G. M. EVANS & J. S. BECKETT.

CALORIMETER.

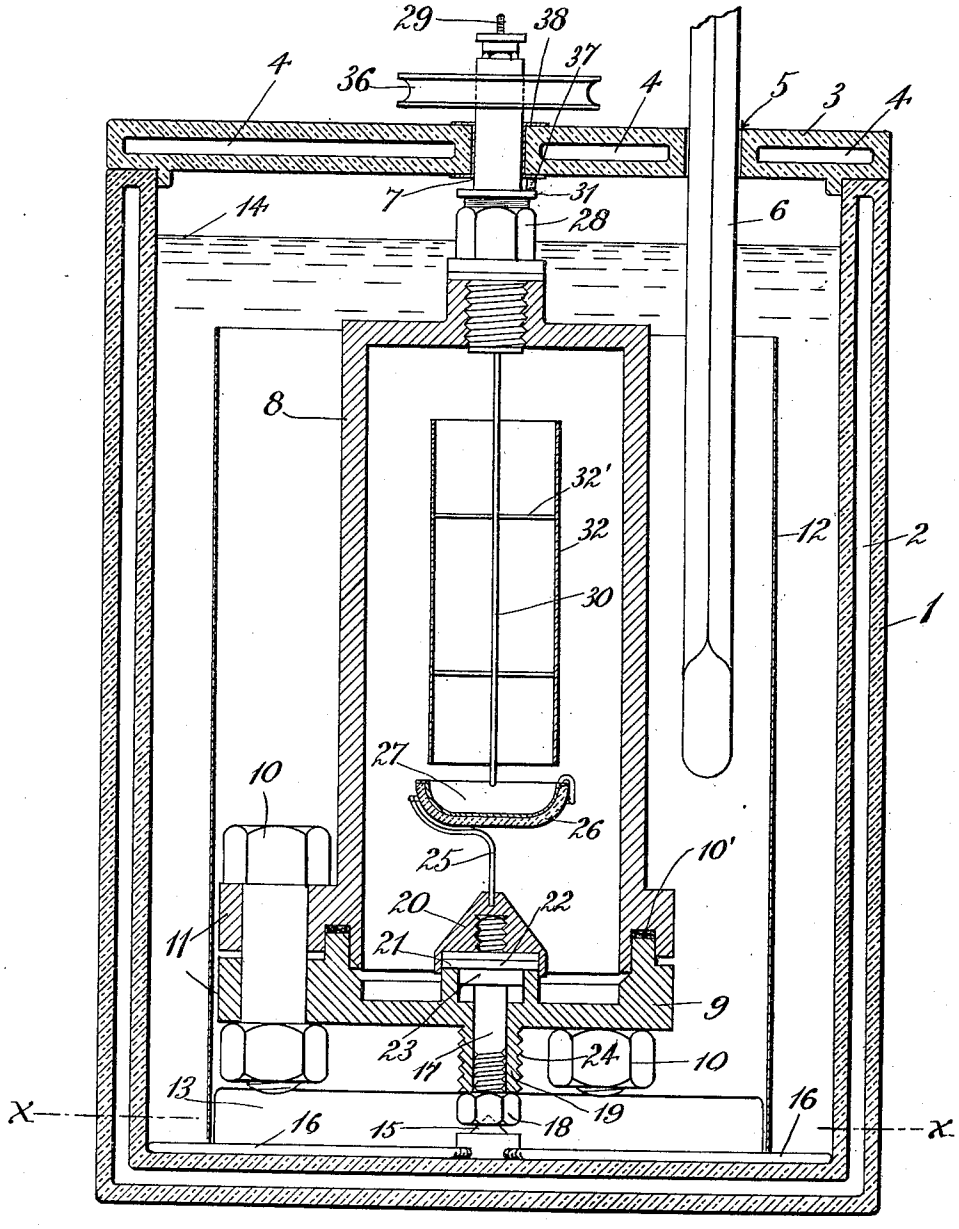
APPLICATION FILED MAR. 6, 1911.

1,000,082.

Patented Aug. 8, 1911.

3 SHEETS—SHEET 1.

Fig 1.



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3 SHEETS—SHEET 2.

Fig. 2.

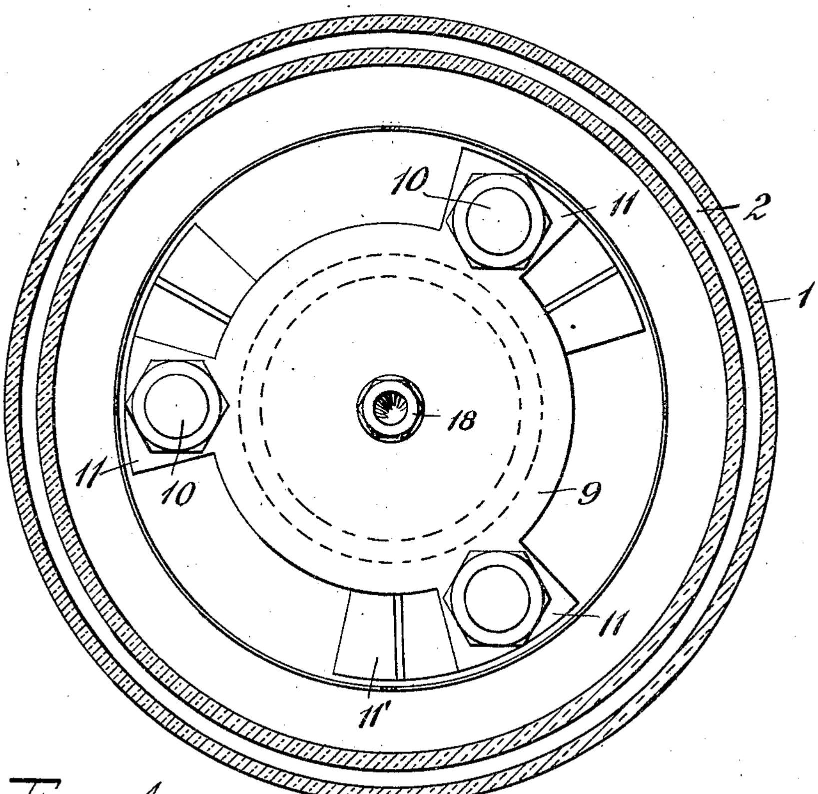
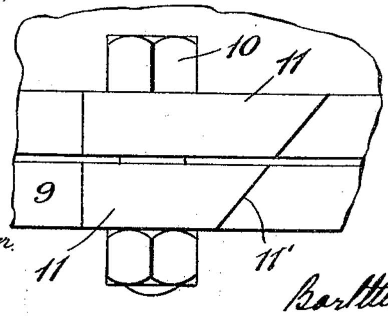


Fig. 4.



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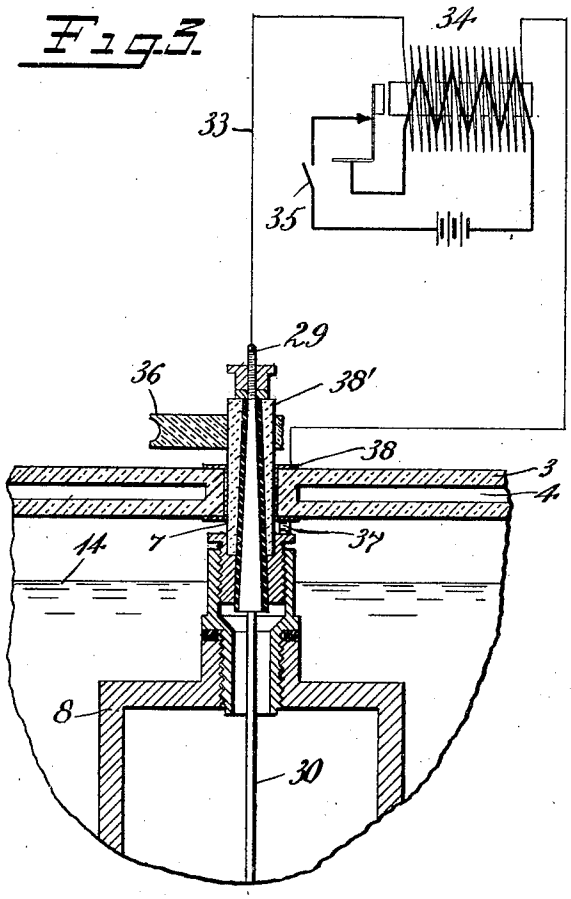
3 SHEETS—SHEET 3.

Fig.3.



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UNITED STATES PATENT OFFICE.

GORDON MAYNARD EVANS, OF NEW YORK, N. Y., AND JOHN SCOULLER BECKETT, OF FANWOOD, NEW JERSEY, ASSIGNORS TO FUEL ENGINEERING COMPANY OF NEW YORK, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

CALORIMETER.

1,000,082. Specification of Letters Patent. **Patented Aug. 8, 1911.**

Application filed March 6, 1911. Serial No. 612,473.

To all whom it may concern:

Be it known that we, GORDON MAYNARD EVANS and JOHN SCOULLER BECKETT, citizens of the United States, residing in the city, county, and State of New York and Fanwood, Union county, New Jersey, respectively, have invented certain new and useful Improvements in Calorimeters, of which the following is a full, clear, and exact description.

Our invention relates to improvements in calorimeters, and has for its object to produce a calorimeter in which the heat introduced for ignition of the fuel can be positively controlled and closely calculated.

It further has for its object to produce a calorimeter which is practically unaffected by radiation.

It further has for its purpose to produce a calorimeter having certain other advantageous features hereinafter described and pointed out in the claims.

The following is a description of an embodiment of our invention, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical section of a calorimeter embodying our invention. Fig. 2 is an upward sectional view of the same on the lines x—x (Fig. 1), Fig. 3 is a sectional detail showing diagrammatically the source of electric current and the circuit connections. Fig. 4 is a detail.

Referring more particularly to the drawings, 1 is a container of glass, vulcanite, or other suitable material, having two walls between which is a closed chamber 2, from which the air has been exhausted so as to produce a vacuum.

3 is a cover having two walls and a similar vacuum chamber 4. The cover has an aperture 5 for a thermometer 6 and a central aperture 7.

Within the container is a metal bomb casing 8 having a metal cover or closure 9 secured thereto by bolts 10, a gasket 10′ being interposed to make a gas-tight joint. The bomb casing 8 and the cover or closure 9 have three lugs 11 each, through which the bolts 10 pass. These lugs form projections from said bomb which are beveled on one side 11′, as shown, so that when the bomb is revolved the water adjacent to the bomb is caused to move downward and thus circulate in the container. About the bomb is a partition 12 having at its bottom openings 13, through which the water flows. The top of the partition is below the surface 14 of the water in the container, so that the water flows in over the top and goes out at the bottom thereof. Supported in the bottom of the container is a pivot point 15, which is maintained in position by spider arms 16. Passing loosely through the cover 9 is a valve stem 17, which has a cavity in which the pivot point 15 bears.

18 is a nut on the valve stem bearing against the projection 19 on the cover 9, so that the valve 20 connected to the valve stem can be firmly drawn to its seat 21. The valve is provided with gaskets 22, and is guided by a projection flange 23 loosely fitting the bore of the valve so as to permit gas to pass. The projection 19 is externally screw-threaded at 24 so as to provide means for attaching a gas conduit thereto for charging the bomb with oxygen under pressure. Mounted in the valve is a wire support 25. This support carries a heat resisting casing 26, preferably made of compressed asbestos, so as to be non-heat conducting in which is a platinum pan 27 with which the support 25 makes electrical contact.

28 is a spark plug which is screwed into an opening in the top of the casing 8 and extends through the cover 3, where it is provided with a contact surface 29. The electrode 30 having the external terminal 29 extends downwardly from the spark plug through the bomb so as to terminate adjacent to the platinum pan 27, which in the particular construction shown in the drawings forms the other electrode of the spark gap. This is a preferred form, since it obviates the necessity of using two downwardly extending electrodes carried by the plug. This pan is electrically connected through the wire support, bomb cover and casing with the external conducting surface 31 of the plug. A chimney 32 of any suitable material is carried by the terminal 30

being connected thereto by arms 32′, causing the gas within the bomb to circulate more evenly as it is heated and to be drawn in over the pan 27 in proximity to the contents thereof.

33 is a high potential secondary of a spark coil 34 having its terminals in contact with the two external terminals 29, 31 and controlled by the switch 35 in the circuit.

36 is a pulley removably mounted on the spark plug whereby power can be applied to revolve the bomb within the container.

The pan constitutes one electrode of the spark gap, the other electrode being carried by the plug. Electrical connection with the plug terminal 31 is made through the brush 37 bearing thereon and carried by a metallic bushing 38, which, engaging the insulating sleeve 38′, forms a bearing for the plug.

The operation of the apparatus is as follows: The fuel to be tested, such as a definite amount of finely divided coal, is placed in the pan 27. The cover 9 is then secured in place. Oxygen is then introduced through the valve into the bomb until a pressure of some 350 to 400 pounds is obtained. The bomb is then disconnected from the gas supply and the nut 18 screwed up so as to hold the valve firmly to its seat. The bomb is then placed in the container which is filled with water, or other suitable liquid to a point above the wall 12. The bomb is then revolved and a current passed through the spark plug, producing a spark which ignites the fuel in the pan 27. This spark is continued for a definite time and then the circuit is disconnected from the spark plug. The current having a known potential and the circuit being maintained for a definite known time, the heat generated by the spark can be definitely controlled and determined. After ignition, the coal burns in the oxygen until it is consumed, the revolution of the bomb causing the water to circulate so that it becomes equally heated throughout all portions of the container, radiation from which is practically prevented by the vacuum chambers. After the coal is consumed, a reading of the thermometer is taken by which the temperature of the water is determined and from which the heat units absorbed by the water can be ascertained. By deducting the heat units introduced by the spark, the heat units, due to the combustion of the coal, can be ascertained, due allowance being made for the fixed co-efficients of the apparatus. The non-heat conducting quality of the casing 26 prevents the heat from being too rapidly conducted away from the fuel burning in the pan 27, with the result that complete combustion is obtained even with a high ash coal.

The form shown by us is the preferred form, but modifications can be made therein without departing from the spirit of the invention or the scope of the appended claims, as will be evident to those skilled in the art.

What we claim is:

1. In a calorimeter, a bomb for containing fuel to be tested, in combination with electrodes forming a spark gap within said bomb adjacent to the fuel therein for igniting said fuel, and having circuit terminals accessible from the outside of said bomb, and a source of high potential current adapted to be electrically connected to said outside terminals.

2. In a calorimeter, the combination of a bomb for containing fuel to be tested, a container within said bomb for said fuel, electrodes forming a spark gap adjacent to the fuel in said container for igniting said fuel, and having circuit terminals accessible from the outside of said bomb, and a source of current adapted to be electrically connected to said terminals.

3. In a calorimeter, a bomb for containing fuel to be tested in combination with electrodes forming a spark gap in said bomb adjacent to the fuel therein for igniting said fuel and having circuit terminals accessible from the outside of said bomb, and a source of current adapted to be electrically connected to said terminals, one of the electrodes of said spark gap being insulated from said bomb, and the other electrode of said spark gap electrically connected to and carried by said bomb.

4. In a calorimeter, the combination of a bomb for containing fuel to be tested, a metallic container for said fuel within said bomb in electrical connection with said bomb, in combination with a spark plug having a spark gap electrode and a terminal which extends outside said bomb and is connected thereto, said container constituting a second spark gap electrode and a source of current electrically connected to said terminal and to said bomb.

5. In a calorimeter, the combination of a revoluble bomb for containing fuel to be tested, a metallic container for said fuel within said bomb electrically connected to said bomb, in combination with a spark gap electrode having a circuit terminal extending outside said bomb, said container constituting a second spark gap electrode and a source of current electrically connected to said bomb and to said terminal, the axis of said plug coinciding with the axis of said bomb.

6. In a calorimeter, a revoluble metallic bomb for fuel to be tested, a metallic fuel container therein, a non-heat conducting support beneath said container, means for electrically connecting said container to said bomb, a spark plug having a spark gap electrode adjacent to said container, a liquid container having a supporting bearing

for said bomb, a cover through which said spark plug extends forming a bearing for the upper portion of said bomb, and means carried by said plug for rotating said bomb.

7. In a calorimeter, the combination of a liquid container, a bomb therein having a casing and a closure secured to the lower portion thereof, said casing and closure having lugs forming projections from said bomb, and bolts passing through said projections to secure said parts together, said projections having inclined sides to produce circulation of the surrounding liquid when said bomb is revolved, and means for revolving said bomb.

8. In a calorimeter, the combination of a bomb casing, a closure therefor secured to the lower end thereof, a gas valve in said closure, and a fuel support carried by said closure.

9. In a calorimeter, the combination of a bomb casing, a closure therefor secured to the lower side thereof, a valve in said closure, a fuel support carried by said closure, and means for drawing said valve to its seat.

10. In a calorimeter, the combination of a bomb casing, a closure therefor secured to the lower end thereof, a fuel support within said bomb, and a chimney supported above said fuel support.

11. In a calorimeter, the combination of a bomb casing, a closure therefor secured to the lower end thereof, a fuel support within said bomb, a spark plug passing through said casing, and a chimney supported by said spark plug and adjacent to said fuel support.

12. In a calorimeter, the combination of a bomb casing, a closure therefor on the lower end thereof, a spark plug passing through said casing, a fuel container supported by said closure, a valve in said closure, said plug and valve being concentric with said bomb casing, bearings in line with said plug and valve, means for revolving said bomb on said bearings, and a liquid container having vacuum chambers surrounding said bomb.

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