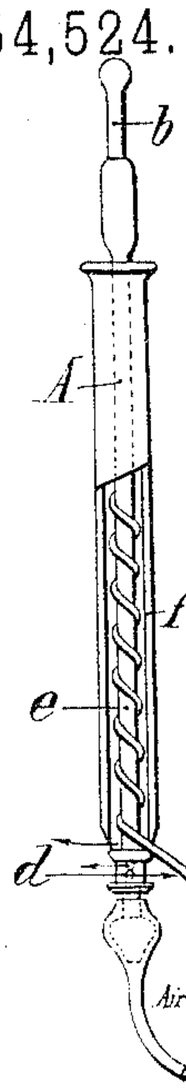
(No Model.)

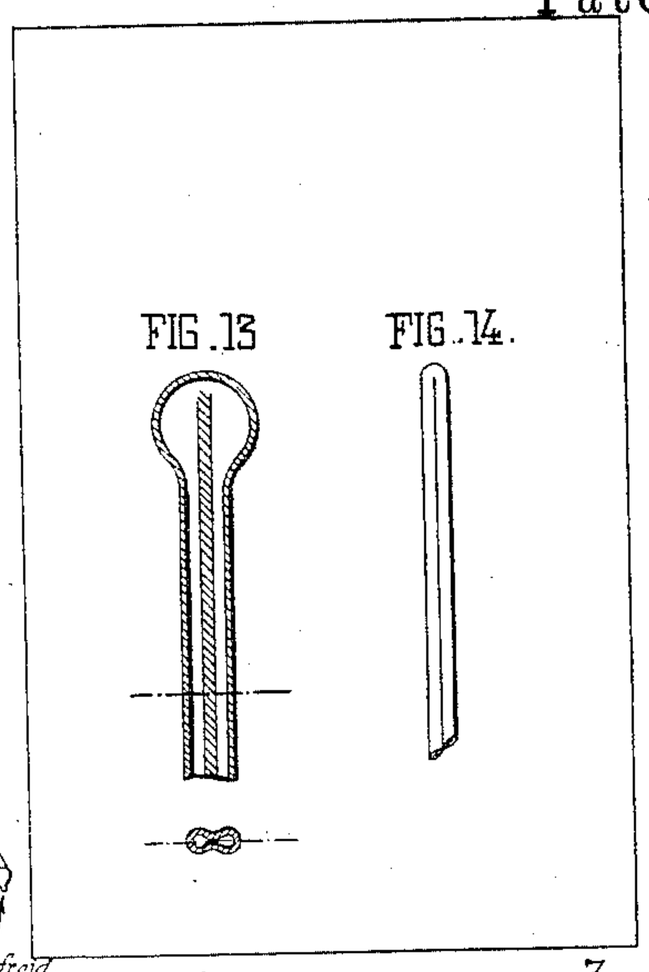
2 Sheets—Sheet 1.

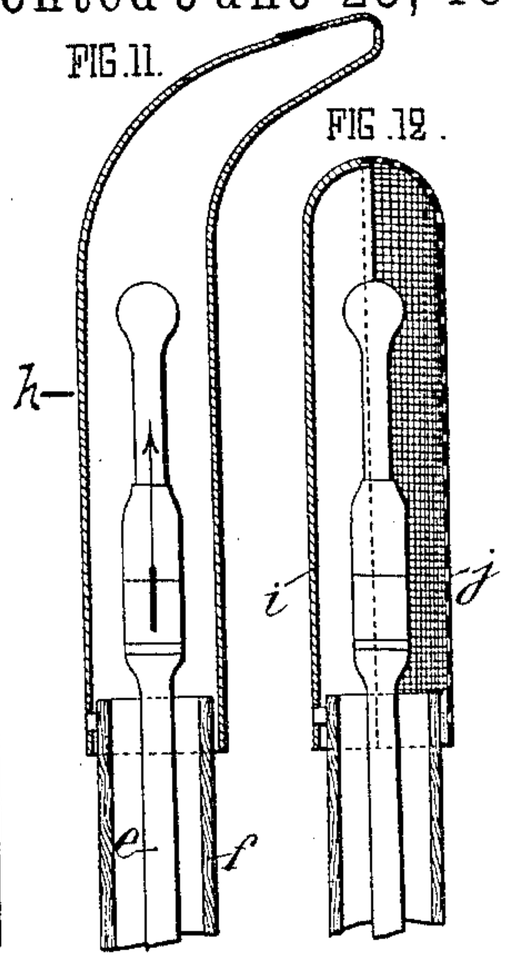
C. A. PAQUELIN.

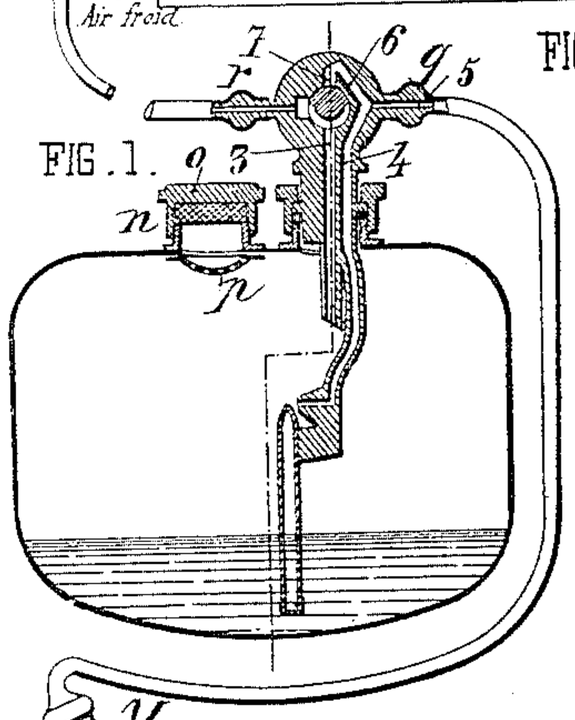
THERMO-CAUTER.

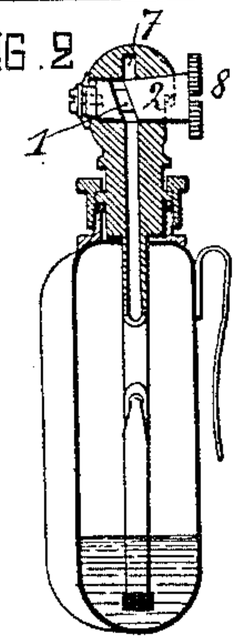
No. 454,524. Patented June 23, 1891.

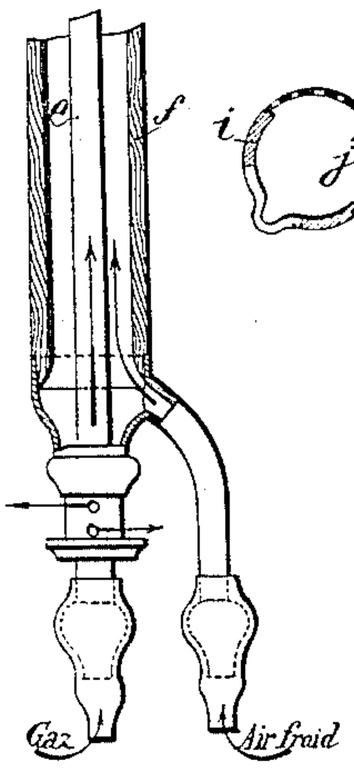


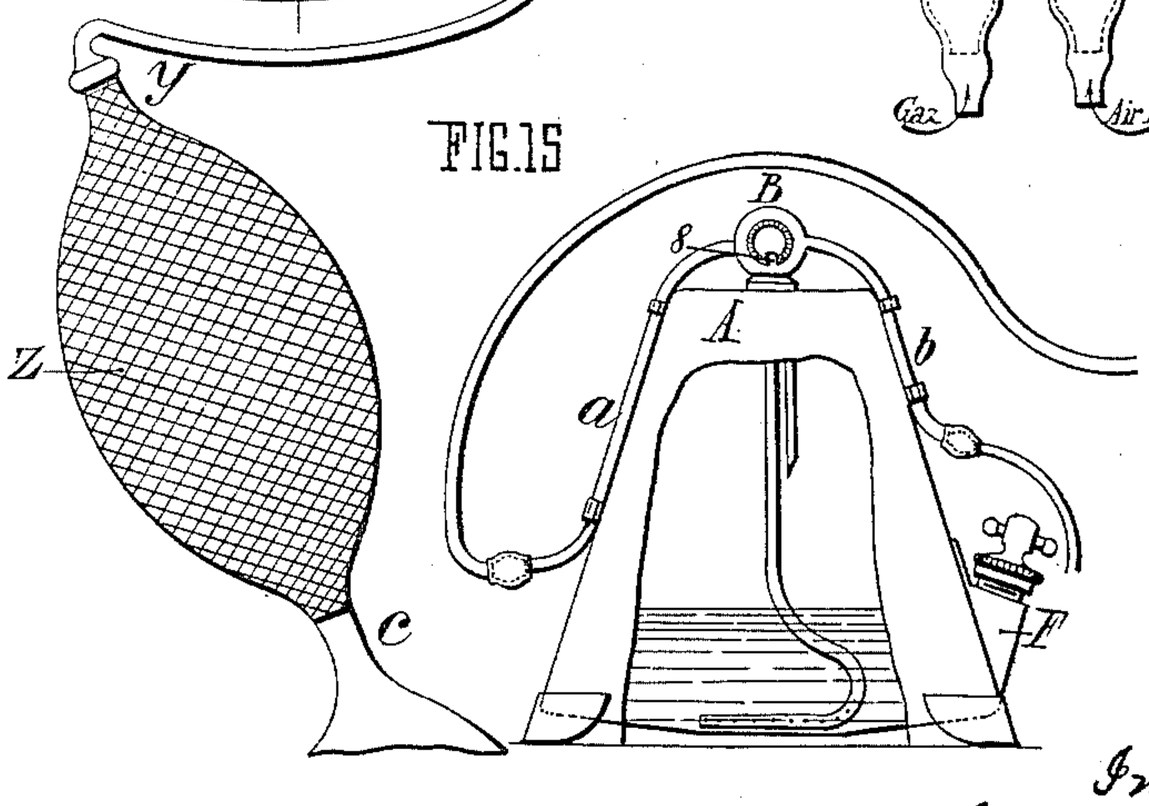












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(No Model.) 2 Sheets—Sheet 2.

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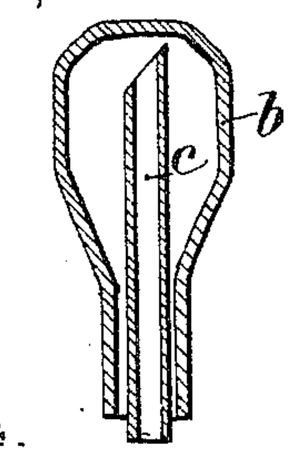
FIG. 4.



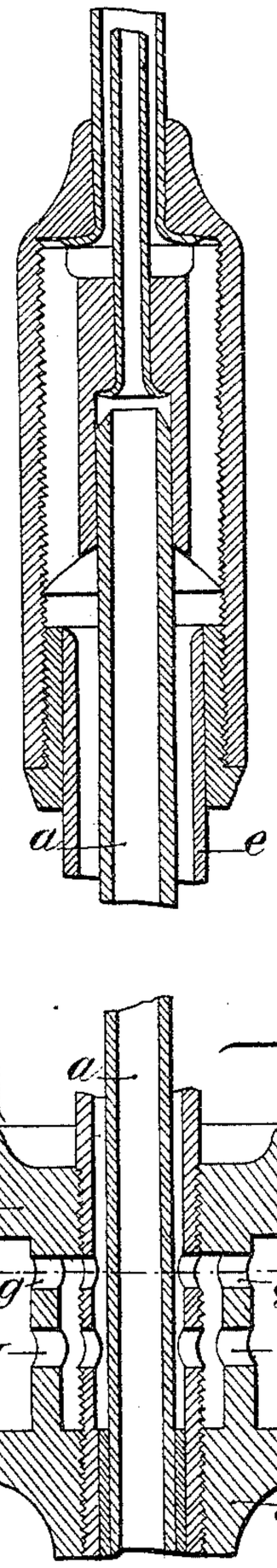


FIG. 5.

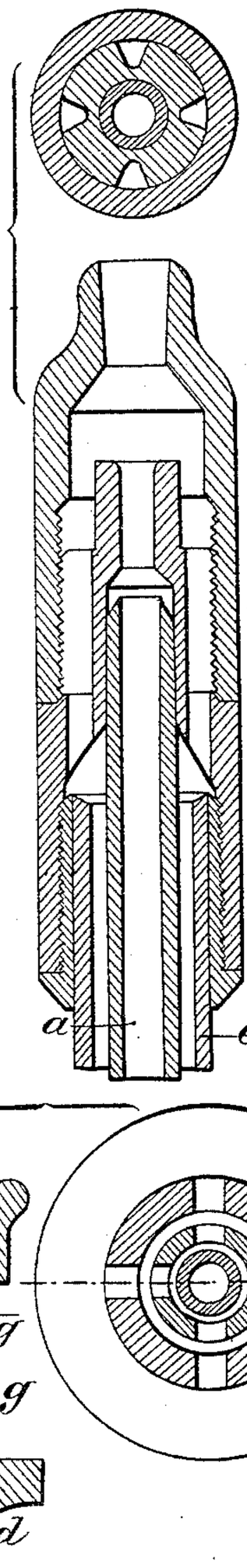


FIG. 3.

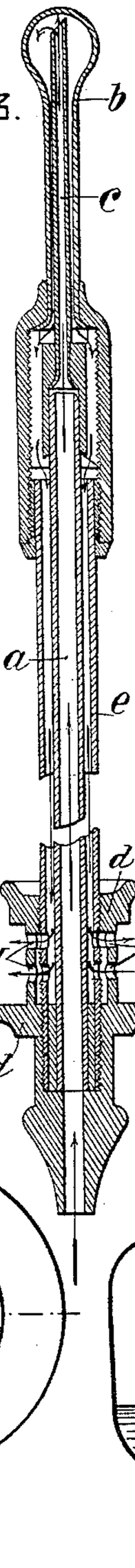


FIG. 6.

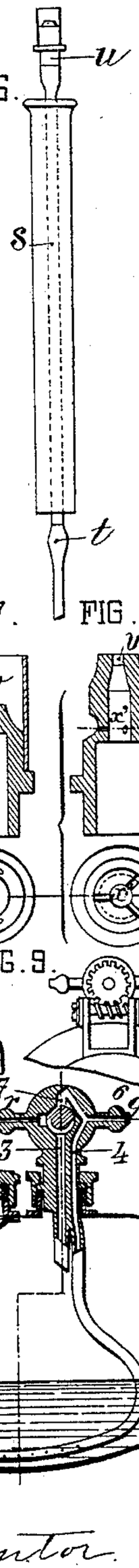


FIG. 7.

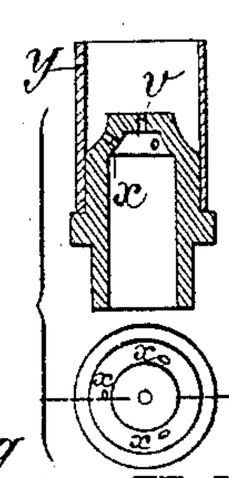


FIG. 8.

FIG. 9.

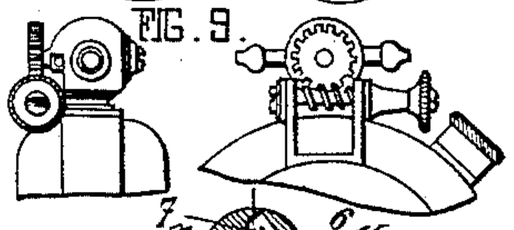
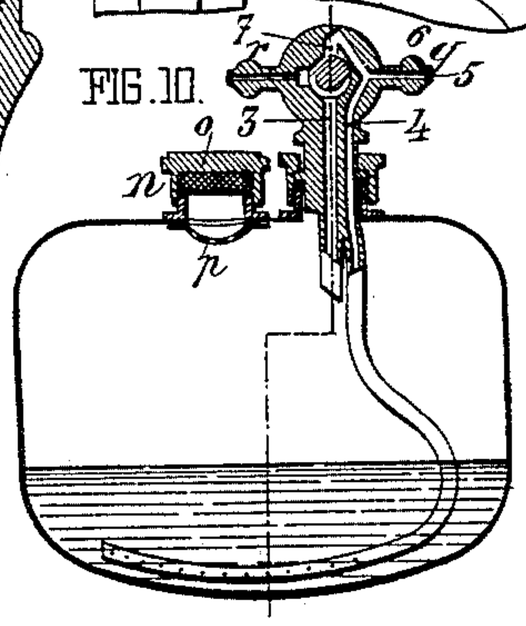


FIG. 10.



Witnesses:
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Gustav Schneppé.

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his attorneys.

UNITED STATES PATENT OFFICE.

CLAUDE ANDRÉ PAQUELIN, OF PARIS, FRANCE.

THERMO-CAUTER.

SPECIFICATION forming part of Letters Patent No. 454,524, dated June 23, 1891.

Application filed October 18, 1890. Serial No. 368,532. (No model.)

To all whom it may concern:

Be it known that I, CLAUDE ANDRÉ PAQUELIN, physician, of the city of Paris, France, have invented Improvements in and Connected with Thermo-Cauters, of which the following is a full, clear, and exact description.

This invention relates to improvements in the parts constituting a thermo-cauter and to the application to the thermo-cauter of a simple form of blow-pipe heater burning a mixture of air and gas or hydrocarbon vapor; and it consists in the details of construction and in the new combinations of parts hereinafter more fully specified.

Reference is to be had to the accompanying drawings, forming part of this specification, in which—

Figure 1 represents a part sectional view of the entire apparatus as arranged for use. Fig. 2 is a cross-section of the carburetor. Fig. 3 is a longitudinal section of the cauter proper. Fig. 4 comprises longitudinal and cross sections on an enlarged scale, showing the passages for the gases. Fig. 5 shows cross and longitudinal sections of a modified arrangement. Fig. 6 is an elevation of the blow-pipe heater. Fig. 7 is a detail section of its burner. Fig. 8 is a detail section of a modified burner. Fig. 9 shows a micrometer adjustment for regulating the mixing-cock of the carburetor. Fig. 10 is a section of the carburetor at right angles to Fig. 2. Fig. 11 shows the thermo-cauter applied as a desiccator, and Fig. 12 shows the thermo-cauter as applied for local illumination in dental and other operations. Figs. 13 and 14 show two forms of points for the cauter. Fig. 15 shows a form of carburetor for use in workshops.

In this improved cauter the combustion is effected by conducting the combustible gases through the central tube *a* to the tube *c*, of platinum or other gas-condensing metal, which conveys them to the end of the cauter-point, where combustion takes place, the resulting products passing off through the annular space between the central tube *a* and the sleeve *e*, and finally escaping through perforations in the boss *d* at the rear end of the handle *f*. The use of the condensing metal is restricted to the exact dimensions required and the platinum-gauze now employed in large cauters is dispensed with, the instrument being thus reduced to minimum dimensions.

A current of cold air is blown between the sleeve *e* and sheath or handle *f*, and may either circulate freely or through a coiled tube, as shown in Fig. 1, or otherwise, and a non-conducting substance—such as asbestus—may also be interposed between *e f*, either or both these means of preventing the transmission of heat to the handle being employed. One of the products of combustion of hydrocarbons is steam, which condenses in the perforations *g* of boss *d* in the form of drops. These condensed vapors may be utilized for cooling purposes either by allowing them to leak between the parts *e* and *f* or by blowing them in by the air-current above mentioned, or the orifices in *d* may be closed and the accumulated pressure utilized for carrying the condensed vapors to any point desired.

The reduction of the mass of condensing metal, as above mentioned, enables the instrument to be ignited at the flame of a candle; but notwithstanding such reduction the construction of the thermo-cauter is such that if, when the point is in complete incandescence, it be dipped in cold water and held there while continuing to supply the combustible gases it will regain its incandescence when withdrawn and it will pass through animal tissues or liquids without being extinguished. By the present improvements there is also a considerable reduction in the field of combustion, with a proportionate diminution of the radiant heat. The edges and sides of cavities are protected from the contact of the gaseous products of combustion, with consequent greater freedom for operating in cavities. The concentration of the heat in the handle of the instrument is prevented. The hand of the operator may be brought close to the field of operation and the instrument may be handled with greater precision.

The instrument may be employed, among other uses, in dental operations, for desiccating by hot air, and also for illuminating the parts under treatment.

To use the thermo-cauter as a desiccator, Fig. 11, a nozzle *h*, of straight or curved tapering form, is attached to the instrument by a bayonet or other joint, and air is blown

both through the carburetor and desiccator, the current circulating between the sleeve *e* and handle *f* becoming heated by contact with the incandescent condensing metal and escaping through the perforated end of nozzle *h*, by which it is projected upon the parts under treatment.

To apply the instrument for the purposes of illumination, Fig. 12, the cap *h*, Fig. 11, is replaced by an enameled hood *i* and wire-gauze *j*, or other arrangement giving the same result. The instrument may thus be inserted in the buccal cavity, for example, for lighting it.

It has been stated that the use of platinum-gauze as heretofore in large cauters is no longer indispensable, but an indispensable element of thermo-cauters generally is the internal surface of gas-condensing metal constituting the focus of combustion, (which in Fig. 3 is in the form of a tube *c*,) serving to prevent the extinction of the thermo-cauter by the loss of a great part of the heat derived from the internal combustion when the instrument is introduced into animal tissues.

To effect the combustion of the gases or hydrocarbon vapors, I may employ the condensing metal in the form represented in Fig. 13, in which the cauter has a longitudinal partition, or in that shown in Fig. 14, in which it is formed of a tube doubled on itself, neither wire-gauze nor a central tube being employed. The carburetor for generating the hydrocarbon vapors serving to maintain the incandescence of the cauter is specially arranged according to the combustible gas or vapors employed. When employing a gas—such as illuminating-gas, for example—the carburetor is provided with a special mixing-cock. When vapors are used, (benzoline vapors, for example,) it is furnished in addition to the said cock with a saturator (washer or atomizer). In the former case the gas is supplied to the carburetor, according to the requirements of the consumption, with or without an automatic governor. In the latter case, hereinafter described, the combustible is contained in a liquid form in the carburetor itself.

The form of the carburetor may vary. In Fig. 1 it is of rectangular section, concave on one side and convex on the other, for application against the body by which it is warmed. The carburetor is filled to the proper height by first completely filling it at orifice *n*, and then, its concave side being toward the operator, the excess is poured off by tilting it to the left. The orifice *n* is preferably closed by a screw-cap *o*, made perfectly tight and provided with a strainer *p* to act as a filter in filling the vessel.

The regulator mixing-cock fitted to the carburetor consists of a rotary plug provided with an inclined groove 1, Fig. 2, which may either be made of the form shown or be formed of several spirals. 2 is a stop to limit the motion of the plug. The body of the cock extends within the carburetor and has two passages, of which the one passage 3 leads directly to the plug, while the other passage 4 connects with an obtuse-angled channel leading past the plug, a horizontal branch channel 5 terminating in a nipple *q*, connected with the bellows by a flexible pipe *y*, while the inclined branch 6 extends up to the top and connects with another channel 7, leading to the plug, like the passage 3, to which it is diametrically opposite. Another horizontal nipple *r*, similar and opposite to *q*, places the valve in direct communication with the thermo-cauter by a flexible tube.

Figs. 1 and 2 show the saturator, which consists of an atomizing-injector, or, by suitably modifying the carburetor, an atomizer operated by air-pressure may be used; or a saturator of the kind represented in Fig. 10 may be used, consisting of a bent pipe perforated at its lower end, which dips into the liquid contained in the vessel. The saturator is branched onto the passage 4; but it may be independent of said passage and open out on the exterior, in which case said passage 4 need not extend below the pipe-connection *q*, the air supplied by the bellows being distributed directly, partly through *q* and partly to the saturator. In all cases the carburetor is so arranged that it may be overturned without spilling the liquid. The mixing-cock may be attached to the carburetor by a screw-nut provided with a packing-ring, so as to enable it to be removed for the purpose of inspecting the injector and keeping it in working order. The liquid-container may also be provided with glazed openings, if desired.

The mixing-cock is operated in the following manner:

First. Supposing the stop 2 to be at the right-hand end of its course, in this position the two passages *q r* are in direct communication by means of the groove 1 in the plug and the passages 7, 6, and 3 are completely closed. The air from the bellows consequently passes first both to the carburetor and also to the outlet-passage *r;* but as the return-passage 3 is closed immediately the carburetor becomes filled with air the whole of the air supplied by the bellows will pass directly from one to the other pipe connection *q r*, so that in this position of the cock it may be said that hardly any but pure air passes from one to the other.

Second. Supposing the cock be turned to the left, during the whole of this movement the passage which places the pipe connections *q r* in communication becomes gradually reduced at the same time that the return-passage for the carbureted air is opened and gradually increased to a corresponding extent. Thus the farther the plug is turned to the left the more will the quantity of air passing from one pipe connection to the other be reduced and the more will that which enters the carburetor be increased, whereby the air will become more highly carbureted. Thus

when the stop 2 is vertical—that is to say, in the intermediate position indicated by the notch 8 in the head of the plug, Fig. 2—one half of the air supplied by the bellows will pass to the carburetor and half to the left-hand pipe connection *r*.

Third. Supposing the stop 2 to be turned to the left to the full extent, in this position the passage 6 7, which puts the right-hand pipe connection in communication with the groove in the plug, is closed; but as the passage 3 is in direct communication with said groove all the air from the bellows will consequently pass through the carburetor. The cock serves thus both for proportioning and mixing, which enables the operator to produce, according to the action desired to be obtained, a series of gaseous mixtures of exactly determined composition and more or less rich in carbureted hydrogen.

The cock may be operated by a micrometer-screw, (see Fig. 9,) whereby much greater precision may be obtained in its operation, and consequently in the distribution of the air. The regulating action of this cock is indispensable for insuring the proper working of the thermo-cauter. By its aid the operator can both regulate at will the degree of incandescence of the instrument and also compensate for any irregularities due to the varying conditions either of the surroundings or of that existing in the interior of the carburetor owing to the exhaustion of the supply of liquid or its vaporization, &c.

The blow-pipe to be employed in combination with the thermo-cauter, which I will now proceed to describe, is intimately connected in its action with the mixing-cock. It is of special construction, and consists, as shown in Fig. 6, of a single tube like a jeweler's blow-pipe, but differs therefrom in the form of the burner, which emits two kinds of flame—viz., a central tongue or flame, around which at its base is a circle of small flames serving to prime and feed the former. The blow-pipe tube *s* terminates at one end in a nipple *t* and at the other in a burner *u*, upon which is fitted a short tube or sheath *y*, as shown in Fig. 7, in which *v* is the central orifice of the burner and *x* the lateral orifices inclined at an angle of about forty-five degrees. In the slightly-modified arrangement shown in Fig. 8 the orifices *x* are formed horizontally in a groove formed at about mid-height of the burner. The metal tube *y*, which may be of variable height, surrounding the burner, while permitting of free communication between the central and lateral jets, insures the combustion of the generating-current by insuring the convergence of the lateral jets. The central tube *s* is inclosed in a handle, which may be protected from the heat in the manner before described for the thermo-cauter.

With a blow-pipe constructed as described all the necessary variation in the form, dimensions, color, and intensity of the flame may be obtained by varying the relation between the areas of the central tube and of the central and radial orifices of the burner for each particular case. The same remarks apply with regard to the dimensions, form, and construction of the burner and other parts of the blow-pipe.

For a burner of the kind represented in Fig. 7 the following dimensions of the orifices have given good results: diameter of central orifice of burner, three millimeters; diameter of outlet-orifice, 2.50 millimeters; diameter of each of the three radial orifices, 1.90 millimeters.

The blow-pipe, when combined with the thermo-cauter, serves, first, to prime or start the cauter; second, to clean it; third, to test previous to each operation the qualities of the combustible liquid; fourth, to establish by means of the mixing-cock previous to each operation the desired composition of the gaseous mixture.

To prime the cauter it is simply necessary to connect the blow-pipe with the carburetor, turn the plug of the cock so as to bring the notch 8 on the head downward and work the bellows, and then light and regulate the flame of the blow-pipe, so that it presents hardly any trace of white flame. Then heat the cauter to a white heat and quickly substitute it for the blow-pipe. The incandescence of the cauter is now regulated by the cock on the carburetor. In order to clean the cauter, the same operation is repeated as in priming, after which the blowing action is increased and the condensing metal maintained at a white heat for a few moments. By the employment of the blow-pipe the spirit-lamp and two kinds of combustible liquids hitherto required are dispensed with, while the operator is also enabled to clean his own instrument. To verify the qualities of the combustible liquid the precise moment when the liquid will fail is known when previous to an operation, whatever may be the position of the cock, the blow-pipe no longer produces a flame largely tinted white. Any kind of bellows may be used, but it is preferred to employ a Richardson bulb, operated either by the hand, foot, or pedal. I have shown in Fig. 1 an improvement consisting in the application of a thick flange *y*, of india-rubber, between the regulating-bulb *z* and the tube to which it is connected, in order to prevent throttling by the netted covering when the bulb is fully expanded. Without this adjunct the tube leading from the regulating-bulb is liable to become imprisoned between the bulb and its netting and flattened, so as to suddenly cut off all circulation of air.

I claim—

1. The combination, in a thermo-cauter, of the cauter proper with a carburetor having a regulating and mixing cock, a pneumatic bulb, and blow-pipe, substantially as shown and described.

2. The combination, in a thermo-cauter, of

the tube *c*, of gas-condensing metal, the outer cauter-point *b*, sleeve *e*, having an outlet at the end *d* of the handle for the escape of the gases of combustion, and hollow outer handle *f*, all arranged to allow for a circulation of cold air and of the products of condensation between the sleeve *e* and the handle *f* for the purpose of cooling the handle, substantially as shown and described.

3. The combination, in a thermo-cauter, of the cauter proper with the desiccating-nozzle *h*, substantially as shown and described.

4. The combination, in a thermo-cauter, of the cauter proper with the illuminating hood or cap *i*, substantially as shown and described.

5. The combination, in a thermo-cauter, of the cauter proper with a partitioned tube for conducting the vapors to and the products of combustion away from the cauter-point, substantially as herein shown and described.

6. The combination, in a thermo-cauter, of the cauter proper, the carburetor, and pneumatic bulb with a blow-pipe having central and lateral orifices *v* and *x*, said blow-pipe serving to ignite and clean the cauter, and also test the gaseous mixture, substantially as shown and described.

7. The combination, in a thermo-cauter, of the cauter proper and the carburetor with the regulating and mixing cock consisting of a plug having the groove 1 and top 2, and of a body having the passages 3, 4, 5, 6, and 7, substantially as shown and described.

The foregoing specification of my improvements in and connected with thermo-cauters signed by me this 1st day of October, 1890.

CLAUDE ANDRÉ PAQUELIN.

Witnesses:

R. M. HOOPER,

ALBERT MOREAU.