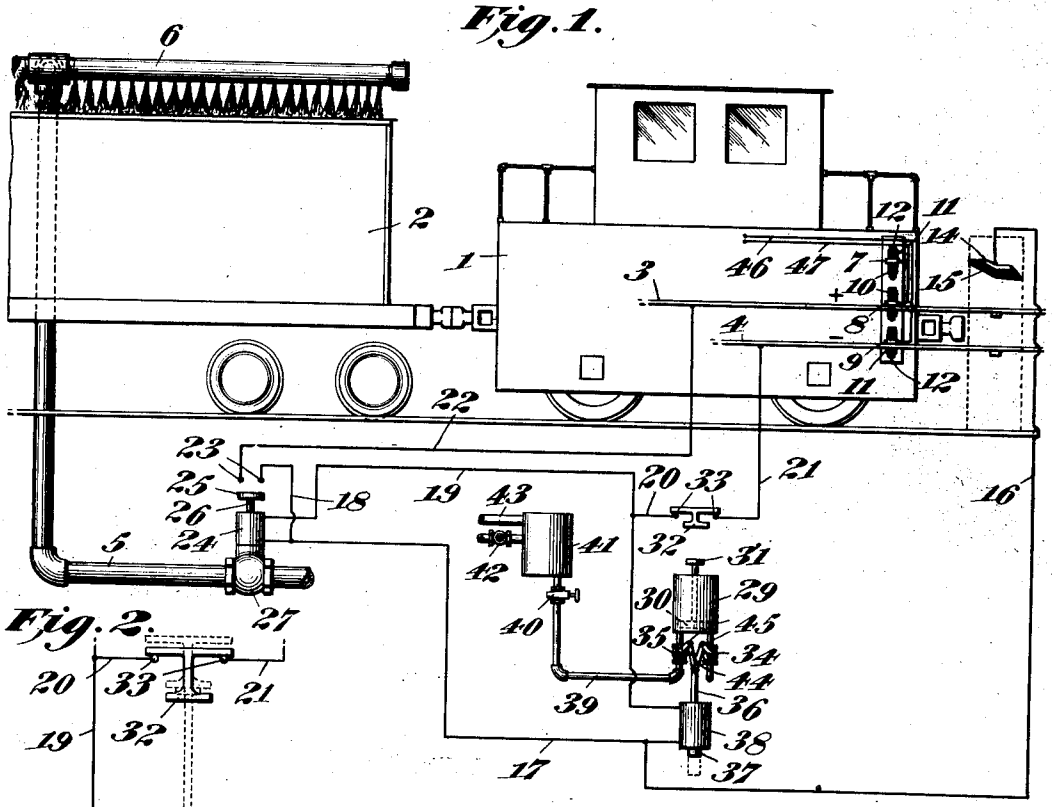


Fig. 2.

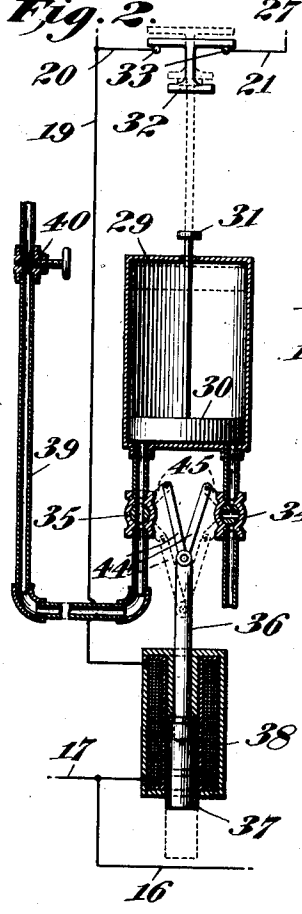


Fig. 3.

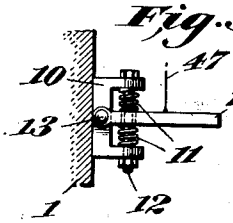


Fig. 4.

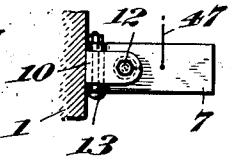


Fig. 5.

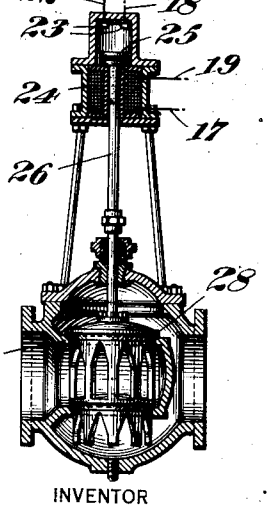
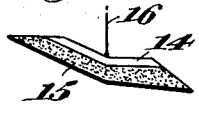


Fig. 6.



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UNITED STATES PATENT OFFICE.

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METHOD OF AND MEANS FOR QUENCHING COKE.

Application filed March 6, 1922. Serial No. 541,290.

My invention relates to method of and apparatus for automatically and accurately measuring definite or desired quantities of fluid in such a way as to avoid the inaccuracies due to personal control, and although my invention is adapted for many and various uses, I will, for the sake of brevity and clearness, herein explain it in connection with control and measurement of a desired or proper quantity of fluid for quenching a charge of hot coke as or after it is discharged from a coke oven or ovens. In doing this it is most essential to produce coke having a minimum amount of moisture, and this minimum should be constant in order that the coke may be most efficient for blast furnace and other use.

My invention is applicable for measuring fluids or liquids of any kind, or for mixture with any other materials, or for use in chemical processes or for cooling or for any other purposes, but I will, for the sake of brevity of description and illustration herein, confine it to the quenching of coke as hereinbefore explained. Although various fluids may be used in accordance with my invention, I will for the sake of simplicity herein, refer usually to the use of water for quenching.

The ordinary time required for quenching the usual quantity of red hot coke when discharged from an oven or ovens requires less time than a minute, and this has heretofore been timed by the operator in charge, who opens and closes the quenching fluid valve within a fixed number of seconds. In doing this, however, the operator is very apt to supply the quenching fluid for a greater or lesser time, due to personal equation, so that by this prior method the quantity of quenching fluid varies from charge to charge, due to the personal inaccuracy or sometimes the carelessness or mistaken intent of the operator. In accordance with my invention the human operator is eliminated and the amount of fluid is measured accurately, as will be hereinafter more fully described.

If the discharge of red hot coke is contained in a quenching car, this car may be moved along a track by an electric or other locomotive or by other means, and after the coke is discharged from the oven into the receptacle the operator moves it directly under the quenching sprays, and in so doing an electric contact is made, which automatically opens a valve in the large fluid supply pipe, allowing the fluid to flow through the spray opening or nozzles thereof at the instant when the car comes to a standstill directly under the quenching pipes. A further automatic portion of the apparatus is also provided, including a tank, which may be supplied with water or any other suitable liquid through an opening of a predetermined or adjustable size, which liquid is supplied under constant pressure from a supply tank of constant level or otherwise. This liquid under constant pressure is automatically supplied to an auxiliary tank which contains a float or piston, and, as the quenching valve is opened automatically, as before stated, the supply of liquid to the auxiliary tank is begun. This supply of regulating fluid is so arranged as to lift the float or piston a certain height in a given predetermined time, and when this float has reached that height a contact piece on the float or float rod actuates another electric contact, which closes the valve of the quenching water supply automatically. As this is done the auxiliary tank inlet valve is automatically closed and the exhaust valve thereof is opened; the liquid flows out and it is then ready for another operation. The auxiliary float tank operates in a manner similar to a water clock or clepsydra and is supplied with liquid at substantially constant pressure from a constant level supply tank or otherwise through a valve or orifice of predetermined size to produce a given flow in a certain time.

Having thus given a general description of my invention, I will now, in order to make the matter more clear, refer to the annexed sheet of drawings, which form part of this specification, and in which like characters refer to like parts.

Figure 1 is a diagrammatic view illustrating the application of my invention; Figure 2 is a vertical sectional elevation drawn on a larger scale showing the mechanism for controlling the flow of quenching water; Figure 3 is a side elevation showing the contact shoe and the collector shoes, Figure 4 is a top plan view of the contact shoe shown in Figure 3; Figure 5 is a vertical sectional elevation through the quenching water supply valve and attachments, and Figure 6 is a side elevation of the contact block.

Referring to the characters of reference

on the drawings:—1 indicates a locomotive in general, which may be electrically driven or otherwise; 2 is a diagrammatic view of the side portion of a coke quenching car, 3 is an electric current feed rail adapted to carry positive current, 4 is an electric current feed rail to carry negative current, 5 is a water supply pipe of large size, 6 is a quenching supply pipe connected thereto and provided with a plurality of small openings or nozzles therein adapted to furnish a spray, 7 is a contact shoe adapted to engage with a contact block 14, the upper portion of which is formed of metal with a connected wire 16, the lower side of the block being provided with insulation 15 and the block being formed with an inclined portion as shown, so that when the contact shoe passes to the left it connects with the metal 14 and when it passes to the right it only touches the insulation 15. A similar collector shoe 8 is provided to engage with the positive current feed rail 3 and a similar collector shoe 9 is engaged with the negative feed rail 4 to supply current to the electric locomotive, all of these being mounted on brackets 10. Springs 11 are provided on each side of the contact and collector shoes to maintain them in operative position, and these springs are mounted on bolts 12, and the shoes are pivoted in the bolts 13 to allow them to move up and down, thus allowing for any irregularity or inclination in the conductors or contact block with which they come in contact. The arrangement of the contact and collector shoes is illustrated in detail in Figures 3 and 4. The electric circuit 16 is connected to the metallic contact block 14 and to the circuit 17, which connects with the two solenoids or electromagnets 38 and 24, and 18 is a circuit connection between the connection 17 and one of the contact points 23, while 19 is another circuit connection between the solenoids 24 and 38. Another connection 20 is provided from the circuit 19 to one of the contact points 33, and 21 is an electric connection between the other contact point 33 and the negative feed rail 4. 22 is an electric connection between one of the contact points 23 and the positive feed rail 3. 23 are contact points which are connected by the bridge piece 25 when the quenching water valve is open, and 24 is a solenoid for controlling the movement of the water supply valve, the moving part of which valve is 28. 26 is a plunger in the solenoid 24, which is secured to the upper part of the stem of the moving portion 28 of the water supply valve, which valve is adapted to be closed on a seat 27. This valve is preferably of the balanced type so as to be easily operated by the solenoid 24. 29 is a float tank or chamber provided with a float or piston 30 mounted therein, provided with a stem as illustrated, having a head portion 31. 32 is a switch member adapted to join the contact points 33, which contact may be broken or made by the movement of the head 31 of the float stem. 34 is a valve or cock in the exhaust or drain pipe connected with the float chamber 29, and 35 is a valve or cock in the supply pipe adapted to supply water or other liquid to the said float chamber. The float chamber is provided with a solenoid 38 below it, having a heavy plunger 37 adapted to be moved up and down therein and provided with a stem 36 projecting upwardly therefrom and which is pivoted to the links 44, the other ends of which are pivotally connected to the valve or cock arms 45, connected respectively to the exhaust and supply valves or cocks 34 and 35. The water supply pipe 39 is connected to the float chamber 29 and this is supplied with water under constant pressure from a supply tank 41 with an overflow pipe 43, thereby maintaining constant pressure, this tank 41 being kept full to the overflow by the water supply pipe provided with the valve 42, which is normally always open. In order to regulate the size of the opening through which the liquid or water is supplied to the tank 29, I provide a needle valve 40 in the supply pipe 39, and this is set in such a way as to supply water to the tank 29 to lift the piston or float 30 to a height sufficient to break the electric connection at 33 in a certain and predetermined time. Electric connections 46 and 47 are provided between the electric driving apparatus of the locomotive 1 and the collector shoes 8 and 9 for the purpose of operating the locomotive from the feed rails 3 and 4 in any usual manner, and a connection is also made from the contact shoe 7 to the wire 47 to cause a current to pass into the contact block 14 and thence into the circuit 16 and connections.

The operation of my apparatus is as follows:—A quenching car is placed in position to receive a charge of red hot coke as it is preferably discharged from the coke oven, preferably by moving the car along the rails by means of an electric locomotive so that this charge of coke is discharged uniformly over the inclined or other floor of the quenching car. The car is then run by means of an electric locomotive under the water spray pipe 6, while the water supply valve is closed and no water is issuing from the spray pipes 6. As soon, however, as the contact shoe 7 touches the metallic side of the contact block 14 it initiates actuation of instrumentalities so operating that as the locomotive and quenching car move from right to left as viewed in Figure 1, an electric circuit is established exactly at the time when the quenching car is stopped directly and fully below the quenching sprays in the position illustrated in Figure 1. This electric current then energizes the solenoid 24,

which raises the movable part 28 of the water supply valve and causes a full supply of water to be immediately discharged from the spray pipes 6 as illustrated in Figure 1. As this is done the bridge piece 25 also moves up with the plunger 26 and makes an electric connection between the contact points 23, which causes a current to flow to and energizes the solenoid 38, the plunger 37 of which rises and opens the cock 35, which supplies liquid to the float chamber 29 and closes the exhaust cock 34. In a given or desired time the float or piston 30 is raised by the liquid supply to the tank chamber and when it has raised to a certain height the head 31 contacts with the switch member 32 and breaks the contact between the points 33. This breaks the electric current, and the solenoid 24 being no longer energized, the valve 28 drops on its seat by gravity and closes off the water supply, and at the same time the plunger 37 of the solenoid 38 drops by gravity, shutting the supply cock 35 of the tank 29 and opens the exhaust cock 34, thereby allowing the liquid in the float tank to be discharged. As the water pipe 5 and the spray pipe 6 are supplied with water under constant pressure from a tank or reservoir of constant level (not shown) or from other sources of constant pressure, a given amount of water will be discharged therefrom in a given time, and this time is determined by the time required to raise the float 30 to a height sufficient to break the electrical connection between the contacts 33. The amount of time may be made greater by partially closing the needle valve 40, or it may be made to operate more quickly by a wider opening of said valve. When the electric locomotive and the quenching car are driven backward over the rails from right to left as viewed in Figure 1, the contact shoe 7 only contacts with the lower part 15 of the contact block, which is composed of insulation, and therefore no current is supplied to the electric circuits during this movement. The shape of this block is such that the contact shoe touches the metallic part and completes the circuit when car travels toward the quenching spray and contacts only with the insulated portion on its return.

Although I have shown the contact shoe as mounted on an electric locomotive and adapted to form an electrical connection by engagement with the stationary contact block at the proper time, I may, if desired, arrange the contact shoe on the quenching car or extension of the same in case the electric locomotive is not used. I can also so arrange that contact may be made otherwise at the proper time when the quenching car is directly and completely under the spray pipes.

My apparatus may also be applied for use in connection with other forms of quenching apparatus without using a quenching car, such as shown and illustrated, and may in fact be installed in connection with a stationary quenching dock or wharf or with any other form of holder or receptacle for red hot coke discharged from an oven, and the electric contact may be made by the movement of any suitable portion of the apparatus at the proper time and an accurately measured quantity of water will be supplied by the automatic operation of the valves, float and other appurtenances.

I may also use waste water, waste liquor, steam or other fluid for quenching the coke and may determine the proper quantity to be used by setting the needle valve or arranging the orifice for supplying liquid to the float tank accordingly.

The timing device, comprising the float tank 29, the float 30 therein, the solenoid 38, the regulating valve 40 and attachments may be enclosed and locked in a box so that it cannot be interfered with in any manner, and when thus set it will control the delivery of a constant amount of quenching fluid to each charge, and the regulation of the same if necessary can be done by one competent person who has the key.

I prefer to arrange the amount of quenching fluid in such a way that it will be substantially the exact amount required to properly quench all the pieces of coke uniformly and in such a way that after the coke has been cooled to a point below its combustion temperature the residual heat remaining therein will substantially evaporate the remainder of the quenching fluid, but the finally remaining moisture will be a very small and substantially constant quantity, say two or three per cent, thus providing coke of uniform moisture content, which is much desired for metallurgical and other purposes.

My quenching apparatus is preferably located near a group of coke ovens and the quenching car may be moved on its tracks to any one of the ovens to receive coke discharged therefrom, and thence moved on the tracks to the quenching apparatus and the operation repeated as necessary, so that the quenching car and apparatus will serve a large number of ovens.

Although I have described and illustrated my apparatus in connection with a timer composed of a float tank and a float therein supplied with liquid through an orifice, I may use any other timing apparatus, such as a clock or any type of pendulum with an escapement, a sand glass, or in fact anything that will determine with accuracy any desired period of elapsed time, and make and break the circuit.

The movement of my quenching car from a coke oven to the quenching spray pipes

and the return thereof to another oven to receive a further charge of coke may be called a cycle or series of movements that are recurrently repeated, and the automatic operation of my quenching apparatus is started during the first portion of the period of said cycle when the quenching car is moved to the spray pipes.

Although I have shown and described my invention in considerable detail, I do not wish to be limited to the exact and specific details thereof, as shown and described, but may use such modifications in, substitutions for, or equivalents thereof as are embraced within the scope of my invention, or as pointed out in the claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A coke quenching apparatus comprising a receptacle adapted to contain hot coke, a liquid spray pipe provided with a control valve, an electric circuit adapted to govern the operation of said valve, means for moving said receptacle under said spray pipe, said means being operable to cause the said electric circuit to open said valve when said receptacle is under said spray pipe, and means for automatically closing said valve at the expiration of a predetermined period of time.

2. A coke quenching apparatus comprising a receptacle, a spray device for delivering a quenching fluid, means for moving said receptacle into and out of the zone of said spray device, a valve for controlling the supply of fluid to said spray device and provided with an electromagnet controllable during the movement of said receptacle and adapted to open said valve while the receptacle is in the zone of said spray device, and an interconnected electrically controlled timing apparatus adapted to close said valves after the expiration of a predetermined time.

3. A coke quenching apparatus comprising a receptacle, a spray device for delivering a quenching fluid to said receptacle, means for moving said receptacle into and out of the zone of said spray device, a valve controlling the delivery of fluid to said spray device, said valve being provided with a solenoid adapted to open the valve while the receptacle is in the spray zone of said device, electrically-controlled means operable during movement of the receptacle adapted to actuate the solenoid to open said valve, and an electrically-controlled timing device adapted to close said valve after the expiration of a predetermined time.

4. A quenching apparatus comprising a coke receptacle, a pipe adapted to discharge a spray of quenching fluid, means for moving said receptacle into and out of the zone of said spray device, a valve in said pipe controlling the delivery of fluid to said spray device, a solenoid adapted to open said valve while the receptacle is in the zone of discharge of said pipe, electrically-controlled means operable during the movement of said receptacle adapted to energize the solenoid to open said valve, and an electrically-controlled timing device adapted to close said valve after it has been opened for a predetermined time, whereby a measured quantity of liquid may be sprayed onto the coke in said receptacle.

5. In an apparatus of the character described, a quenching spray device, a receptacle adapted to be moved into and out of the zone of said spray device, a delivery pipe for feeding fluid for said spray, and provided with a control valve, an electromagnet adapted to open said valve, a stationary contact block in electrical connection with said magnet, a contact shoe connected to and moving with said receptacle, and adapted to temporarily close a circuit energizing said magnet to open said valve when the receptacle is under the zone of said spray device, and an automatic timing device adapted to close said valve after it has been open a predetermined time.

6. In a quenching apparatus, a receptacle, a quenching spray device, means for moving the receptacle into and out of the zone of said spray device, a valve controlling said spray device, and means for electrically opening said valve, including a stationary contact block mounted in the path of travel of said receptacle and adapted to cause an electric current to momentarily pass to and open said valve when the receptacle is in the zone of said spray device, and an automatic timer adapted to close said valve after a predetermined time.

7. In a quenching apparatus, including a receptacle. a spray head, a pipe communicating with said spray head and provided with an electrically operable control valve and means for moving said receptacle into and out of the zone of said spray head, an electric circuit connected so as to operate said valve and provided with a stationary contact block which is metallic on one side and insulated on the other side, a contact shoe mounted for movement with the receptacle and adapted to contact with the metallic portion of said block and open said valve when the receptacle is moved up to and into the zone of said spray head, and with the insulated portion when the receptacle is moved in the other direction, whereby the valve is caused to open during one movement of the receptacle, but is not affected by a reverse movement.

8. In a quenching apparatus, a pipe having a spray head, means adapted to supply said pipe with fluid under pressure, a receptacle for coke movable into and out of the

zone of operation of said spray head, an electrically-operable valve controlling the output of said pipe, an electric contact in circuit with said receptacle and said value, whereby to control the opening movement thereof when the receptacle is in the spray zone of said head, said contact being made operable by the movement of the receptacle, and an automatic timing device operable to automatically close said valve.

9. In a quenching apparatus, a spray pipe in communication with a pipe adapted to carry fluid under pressure and provided with a control valve, a spray head on said pipe, an electrically-operable control valve for said pipe, a receptacle for coke movable into and out of the zone of operation of said spray head, a solenoid in circuit with said receptacle and said valve and adapted to open the latter when the circuit is closed as the receptacle passes into the zone of said spray head, and a liquid clock so connected to the valve that opening movement of the latter will start the clock mechanism, said clock mechanism being adapted to break said electric circuit and close the valve after a predetermined interval of time.

10. In a liquid supply apparatus, a spray pipe having a spray head and connected to a pipe adapted to carry fluid under pressure, a receptacle for coke movable into and out of the zone covered by the spray from said pipe, an electrically-operable valve controlling the exit of fluid from said pipe, and adapted to be automatically opened when said receptacle moves into the zone covered by said spray, and means for automatically closing said valve, comprising a liquid clock, comprising a tank, a float in said tank, means for supplying liquid under pressure to said tank, and a contact breaker attached to said float and in circuit with said valve, said contact breaker being operable to break said circuit and close said valve after a predetermined interval of time.

11. In a liquid supply apparatus, a spray pipe having a head and in communication with a pipe adapted to carry fluid under pressure and provided with an electrically-actuated control valve, a receptacle movable into and out of the area covered by the spray from said pipe, means for opening said valve when the receptacle is in the area covered by said spray, and a timing device in circuit with said valve and adapted automatically close said valve, comprising a float tank, a float therein having a stem projecting outwardly therefrom, automatic means for supplying liquid under pressure to said tank when said valve is opened, and a contact breaker operably associated with said float and so positioned that, after a predetermined interval of time, movement of the float will break the contact and close said valve.

12. A quenching apparatus, comprising a receptacle, means for moving it to and from a spray pipe provided with a control valve, a solenoid adapted to open said valve, a stationary contact block having electric connection to said solenoid, a contact shoe connected to said receptacle and adapted to temporarily contact with said block during the movement of the receptacle whereby to energize the solenoid and open said valve, a timing apparatus comprising a float tank, a float mounted therein, a pipe adapted to supply liquid thereto at substantially constant pressure, a cock in said pipe, a solenoid in the electric circuit, the plunger of which is connected to and adapted to open said cock, whereby liquid may be supplied to said timing device, and a circuit breaker attached to said float and adapted to break the electric circuit after a predetermined time, whereby to de-energize the control valve solenoid and to close said control valve.

In witness whereof I hereunto affix my signature.

HOMER M. CROSSETT.