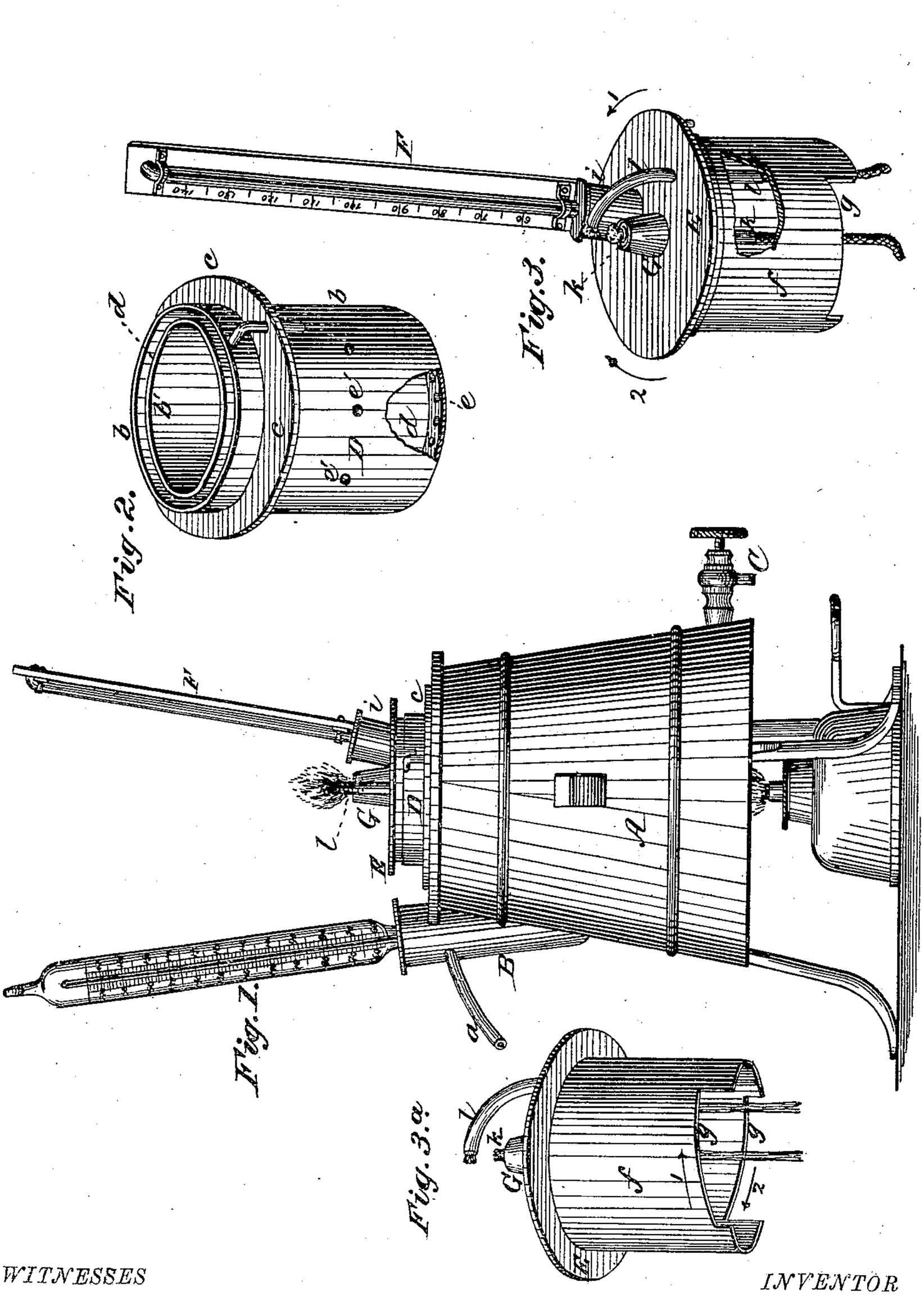
(Model.)

2 Sheets—Sheet 1.

G. M. SAYBOLT.

APPARATUS FOR TESTING HYDROCARBON FLUIDS.

No. 245,568. Patented Aug. 9, 1881.



WITNESSES

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(Model.)

2 Sheets—Sheet 2.

G. M. SAYBOLT.

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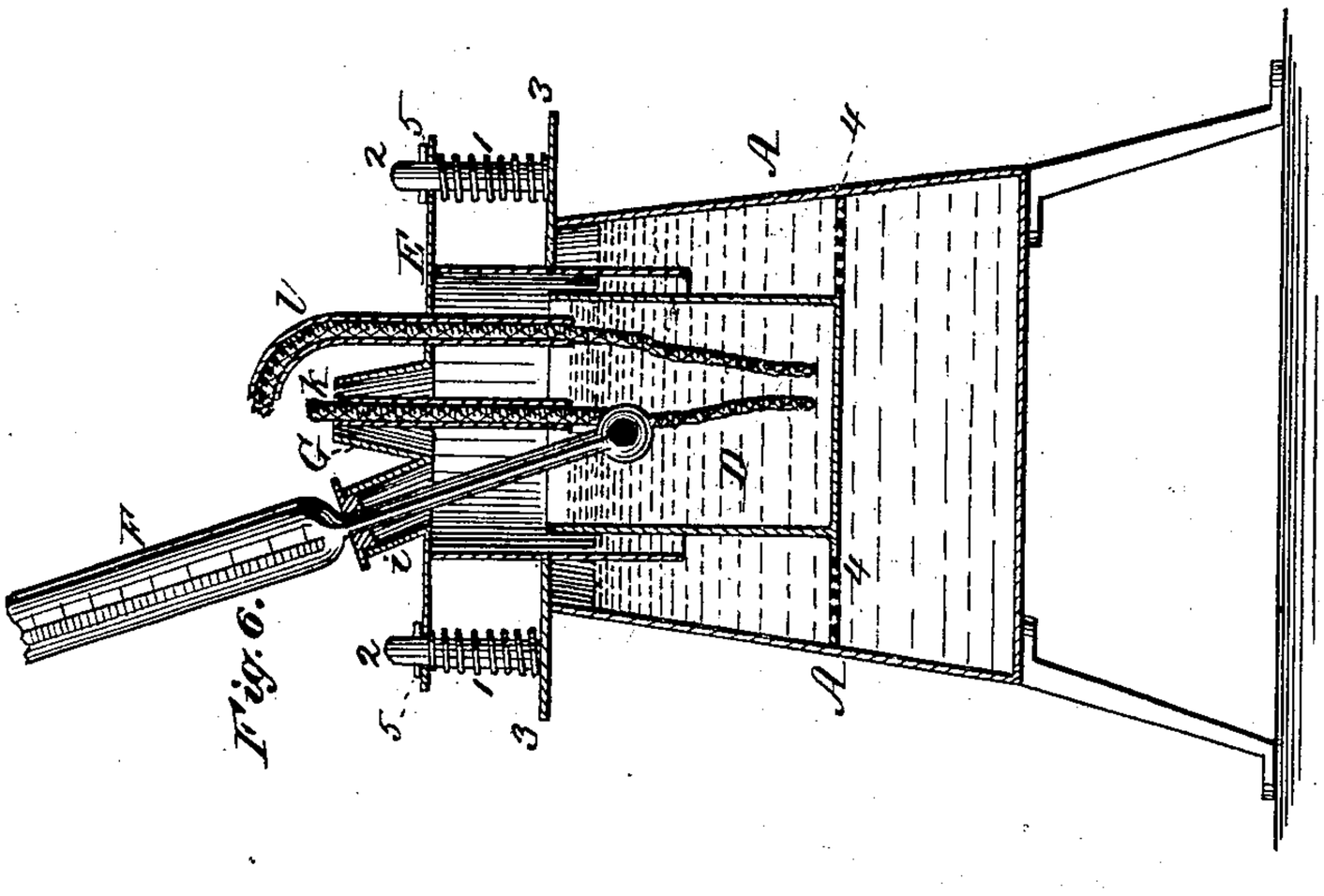

Fig. 6.

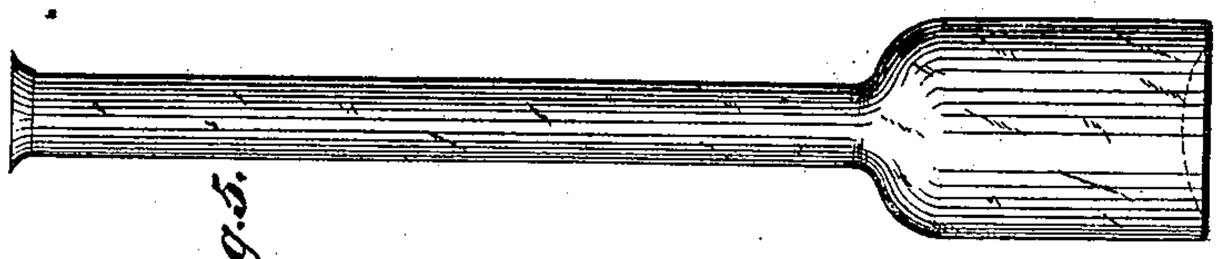

Fig. 5.

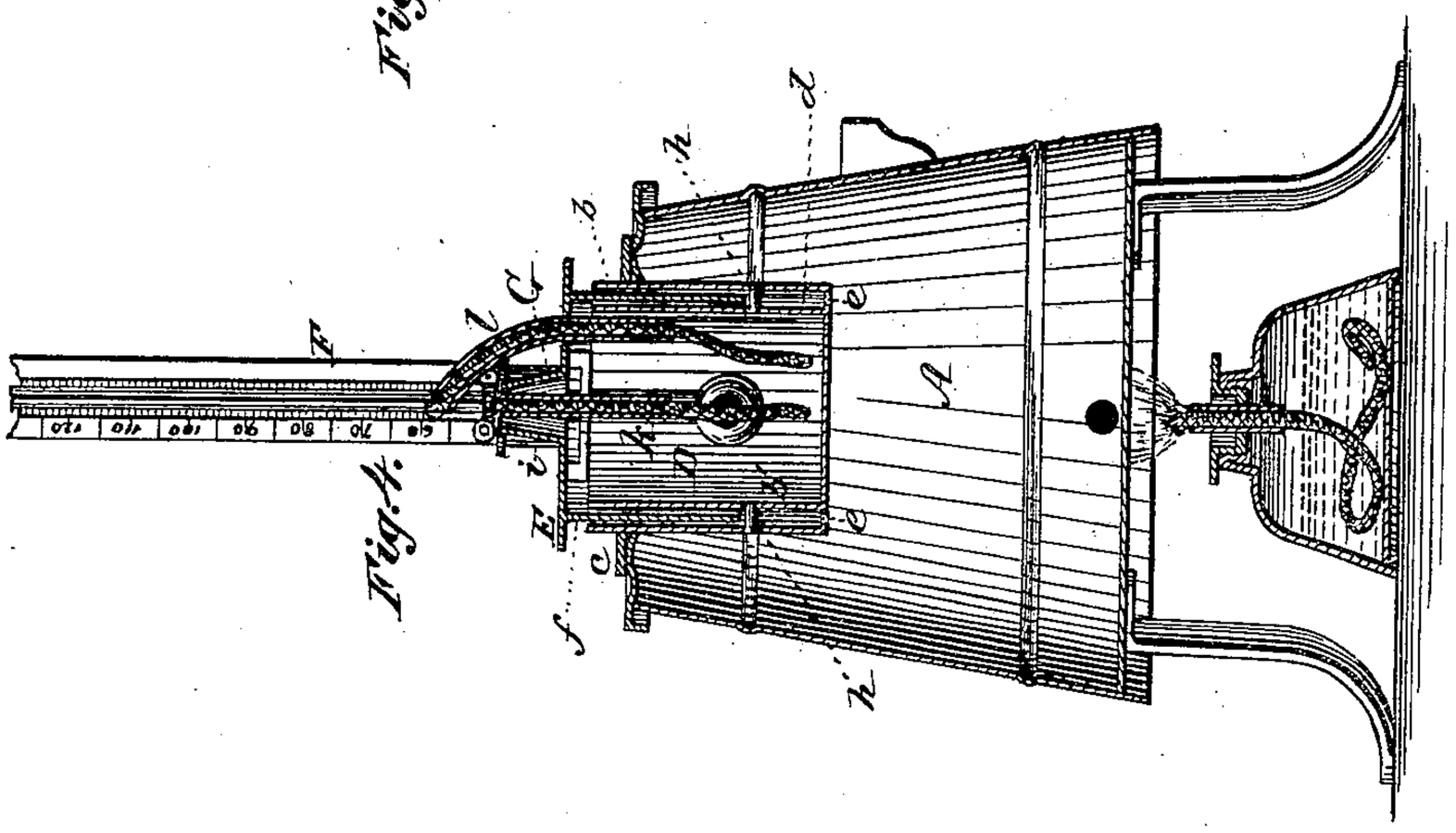

Fig. 4.

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UNITED STATES PATENT OFFICE.

GEORGE M. SAYBOLT, OF ELIZABETH, NEW JERSEY.

APPARATUS FOR TESTING HYDROCARBON FLUIDS.

SPECIFICATION forming part of Letters Patent No. 245,568, dated August 9, 1881.

Application filed May 27, 1881. (Model.)

To all whom it may concern:

Be it known that I, GEORGE M. SAYBOLT, a citizen of the United States, residing at Elizabeth, in the county of Union and State of New Jersey, have invented new and useful Improvements in Apparatus for Testing the Inflammability of Hydrocarbon Fluids, of which the following is a specification.

The invention relates to devices for testing the inflammability of petroleum and other hydrocarbon fluids; and the object of my improvements is primarily to determine at what degree of temperature such fluids give off inflammable vapors.

In my apparatus I employ mechanical means to press down upon the generated vapor, and thereby cause its discharge to a lighted torch without disturbing the fluid under examination, and without allowing the escape of the vapors, except to the torch, when required. This I do by causing the covering part which carries the torches to have the capacity of being held raised while the vapors are generating, and of being lowered into the oil-cup to press up the vapors to a lighted torch before the thermometer indicates that the supposed point of inflammability is reached, and by interposing a water or other seal between the pressing-cover and the vapors in the oil-cup, as will be hereinafter fully set forth.

In the accompanying drawings, Figure 1 represents the apparatus in its complete form and as arranged when in operation; Fig. 2, a perspective of the oil-cup detached; Fig. 3, a similar view of the cover carrying the vapor-escape and torches. Fig. 3ª is a view of the cap or cover, showing the rideways of its mantling; Fig. 4, a vertical section through Fig. 1; Fig. 5, the measuring-glass, and Fig. 6 a modification.

In these drawings, A is a bath-vessel provided with a tripod, and having a heating-lamp underneath it, and also provided with a socket, B, for the thermometer which indicates the temperature of the bath. This thermometer-socket B is provided with an overflow-pipe, *a*, communicating with the chamber or bath-vessel. The thermometer indicates the temperature of the bath for a purpose well understood by those skilled in the art. The bath-vessel is also provided with a discharge-cock, C, as shown, for use when necessary.

The oil-cup D, or receptacle for the oil to be tested, is made with a double wall, *b b'*, and a flange or supporting-collar, *c*, projecting from the outer wall, by which it is supported upon the top rim of the bath-vessel. The annular chamber *d*, formed by the walls, is in communication with the bath by perforations *e e'* in the outer wall, *b*, for the purpose of admitting the water from the bath. The reason for this is that it is necessary to have a seal for the cover E, which is a cap having a mantling, *f*, extending, when in use, down into the above-described annular chamber of the double-walled oil-vessel, and which rests in its normal position upon the top of said oil-vessel. The bottom of this mantling *f* is formed with ratchet-rideways *g g*, adapted to rest upon and ride over, as the cap is turned, bearing-pins *h h*, as the drawings show, and which pins cross the annular chamber *d*, and the holes *e'* in the outer wall of the oil-cup should be above these bearing-pins *h*, in order to a proper sealing by the bath, since the point of bearing of the mantling of the cap should be below the surface of the bath in the chamber. The top of this cap or cover E is provided with a socket, *i*, for the thermometer F, which indicates the temperature of the generated vapor of the heated oil, and with a central vapor-exit, G, which, in this instance, is a tubular or conical prolongation from the cap, and within it depends a torch, *k*, properly supported by arms or other means, and having a wick communicating with the oil. The cap has also a fixed torch-tube, *l*, carrying a lighting-wick communicating with the oil, and extending upward and over the torch *k*, for a purpose which will presently appear, the torch *k* being on a level with the top of the tubular prolongation. The cap or cover is raised and lowered similarly to the manner of withdrawing and inserting a screw.

In using this oil-tester as I have described it the bath-vessel is filled with water or suitable liquid until the said liquid escapes through the overflow-exit. The cup D is filled with the quantity of oil desired to be tested (and I use preferably a measuring-glass for this pur-

pose) and placed in the bath. The cover or cap is then placed upon the cup with its mantling down in the annular chamber, and turned in the direction of arrow 1 until the ratchets limit its upward movement. Then, as the oil is being heated and the vapor generated at some point of temperature below that of the given or supposed test-point of the fluid under examination, I light the torch *l* and give the cover a turn in the direction of arrows 2, which allows it to fall down to the top edge of the cup, (its normal position,) thus decreasing the capacity within the oil-cup and compressing the vapor, should there be any generated, and ejecting it through the vapor-passage, and at its exit against the outer torch, *l*, projecting over the torch *k*, where it will ignite and carry the ignition to the lower torch, *k*, and the point of temperature indicated on the thermometer of the cup will be the test-point. Should there be no vapor ejected at the first turn of the cover, I immediately turn it again to raise it, and at the next degree higher I turn or screw the cover down again, and repeat these operations until the test-point is reached.

In testing petroleum or other oils of high volatility I heat the bath to a prescribed temperature before placing the oil-cup therein. In fluids of low volatility I start with cold water and heat gradually with the lamp. In fluids of very low volatility—such as naphtha, benzine, and natural crudes—I use a frigorific mixture for the bath, and reduce therewith the fluid under examination to its congealing-point, and then gradually weaken the frigorific mixture by pouring in through the thermometer-socket of the bath-reservoir a quantity of water, and allow it to run off through the overflow-pipe, and as the temperature rises I proceed as above to determine the inflammable point of the fluid under examination.

The theory of the invention designed to be carried out by substantially such an apparatus as described is, that a cap with its mantling, adapted to be raised and lowered, is the best means of compressing the vapors and causing them to be ejected to the torch.

In my apparatus the oil-cup is a representation of a burning lamp containing oil, and the oil under examination is in exactly the same condition it would be if burned in a lamp, and said fluid and its generated vapor are alone dealt with; and my apparatus is as practical in the hands of the refiner as with the inspector or consumer. With my instrument the refiner can find the inflammable point with the same facility as the inspector or consumer can determine whether inflammable or not at a certain point. The refiner, in making an oil for a certain standard, must know its exact inflammable point at certain times during the course of its manufacture. Upon my apparatus this can be found in a practical way and to a certainty, and under the same conditions and circumstances as if the oil were being burned from a wick in a lamp. The perfect seal against the escape of the generated vapor through any part of the cover other than the escape to the torch insures holding all the vapor generated without the gradual loss of any.

In my apparatus I simply heat the oil in the oil-cup by a bath-vessel, as usual, and at certain points, as indicated by the thermometer, bear down on the generated vapor to discharge it through the exit in the cap to the torch.

The construction of the oil-cup and of the cap might be varied without departing from the characteristics of my invention. The oil-cup could be made without the outside wall, and instead of hanging by a flange could rest upon a contrivance arranged inside the bath, and the cover be made to come down over the oil-cup, with its mantling directly in the bath. Such an apparatus is shown in the modification, Fig. 6, in which the cap or cover E is arranged to be supported upon spiral springs 1, wrapping guide-posts 2, fixed in the top rim, 3, of the bath-vessel A. Holes in the cap E, through which the posts pass, permit the said cap to press down the springs, and as they do this the lowering cap presses up the vapors through the exit G K, as before described, and the retraction of the cap is effected by the resiliency of the springs. The oil-cup D rests upon a false bottom, 4, reticulated or perforated to admit the full bath above and below it. Stop-pins 5 pass through the posts above the cover to limit its height. The oil-cup D in this case is a plain cylindrical vessel with a bottom; and instead of the springs there might be weights and pulleys.

Having described my invention, I claim—

1. An apparatus for testing hydrocarbon fluids or for finding their inflammable degree of temperature, consisting of a suitable bath, an oil vessel or cup, and a cap or cover for mechanically compressing the generated vapor at a certain point to eject it to an igniting-torch.

2. In an apparatus for testing the inflammability of hydrocarbon oils and other burning-fluids, the combination, with a bath-vessel, of an oil-cup provided with a chamber for a seal to the cap or cover, and the said cap adapted to be raised and lowered to compress the generated vapor and eject it to a torch, substantially as described.

3. In an apparatus for testing the inflammability of hydrocarbon oils and other burning-fluids, an oil-cup provided with a surrounding chamber having perforations to admit water, in combination with a cap or cover adapted to be raised and lowered therein to compress the generated vapors through an exit to a torch and to seal them against atmospheric air, substantially as described.

4. In an apparatus for testing the inflammability of oils, the combination, with the oil-cup provided with a surrounding chamber, of a cap or cover having a mantling with ratchet-rideways adapted, in being raised and lowered, to ride over bearing-points in said sur-

rounding chamber, substantially as described, for the purpose specified.

5. In an apparatus for testing hydrocarbon fluids or for finding their inflammable degree of temperature, the combination of a bath-vessel, an oil-cup, a vertically-operating pressure cap or cover for said oil-vessel, and a seal for said cap or cover, substantially as described, for the purpose specified.

6. In apparatus for testing the inflammability of oils, a double-walled oil-cup heated by a bath, and a cover or cap sealed in its relation to said double walls by said bath, and having a vapor-exit, G, a lighting-torch, *l*, a vapor-exit torch, *k*, and a thermometer, F, substantially as described, for the purpose specified.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

GEO. M. SAYBOLT.

Witnesses:

C. GODFREY PATTERSON,

IVERSON W. KNAPP.