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METHOD OF TIMING BOILER BLOWDOWNS

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FIG. 1.

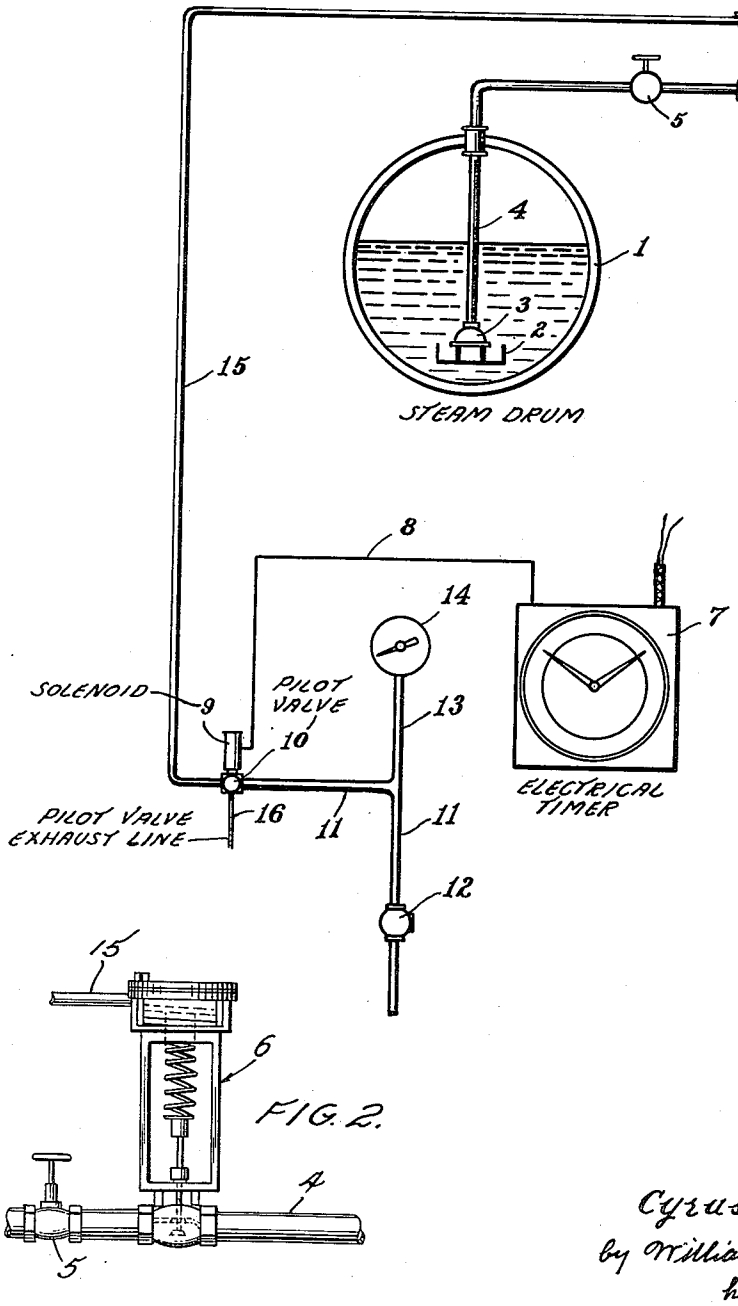


FIG. 2.

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METHOD OF TIMING BOILER BLOWDOWNS

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2 Claims. (Cl. 122—382)

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This invention relates to a method of automatically timing the periodic blow-down of steam-generating boilers.

As is well known, it is necessary in the operation of steam boilers to blow out from some point in the structural assembly of the boiler concentrations of solids naturally occurring in the boiler water and excess of chemical conditioning agents together with precipitated solids in the form of scale or sludge. Over-concentration and precipitation results in troublesome boiler deposits and the contamination of the generated steam unless such concentrates and precipitates are adequately removed by blowing down the boiler; that is, by blowing out a portion of the boiler water containing concentrates and precipitates. The necessity for adequate boiler blow-down is greatest in high pressure boilers employed in the power plant generation of steam.

Assuming that the blow-down operation is an essential incident to the satisfactory operation of steam boilers, it should be noted that there are problems connected with the accomplishment of the blow-down in an adequate and wholly satisfactory manner. If the blow-down operation be performed recurrently under manual control, the problem of human forgetfulness and inattention is involved. Thus if the operations are conducted at improperly spaced intervals either concentrations and precipitated solids are permitted to build up to a detrimental extent, or there is waste of the heated boiler water with chilling by forced introduction of fresh feed water accompanied by loss of the boiler conditioning agents. If the blow-down is continued through too short or too long a blow-down period, the same undesirable results are met. I have found that blow-down timed with respect to boiler conditions other than analysis of the boiler water for boiler concentrates fails to maintain proper control of concentration and scale formation and to maintain a proper control of sludge accumulation in the boiler.

A commonly employed expedient to avoid irregularity due to the fallibility of the boiler operator is to utilize a slight continuous blow-down of boiler water from a point where high concentrations of dissolved and precipitated solids occur. While apparently solving the problems created by manual operations, the continuous blow-down is itself subject to a serious objection. In practicing continuous boiler blow-down it is necessary to utilize a throttling valve which is open to a slight degree through long periods of time. Such throttling valves necessarily employed in continuous boiler blow-down act in effect as filters to separate particles of disintegrated scale and sludge from the blow-down water which is discharged from the boiler. Such particles accumulate inwardly of the valve and in the course of time build up to a point at which flow of water past the valve is negligible or is cut off completely. Cleaning of such valved blow-down lines requires boiler shut-down and unless the lines are cleared frequently the boiler is susceptible of unduly high concentration of dissolved and precipitated solids and to steam contamination.

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It is the object of my invention to provide a method of operation by which when the proper timing and duration of boiler blow-down has been determined by analysis of the boiler water in a region of the boiler which is optimum for the purpose, blow-down automatically takes place from that region at accurately spaced intervals and throughout accurately apportioned periods of time.

In the accompanying drawings:

Fig. I is a schematic view showing an exemplary apparatus organization suitable for conducting the method of my invention.

Fig. II is a detail elevational view of the blow-down valve forming part of the apparatus organization and connections immediately associated with it, taken on an enlarged scale.

In the drawings reference numeral 1 designates the steam-separating chamber of a steam generating boiler, shown specifically as the steam drum of a water-tube boiler, which portion of the boiler is best adapted to the collection and removal of boiler concentrates and precipitated solids and in which boiler pressure is at a maximum. Not only is concentration of dissolved solids and sludge forming matter at a maximum in the steam drum of a boiler, but also that region is best adapted to their collection and removal. This is because in the steam drum the velocity of flow of steam and water is at a minimum. There is thus in this region the best chance for high boiler concentrations and undis-

solved solids to gather. In steam drum 1 there is a trough 2 from which to withdraw concentrates and precipitated solids through a filter cup 3 at the end of a blow-down duct 4. In blow-down line 4 beyond the drum there is a manually operable valve 5 which normally is wholly open throughout the operation of the boiler, and an automatically operated control valve 6 arranged to open against boiler pressure and adapted to move between fully open and fully closed positions.

The timing means associated in the apparatus organization are of the well known electrical sort comprising a timer 7 arranged to permit the passage of an electrical current at predetermined intervals and for a predetermined period of time. From electrical timer 7 an electrical circuit 8 leads to a solenoid 9 controlling a valve 10. It will be noted that the solenoid valve does not act directly to control blow-down line 4. I have found it impractical in installations of this sort to include a solenoid valve sufficiently powerful to open positively against high boiler pressure. I utilize a solenoid valve to control the passage of fluid pressure to valve 6 which is a diaphragm operated valve movable, as has been noted, between fully open and fully closed positions, and which opens against boiler pressure so that instantaneous and complete closing of the valve is insured and a continuous dribbling discharge is prevented.

Fluid pressure, such as compressed air, for operating diaphragm valve 6 is supplied by way of fluid pressure line 11 leading to solenoid valve 10. This line 11 is provided with a pressure regulator 12 and in a branch 13 of the line there is a pressure indicator 14. From solenoid valve 10 an extension 15 of fluid pressure line 11 leads to diaphragm valve 6. For automatic operation of the blow-down system electrical timer 7 is set to control the frequency and the duration of the blow-down periods. During these periods solenoid valve 10 is maintained open by passage of current thereto by way of circuit 8 and fluid pressure passes through line 11 and extension 15 to blow-down valve 6, which is fully opened against boiler pressure. Valve 6 being open, pressure in steam drum 1 forces out water containing boiler concentrates and solids from trough 2 and discharges them through line 4 and by way of blow-down valve 6. Because of the full opening of the valve 6, any entrained particles of boiler scale and other precipitated solids are swept out with the water and cannot collect behind the valve to obstruct its movement to fully opened and closed positions or to restrict the orifice through the valve. At the end of each blow-down period solenoid valve 10 closes off primary pressure line 11 to terminate the exertion of fluid pressure on blow-down valve 6 by way of extension 15 of the fluid pressure line and simultaneously opens an exhaust 16 by which pressure in extension 15 is exhausted to the atmosphere.

In conducting the method, a series of analyses at timed intervals first is made to determine the length of time required for concentrations to build up to a disadvantageous order and the length of time required to blow-down the boiler from the region in which the blow-down water is taken under normal boiler operation. The spacing and duration of the blow-down periods then is established by setting the electrical timer in accordance with the determinations. From that point onward the method proceeds automatically, with the blow-down valve opened periodically and remaining open for a determined

period to discharge from the region of highest concentration the quantity of sludge and concentrates that should be removed to give satisfactory boiler operation.

Operation thus is based accurately on timed analyses of the blow-down water so that the frequency or duration of the blow-down periods may be caused to suit conditions in the boiler. With this automatic regulation there is assurance against waste by reason of blow-down periods which are too frequent or too long continued and assurance against preventable boiler encrustation or steam contamination by the dissolved or precipitated solids in the boiler when concentrations become too high. The operation of the ultimate control valve under the control of the electrical timing means is as has been explained positive and instantaneous and because of the accuracy of the timing any throttling effect is unnecessary.

It is to be understood that whereas the method of my invention has been described specifically with respect to timed analyses in the blow-down from the steam drum of a water-tube boiler, it is applicable to fire-tube boilers and to boilers of all usual types. In all such boilers I base the spacing and duration of the blow-down periods on a series of analyses of the boiler water in a region in which boiler concentrations are high, and the blow-down water is taken from that region. So long as the condition of boiler feed water remains uniform and the build-up of boiler concentrates follows a course which has already been determined and made the basis of timed blow-down periods, no change in timing is necessary. When the rate at which boiler concentrates build up changes because of changed feed-water or changed conditions of boiler operation, further timed analyses and change in the timing of the blow-down periods is necessary.

I claim as my invention:

1. The method of controlling chemical concentrations and sludge accumulations during the operation of a steam-generating boiler which comprises determining the rate at which such concentrations build up in the boiler by making outside the boiler at timed intervals a series of analyses of boiler water taken from a region of high boiler concentration of dissolved solids and sludge and in which liquid velocity is low, presetting timing apparatus in accordance with the progress of concentration and accumulation indicated by said analyses, and under the influence of said timing apparatus electrically controlling the discharge of blow-down water and entrained solids from the said region of high boiler concentration throughout periods the pretimed spacing and duration of which are based on the said analytically determined rate at which concentrations and sludge accumulation build-up in the boiler.

2. The method of controlling chemical concentrations and sludge accumulations during the operation of a steam-generating boiler which comprises determining the rate at which such concentrations build up in the boiler by making outside the boiler at timed intervals a series of analyses of boiler water taken from a region of high boiler concentration of dissolved solids and sludge and in which liquid velocity is low, presetting timing apparatus in accordance with the progress of concentration and accumulation indicated by said analyses, under the influence of said timing apparatus electrically controlling the discharge of blow-down water and entrained

solids from the said region of high boiler concentration by maintaining a blow-down valve fully open against boiler pressure throughout periods the pretimed spacing and duration of which are based on the said analytically determined rate at which concentrates and sludge accumulations build-up in the boiler, and tightly closing the said blow-down valve with boiler pressure at the end of each such period.

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