Feb. 22, 1927. 1,618,474

F. D. POTTER

COMBUSTION CONTROL APPARATUS

Filed Dec. 20, 1918 2 Sheets-Sheet 1

Fig. 1.

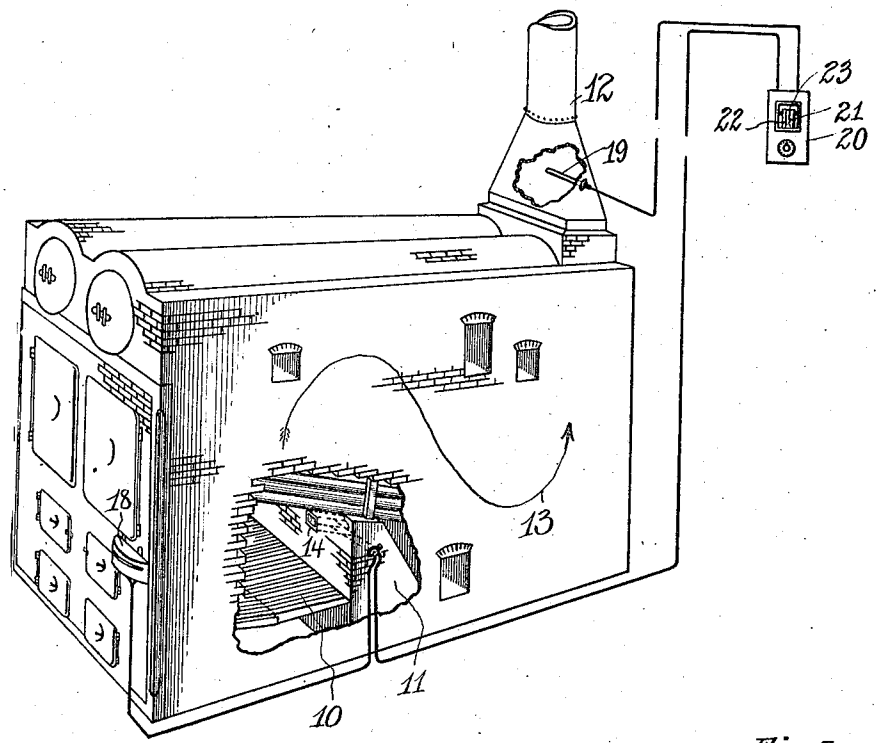


Fig. 2.

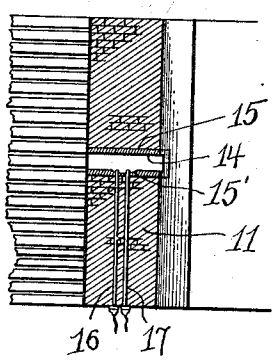
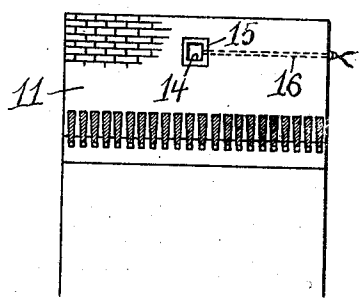


Fig. 3.



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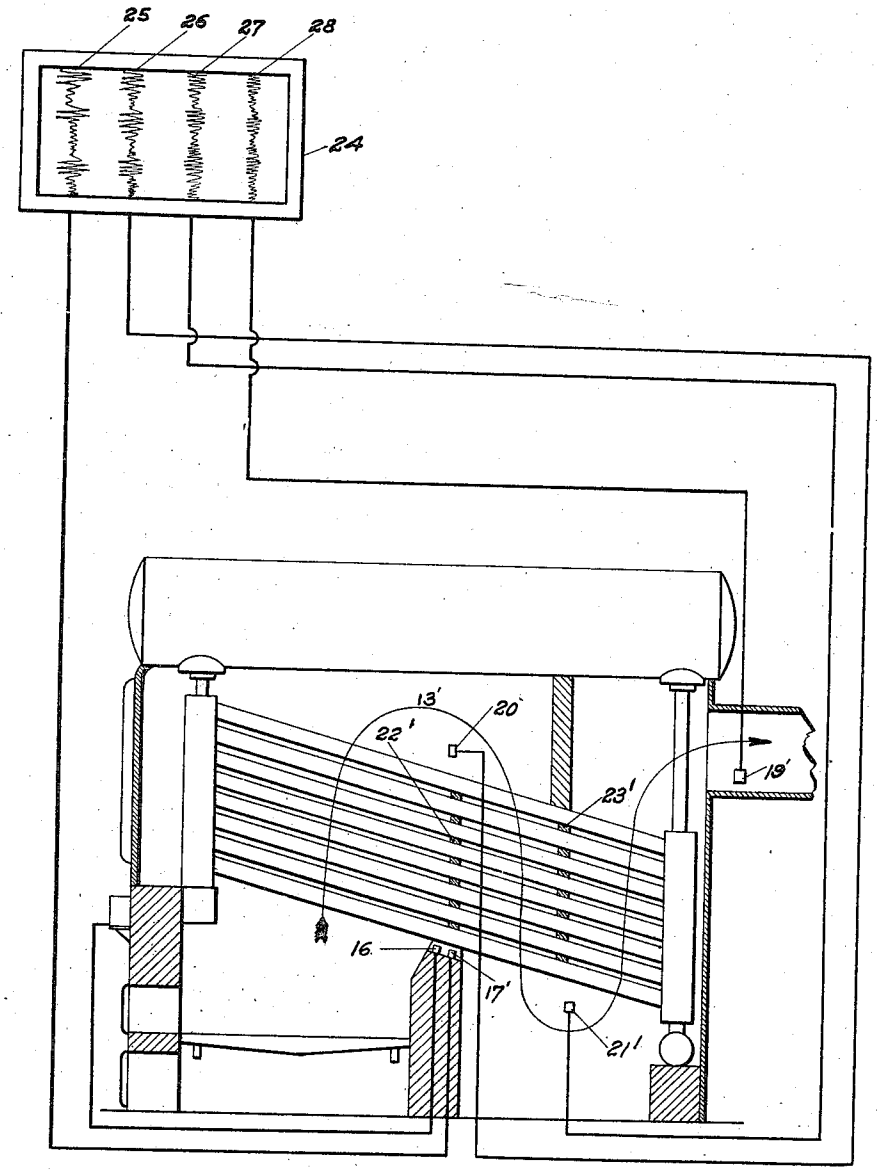


FIG. 4

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UNITED STATES PATENT OFFICE.

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COMBUSTION-CONTROL APPARATUS.

Application filed December 20, 1918. Serial No. 267,631.

My invention relates to apparatus for securing combustion control and is an improvement upon my Patent No. 1,246,656, granted on the 13th day of November, 1917.

In my said patent I have disclosed means for indicating changing temperature conditions of furnaces for boilers and the like, making use of a small short circuit passage through the bridge wall, for example, associated with means for indicating temperature changes of gases, etc. passing therethrough.

Such control means in accordance with my said patent give an effective indication of conditions within the combustion chamber, and enable any undesirable conditions in the combustion chamber, such as a hole in the fire bed or the like, to be quickly detected and remedied.

While the maintenance of a good fire is one essential to economical utilization of coal for heat production, it is not the only essential. For example, even when a good fire is maintained the furnace gases may pass out through the stack without the substantial reduction of temperature which takes place under good working conditions, and much heat is lost up the stack by reason of the boiler tubes being dirty or the boiler being coated with scale, etc., etc.

More or less check on such conditions can be obtained by means of a temperature indicator giving the temperature of the outgoing gases, but such an indicator by itself affords no reliable information, as manifestly its variations will depend on variations in furnace conditions, as well as on variation in amount of heat being delivered to the boiler or other heat utilizing device.

According to the present invention I combine an indicator of furnace conditions, preferably embodying the invention of my said patent, with means for indicating the temperature of the gases after they have done all or part of their work, as, for example, heating a boiler. Such indicators are preferably of the recording type and means are preferably provided for making the records on a single record sheet, whereby records are obtained side by side showing approximately the furnace temperatures and the temperatures of the outwardly traveling gases. The differences between these at any given time show the temperature reduction due to the performance of useful work, and in this way accurate information is available, not only of the efficiency with which firing operations are being carried out, but also of the efficiency attained in the utilization of the heat produced.

The accompanying drawing illustrates a boiler setting equipped with apparatus in accordance with my invention. In said drawing, Figure 1 is a perspective view of a boiler in its setting and with parts broken away to show interior construction. Figure 2 is a cross-sectional view through the bridge wall. Figure 3 is a cross-sectional view at right angles to Figure 2, and Figure 4 is a longitudinal view of a boiler setting partly in section.

The boiler illustrated is of the Babcock type. 10 is the fire box and 11 the bridge wall. The gases and products of combustion pass indirectly from the fire box to the stack 12, their line of travel being indicated in a general way by arrows 13, 13'. The short circuit passage in the bridge wall is indicated at 14, and preferably a fire resistant hollow tile 15 is inserted to form such passage. A small part of the furnace gases and products of combustion always pass through such opening when the boiler is being fired, by reason of differences in pressure, etc. on the opposite sides of the bridge wall. Temperature sensitive means are associated with the passage 14, as, for example, two thermo-couples 16 and 17 extend from the end of the bridge wall to the passage 14, through which gases from the furnace are passed. One of these thermo-couples 16, as shown, is wired to the indicating pyrometer 18 placed in a convenient position for observation by the fireman, as on the boiler front. This, however, is not separately claimed herein, being one embodiment of the invention of my said patent. One feature of the present invention consists in providing the recess 15' within the wall of the hollow tile 15 where the heads of the thermo-couples are placed. In this way, while the temperature of the gases may be obtained satisfactorily, the heads of the thermo-couples are not directly exposed to the flames so as to be impaired, and collection of dust, ashes, etc. about the heads of the thermo-couples is eliminated.

Thermo-couples are also placed in positions to take the temperature of the gases after they have done their work of heating,

or parts thereof. In the form shown in Figure 1 one such thermo-couple 19 is placed in the base of the stack 12. Both the thermo couples 17 and 19 are connected with temperature indicating means, which is preferably also a recording means. In the form shown they are connected to a recording pyrometer 20 and both records made side by side in the form of curves 21 and 22 on the record sheet 23.

The pyrometer may be located wherever desired, as, for example, in the engineer's office, and affords a ready means at all times of directly observing the approximate temperature of the fire box and of out-going gases, together with the difference between these, which affords a good index of the efficiency with which the heat generated is being utilized.

Where additional and more complete information is desired, additional thermo-couples may be located in the gas passages. In the form shown in Figure 4, for example, themo-couples 20′ and 21′, are placed within the passages traveled by the gases between the fire box and stack, one such thermo-couple 20′ being placed substantially above the front baffle 22′, over which the gases must pass, and the second thermo-couple 21′ being placed beneath the rear baffle 23′, below which the furnace gases must likewise pass. It will, of course, be understood that such arrangement is merely illustrative of one type of arrangement for a particular type of boiler and setting, and that other arrangements are used with other types of boilers and settings, and that the number of thermo-couples used may be more or less than as shown.

All four of the thermo-couples 17′, 20′, 21′ and 19′ are shown in Figure 4 as connected up to a recording pyrometer 24, and their record lines are shown at 25, 26, 27 and 28, respectively.

It will be understood that the line 25 corresponding to the thermo-couple 17′ serves substantially as a base line and that ordinarily variations in the other record lines will follow variations in the base line 25, at least in a general way, and by comparing and taking the differences indicated between the base curve and any other of the remaining curves, or between two or more of such curves, substantially complete information of what is going on and how the heat produced is being utilized in the parts of the boiler setting may be obtained.

It is to be understood that modifications and changes from the form shown for illustration may be resorted to within the scope of my claims, and that, among other things, where the recording pyrometer has a lesser number of recording pens than the number of thermo-couples supplied, it will be understood, of course, that switches are arranged for taking the records of the various thermo-couples as desired. It will also be understood that the invention here shown in connection with a single boiler unit may be utilized with larger batteries of boilers by provision of proper switches, connecting wires, etc., which will be readily understood and do not require illustration, and that it is not confined in its application to boilers, but may be made use of in various other forms of devices in which heat is generated and utilized.

I claim:

In combination, a combustion chamber, a heat utilizing device such as a boiler, for example, provided with a passage traveled by combustion gases as they give up their heat for utilization, a relatively small conduit separate from said passage and arranged for passage of gases direct from the combustion chamber, which said gases passing through said conduit constitute average representative portions of the combustion chamber gases at a temperature which, while having a substantially direct correspondence to combustion chamber temperatures, is sufficiently reduced from the temperature of the combustion chamber to avoid the impairment of refractory covered thermo-couples which would result if exposed to flame in the combustion chamber, means for taking temperatures of the gases of said passage at a region remote from the combustion chamber and after they have given up heat for utilization, and refractory covered thermo-couple temperature taking means for taking the temperature of the gases passing through said conduit, whereby upon comparing the temperatures of gases passing through said conduit, plus the necessary differential to convert same to combustion chamber temperatures, with the temperatures taken in the remote portion of the gas passage, the extent to which heat is given up to the heat utilizing device between the combustion chamber and said remote region of said passage may be substantially determined.

In testimony that I claim the foregoing, I have hereto set my hand, this 18th day of December, 1918.

FREDERICK D. POTTER.