

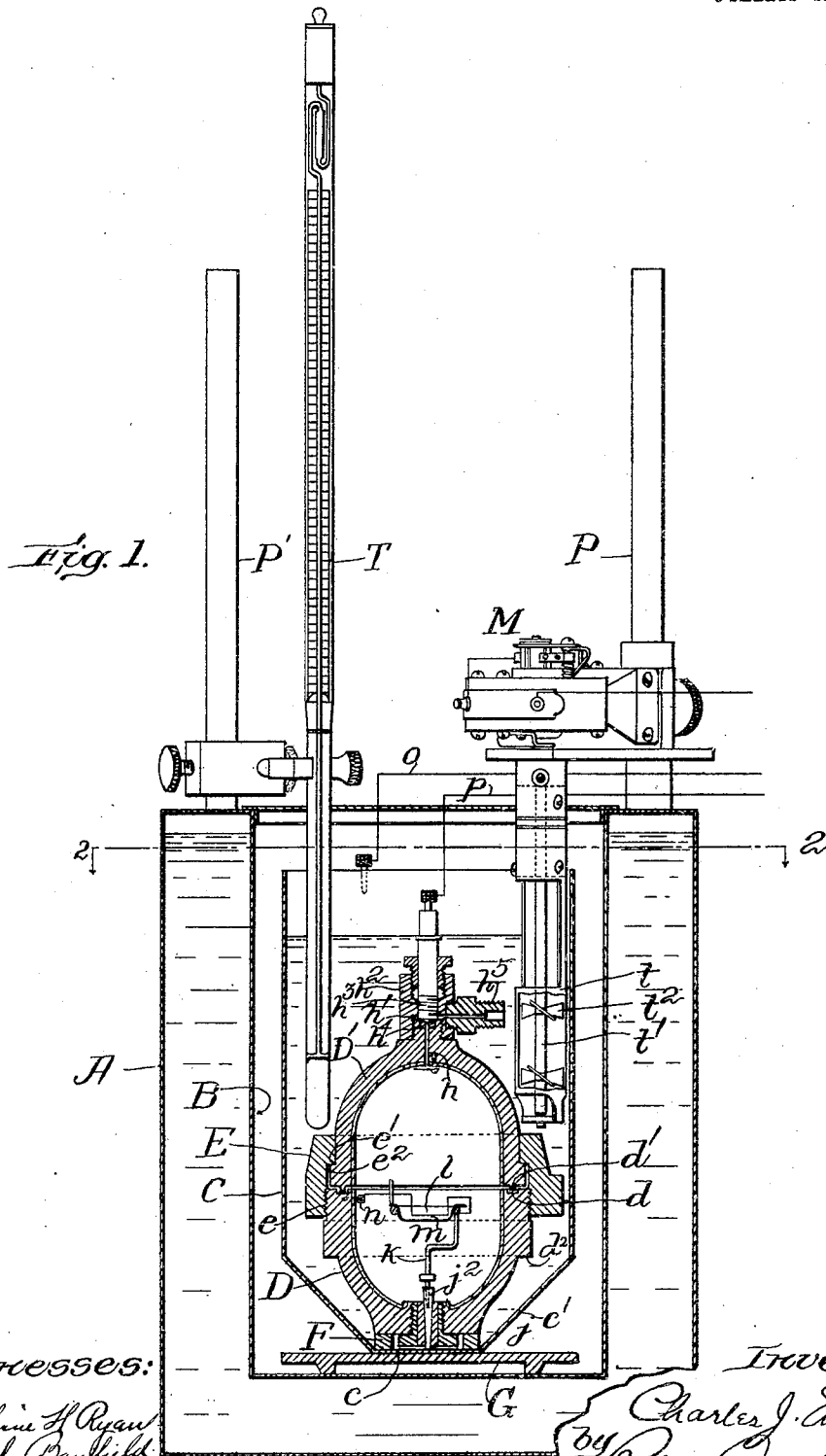
C. J. EMERSON.
CALORIMETER.

APPLICATION FILED AUG. 20, 1908.

931,189.

Patented Aug. 17, 1909.

3 SHEETS—SHEET 1.



Witnesses:

Josephine H. Ryan
Ruby Canfield

Inventor:

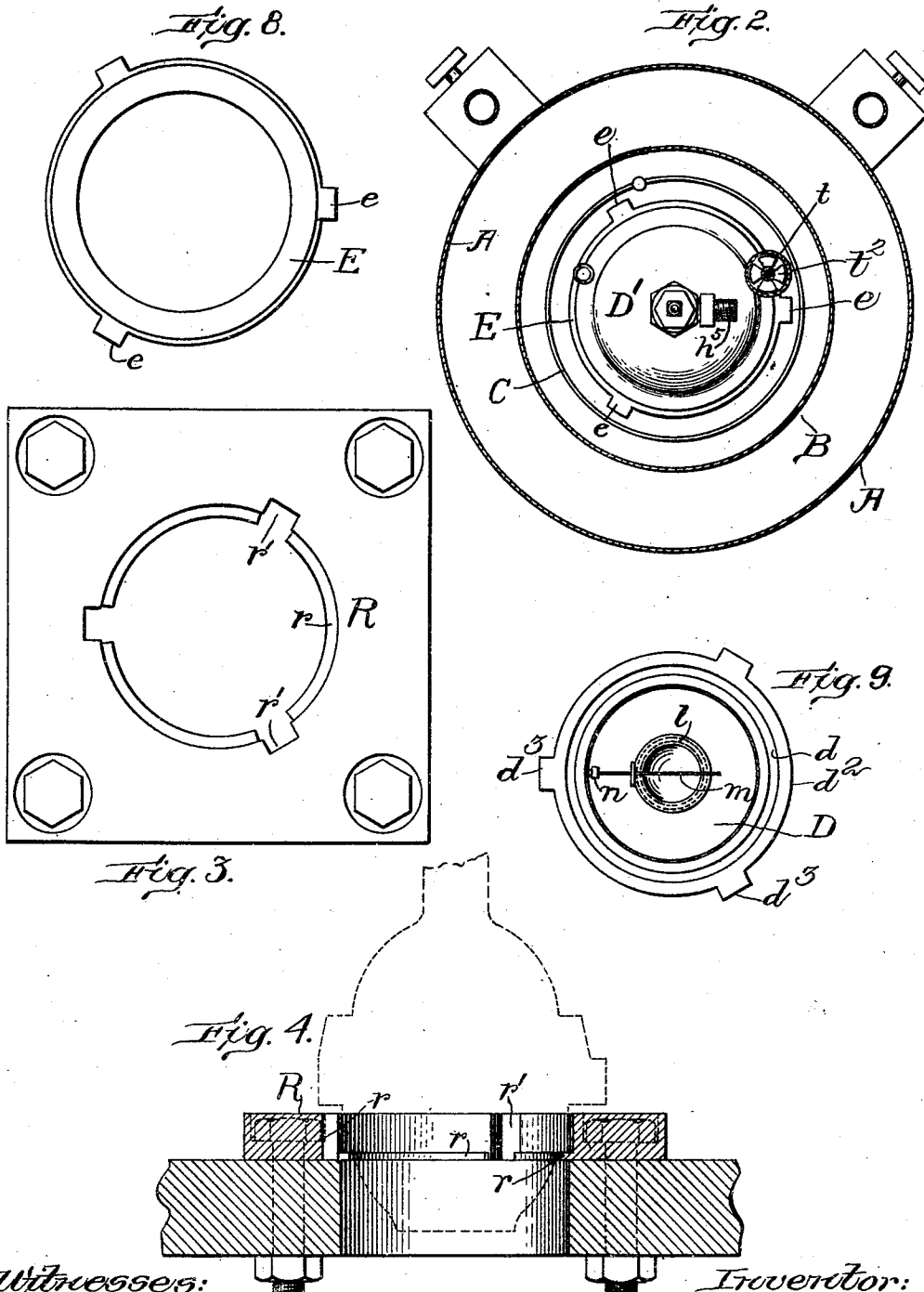
Charles J. Emerson,
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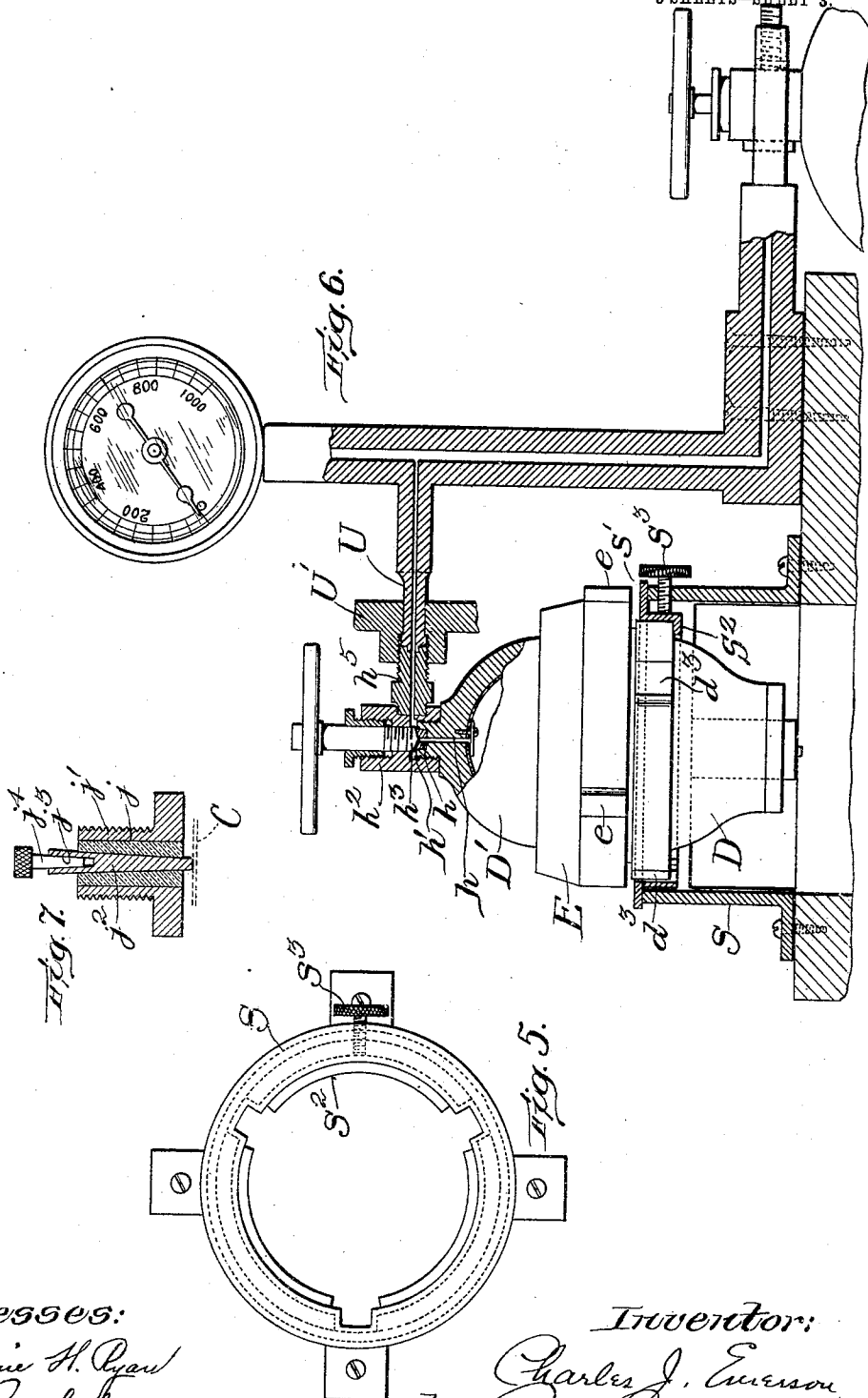
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UNITED STATES PATENT OFFICE.

CHARLES J. EMERSON, OF PROVIDENCE, RHODE ISLAND.

CALORIMETER.

No. 931,189.

Specification of Letters Patent.

Patented Aug. 17, 1909.

Application filed August 20, 1908. Serial No. 449,445.

To all whom it may concern:

Be it known that I, CHARLES J. EMERSON, a citizen of the United States, and resident of Providence, in the county of Providence and State of Rhode Island, have invented new and useful Improvements in Calorimeters, of which the following is a specification.

This invention relates to calorimeters, and particularly to calorimeters of the class commonly known as bomb calorimeters, used for determining the calorific value of combustible materials.

The bomb calorimeter hereinafter described is particularly designed for determining the exact heating value of solid and liquid fuels such as coal and fuel oils commonly used for heating and generating power.

In the accompanying drawings which illustrate certain embodiments of the invention; Figure 1, is a central vertical section of an improved bomb calorimeter with the parts assembled in position for testing the calorific value of a fuel; Fig. 2, is a horizontal cross section on line 2—2 of Fig. 1; Fig. 3, is a plan view of the holder for the bomb; Fig. 4, is a vertical central section of the holder shown in Fig. 3; Fig. 5, is a plan view of another form of holder for the bomb; Fig. 6, is a vertical central section of the holder shown in Fig. 5, together with part of the oxygen apparatus in its relation to the holder; Fig. 7, is an enlarged detail view showing in central longitudinal section, the plug used at the bottom of the bomb; Fig. 8, is a plan view of the nut used for coupling the two sections of the bomb together; and Fig. 9 is a plan view of the lower cup or section of the bomb.

Referring to the drawings, A represents a jacket consisting of a double walled tank or vessel, preferably made of copper, into which water is inserted. Within the chamber B formed within the inner wall of the jacket A is placed a calorimeter can C. The bomb contained within the calorimeter can C comprises a lower cup D and an inverted upper cup D'. The two cups are made of a high tensile strength metal, and are separably joined together by means of a steel nut or coupling ring E, threaded upon the lower cup at *e*, and having a flange *e'* engaging the flange *e*² on the upper cup. The contact faces of the two cups are provided respectively with a groove *d* and a tongue *d'*, a

lead gasket being inserted in said groove to insure a tight joint. The bomb is lined as usual with sheet metal, spun in to fit, or with porcelain. The principal advantages of providing a bomb separable at or near its middle, are that after the fuel has been put in the fuel pan, the fuel pan need not be disturbed or moved within the bomb and further that easy access may be had to the lower part of the bomb for arranging and adjusting the fuel pan and the fuse wire.

In the bomb calorimeters commonly used it is necessary to lower the fuel pan after it is filled into the bomb through an opening in the top of the bomb, and in some cases thereafter to connect the fuse wire with its proper contacts, all of which endangers the spilling of the fuel. By making the whole top part of the bomb removable and by supporting the fuel pan in the manner hereinafter described, the danger of spilling or disturbing the fuel in the pan is avoided, and this construction will be greatly appreciated by those who have experienced the difficulties of manipulating bombs as heretofore usually constructed having merely a lid or cover at the top. Furthermore a separable bomb of the above described type renders more easy the insertion of the lining whether of spun metal or porcelain than in bombs heretofore used, having simply a cover.

The bomb is supported at the bottom of the can C by means of a stand made of suitable insulating material such as vulcanite, and herein shown as an annular support or ring F.

The bomb is preferably made of substantially oviform shape as shown in the drawings. As it is desirable that the quantity of water in the calorimeter can C should be reduced as far as practicable in order that a greater variation in temperature of the water may be observed in testing the fuel, thus reducing the percentage of error, a can is provided having its lower end made in the form of a truncated cone, the flat surface of which accommodates the stand F for holding the bomb, and the conical surface of which approximately conforms with the general contour of the lower end of the bomb, which is tapering, thereby reducing the capacity of the can between the walls thereof and the walls of the bomb.

The table or stand G rests in the bottom of the chamber B and supports the calorimeter can C and its contents.

At the top of the bomb in the dome formed by the inverted cup is an oxygen inlet passage h connected with the interior of the bomb and with the valve chamber h' formed within the valve casing h^2 . The inlet passage h , is controlled by the valve h^3 , whose spindle is screw-threaded in the valve casing h^2 and adapted to be seated upon the valve seat h^4 made of vulcanite or other suitable material to insure a tight joint when the valve is closed. The short pipe h^5 communicating with the valve chamber is adapted to be connected with the oxygen apparatus for filling the bomb.

Centrally located in the bottom of the bomb is a plug, consisting of a steel sheath or wall j , containing therein an insulation of porcelain j' , through which extends the tapered contact pin j^2 . The contact pin j^2 projects beyond the surface of the bomb and beyond the end of the plug into contact with the calorimeter can C , and the bomb rests upon said contact pin as well as upon the stand F , thus insuring a perfect contact by merely setting the bomb within the can, without any attention or manipulation on the part of the user. Secured to the upper end of said tapered contact pin is a wire frame k of non-corrosive metal which supports the fuel pan l . The connection between the pin j^2 and the wire frame k is separable, and preferably consists in a tapered bore j^3 in the end of pin j^2 cooperating with the tapered end j^4 of the frame k , which is held in the bore by frictional engagement. The fuse wire m which is of platinum, as is also the fuel pan l , is connected as shown with the fuel pan at one edge thereof, then dips within said pan sufficiently to come in contact with the fuel to be placed in the pan and thence is led to the side of the bomb where it is grounded at the binding post n . The circuit through said fuse wire m is completed by the conductor o , connected with the calorimeter can C , and the conductor p , connected with the bomb through the stem of valve h^3 , said conductors o and p leading to a suitable source of electrical energy (not shown).

In order to circulate the water within the calorimeter can C to equalize the temperature, a stirrer is provided consisting of a depending tube t which extends into the calorimeter can C above the broadest part of the bomb but terminates short of the broadest part of the bomb, thus obviating the necessity of enlarging the can to accommodate the stirrer at one side of the bomb as is usual. The volume of water is thereby reduced as much as possible. Within the tube t is a shaft t' , on which are mounted the propeller is open at the lower end and is also provided with an opening in its upper part to admit of free circulation of the water. The shaft t' is driven by a small directly con-

nected motor M both motor and stirrer being mounted on post P on the calorimeter jacket; or may be driven by any other suitable driving mechanism. A similar post P' on the calorimeter jacket supports the thermometer T .

The manipulation of the device is as follows:—The lower half of the bomb is placed in the holder shown in Figs. 3 and 4, which consists of a plate R having an annular recess to receive the bomb, said recess provided with a flange or ledge r upon which rests the supporting flange or rim d^2 provided on the lower cup of the bomb. The bomb holder or support is provided with sockets or recesses r' adapted to cooperate with the corresponding lugs d^3 on the lower cup of the bomb to prevent the bomb from turning therein. After the fuel pan, its supporting frame, and the fuse wire have been arranged as already described, and the finely divided coal or other fuel to be tested has been placed in the pan, the upper inverted cup is placed in position and drawn into place by means of the coupling ring or nut E , a heavy wrench or spanner engaging the lugs e being used for this purpose. The holder just described holds the bomb rigidly and firmly against any danger of tipping or jarring, and possesses important advantages over the common forms of screw clamps heretofore used to hold the bomb while screwing on the caps. The bomb is then placed in the holder shown in Figs. 5 and 6 which consists of a standard S having an annular support S' made with a supporting ledge S^2 and notched similarly to that already described and shown in Fig. 3. Said annular support S' is revoluble upon or angularly adjustable with relation to, the frame or standard S . The bomb is then turned upon its revoluble support until the short inlet pipe h^5 is in alinement with the delivery end U of the oxygen apparatus. The set screw S^3 of the bomb holder is then set up to hold the adjustable supporting ring and the bomb in its adjusted position. The nut or coupling screw U' is then screwed up to connect the pipe h^5 with the oxygen delivery pipe U . The oxygen delivery pipe is rigid and is permanently fixed in its proper relation to the bomb holder S , so that the oxygen apparatus may be connected or disconnected with the bomb without danger of jarring the bomb or disturbing the fuel and fuse wire therein.

When the bomb has been filled with oxygen to the required pressure it is placed in the calorimeter can and is ready for use.

I claim:

1. In a calorimeter, a calorimeter can, and a bomb therein comprising a lower cup, and an inverted upper cup, separably joined together, the lower cup having therein a fuel pan, a fuse within the pan and a contact pin passing through the bottom of the lower cup

insulated therefrom and making contact with said can, said fuse wire being connected at one end with said pin and at its other end with the walls of said bomb.

5 2. In a calorimeter, a calorimeter can, and a bomb therein comprising a lower cup, and an inverted upper cup, separably joined together, the lower cup having therein a fuel pan, a fuse wire within said pan, and a plug
10 in the bottom of the lower cup comprising a tubular shell, an insulation therein of porcelain or the like and a contact pin passing through said insulation and making contact with said can, said fuse wire being connected
15 at one end with said pin and at its other end with the wall of said bomb.

3. In a calorimeter, a calorimeter can, and a bomb therein comprising a lower cup, and an inverted upper cup separably joined together, a stand of insulating material resting in the bottom of said can and supporting said bomb, a contact pin passing through the bottom of said lower cup insulated therefrom and projecting therebeyond into contact
25 with said can, a fuel pan supported in said lower cup and a fuse wire in said pan connected at one end with said contact pin and at its other end with the wall of the bomb.

4. In a calorimeter of the character described a calorimeter can, a bomb therein containing a fuel pan, a fuse wire, and fuse wire circuit, said circuit including a contact pin passing through the bottom of the bomb, insulated therefrom and projecting therebeyond, and an annular stand of insulating material resting upon the bottom of said can and surrounding the contact pin, said bomb being supported within the can by said stand and contact pin.

40 5. In combination with a calorimeter can and bomb of the character described, a plug in the bottom of said bomb consisting of a tubular sheath, porcelain insulation therein

and a tapered contact pin extending through said porcelain insulation and beyond the bottom wall of the bomb, adapted in part to support the bomb in the can. 45

6. In combination with a calorimeter can and bomb of the character described, a plug in the bottom of said bomb consisting of a tubular sheath, porcelain insulation therein, and a tapered contact pin extending through said porcelain insulation and beyond the bottom wall of the bomb, adapted in part to support the bomb in the can, and a wire
55 frame secured to said pin serving both to support a fuel pan and to form part of the fuse wire circuit.

7. In a calorimeter, a bomb having its lower end tapering in general contour, and a calorimeter can containing said bomb, tapered at its lower end to conform approximately to the form of the bomb and so reduce the capacity of the space between the can and bomb. 60

8. In a calorimeter, a bomb having its lower end tapering in general contour, and a calorimeter can containing said bomb having its lower end in the form of a truncated cone, the flat surface of which supports the bomb, and the conical surface of which conforms approximately to the form of the bomb. 65

9. In a calorimeter, a bomb, a calorimeter can containing and closely surrounding said bomb, and a stirrer for circulating the fluid within said can, consisting of a depending tube within the can located above and terminating short of the broadest part of the bomb, containing revoluble propeller blades. 70

Signed by me at Boston, Massachusetts, this thirty first day of July 1908. 80

CHARLES J. EMERSON.

Witnesses:

CHARLES L. NORTON,
ROBERT CUSHMAN.