

## PHINEAS ALLEN ROYCE.

## Improvement in Generating Ozone.

No. 118,976.

Patented Sep. 12, 1871.

FIG 1

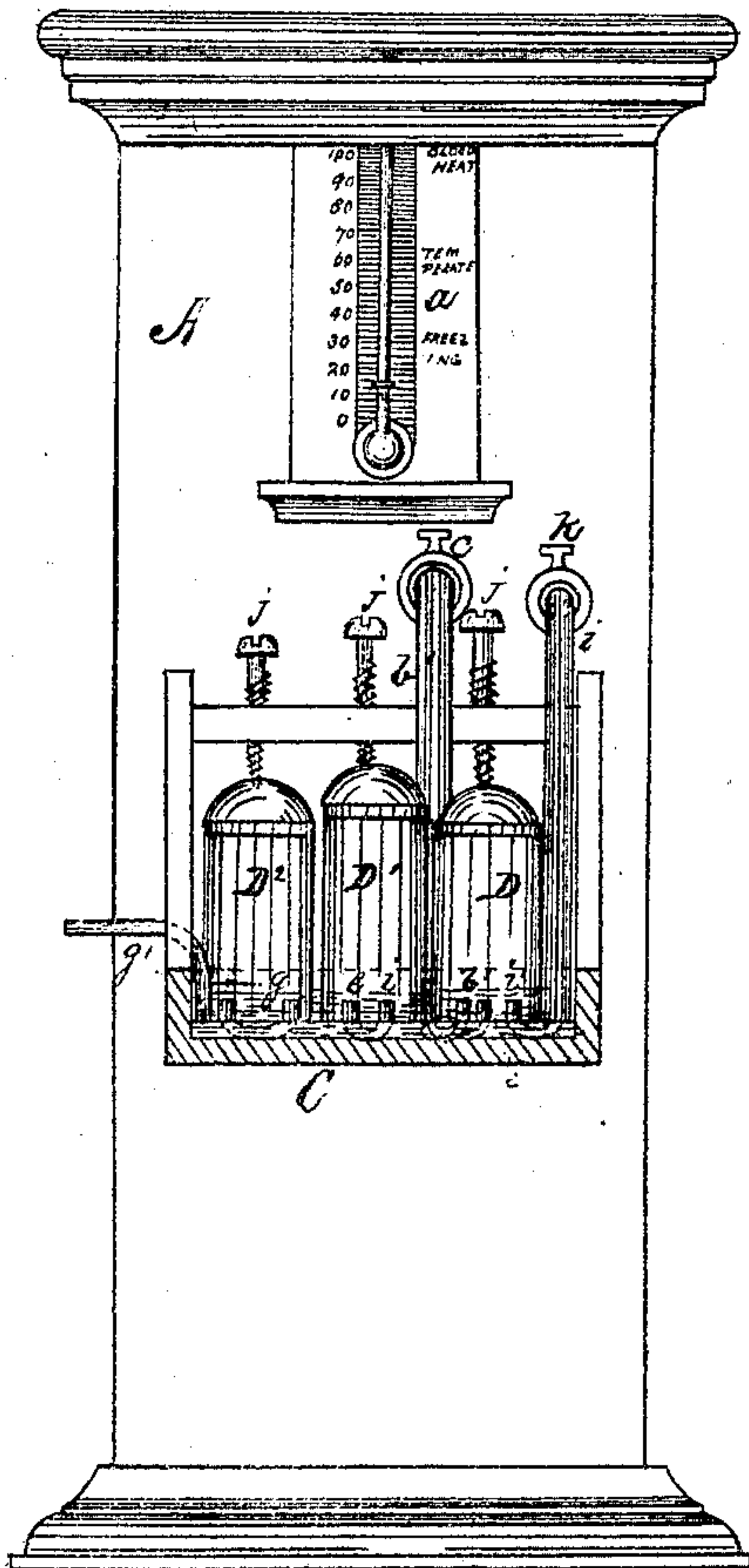


FIG 2

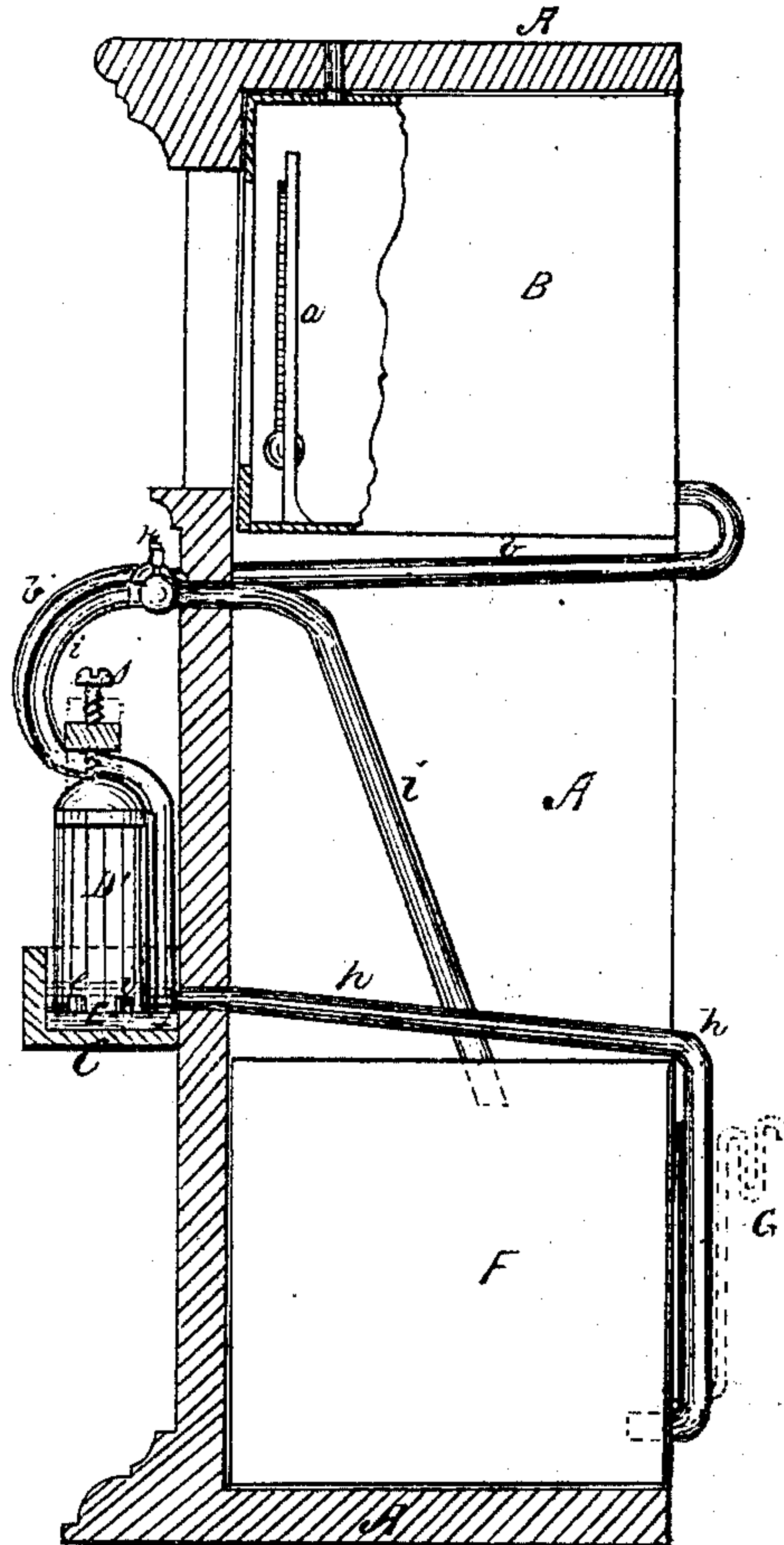
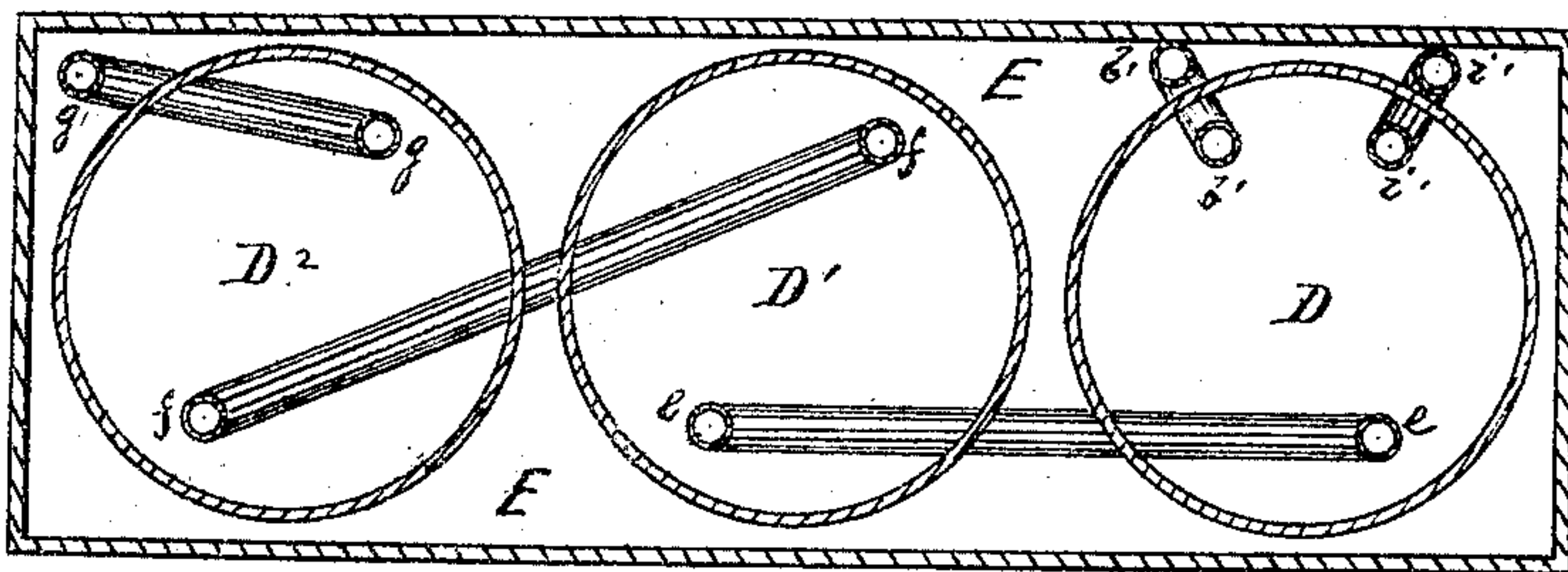


FIG 3



## WITNESSES:

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# UNITED STATES PATENT OFFICE.

PHINEAS ALLEN ROYCE, OF SUSPENSION BRIDGE, NEW YORK.

## IMPROVEMENT IN GENERATING OZONE.

Specification forming part of Letters Patent No. 118,976, dated September 12, 1871.

*To all whom it may concern:*

Be it known that I, PHINEAS ALLEN ROYCE, of Suspension Bridge, in the county of Niagara and State of New York, have made certain new and useful Improvements in Apparatus for Generating, Expelling, and Controlling Ozone, of which the following is a specification:

Ozone is now well understood to be an important principle contained in the external air, existing in a greater or less degree, according to the locality and purity of the atmosphere. It is the peroxide of hydrogen, and contains the vitalizing and purifying element of the external air. Ozone in a state of purity is too penetrating and even suffocating to be inhaled with safety, and when concentrated is irritating to the respiratory organs, but is readily diffusible in the air. Its odor is often noticeable in the atmosphere after a thunder-storm, and its pressure is noted by the ozonometer.

It is shown, by placing these ozonometers or ozonoscopes in the halls and wards of hospitals, (and in dwellings,) that no trace is given of its presence; while, if placed outside in the air, they indicate as high as  $7^{\circ}$  to  $10^{\circ}$ , the scale of an ozonometer running from  $1^{\circ}$  to  $10^{\circ}$ . It is conclusively proved that a deficiency of ozone is productive of disease, and writers universally concur in the assertion that all forms of anemic or low grades of vitality are caused by or are coincident with a low grade of ozone in the air.

The object of my invention, therefore, is to produce an apparatus or machine—compact and portable, if necessary—that will, by simple means and appliances, generate the ozone, and diffuse and control it, so that a greater or less quantity can be expelled into sick rooms, manufactories, hospitals, coal-mines, or other places where the ozonoscope or ozonometer shows a deficiency in the air of this important vitalizing agent, and also for other purposes. To generate and control the supply of this life-preserving, purifying, and disinfecting element is, as before stated, the main object of the present invention; and the invention consists, first, in generating the ozone from phosphorus acted on by water and air under hydraulic and atmospheric pressure; and, second, in producing and controlling it by the appliances and apparatus

hereinafter fully described.

In the drawing, Figure 1 is a front elevation of the apparatus. Fig. 2 is a cross-section. Fig. 3 is a plan of the generating and purifying chambers.

A is the case or frame. B is a reservoir of water, standing in the upper part of the case at a suitable distance from the ground, and having a thermometer, *a*, inclosed in it, and a glass window in front of it, so that the temperature of the water can always be ascertained. To the bottom or back part of this reservoir B is connected a pipe, *b*, coming out in front of the case, with a stop-cock, *c*, to regulate the flow of water. This pipe runs down into a tank, C, arranged on the front of the case, about midway. Here the pipe is connected to a bent glass tube, *b'*, which comes up into a glass globe or generator, D, which stands partly in water on a water-tight bottom, E, through which the tubes also pass. In this generator D, near the bottom, is placed phosphorus, partly in and partly out of water, which is tempered by the temperature of the water and action of the air to increase or diminish the chemical action, to be hereinafter described. From the bottom of this globe a bent glass conducting-tube, *e*, runs, leading and opening into the bottom of a similar globe or chamber, D<sup>1</sup>, standing next to it. From this globe also runs a similar conducting-tube, *f*, into a corresponding globe, D<sup>2</sup>. Two, three, or more of these globes or chambers may be used, the object being to more thoroughly cleanse the ozone. Another tube, *g*, runs from the last globe, and the water and ozone pass out of it into the tank C. The tube opening under water, a larger glass tube, *g'*, is inserted over it, to carry the ozone into the room or other place. The tank is filled with water kept constantly supplied by the overflow of this discharge-pipe. The receiving ends of these conducting-pipes are below the water and the discharge end is above water, the object being to create a better circulation through the globes and force the ozone down through the water. The water which rises in the tank C is conducted off and discharged into the lower reservoir F by a pipe, *h*, capacitated to receive the water and a sufficient amount of air necessary to produce the pressure and chemical action. This pipe discharges the water and air into the



bottom of the lower reservoir F, which is air-tight, and which rests on the bottom of the case A. In this the water accumulates and the air rises to the top, the constant flow of water producing the pressure and forcing the air through a pipe, *i*, attached to the top of the air-tight reservoir, and which conducts it through the case A by a connecting glass tube, *i'*, back through the tank C underneath and into globe or generator D. A stop-cock, *k*, arranged in front, regulates the flow of air, as the stop-cock *c* regulates the passage of the water into the same globe or generating-chamber. The tubes *b'* *i'* enter the chamber D near together, and the air and water combined under pressure act immediately upon the phosphorus, producing ozone in a crude form, the pressure of water and air also forcing the ozone into the next chamber, and so on. As before stated, the current of water as it passes through these chambers washes and cleanses the ozone from phosphoric acid and other impurities. The ozone rising to the top of the globes is forced down by the current of air through the water from one tube to another to its final exit-point in a pure state.

The chambers are all air and water-tight, and are suitably packed at the bottom. They are always partially filled with water, as shown in Figs. 1 and 2, and are held down in place by thumb-screws *j j j*, suitably arranged in an outside frame, as shown.

To prevent the lower or air-tight reservoir F from filling with water and thereby expelling all the air, I attach a siphon-tube, G, (see Fig. 2,) near the bottom, by which means the water is always kept at the same level, and the superfluous water flows off. By this means, and keeping the upper reservoir filled, a constant flow can be secured. Thus, by these simple means, the generation, cleansing, and expelling of the ozone in greater or lesser quantities is accomplished; and, by merely turning the cocks, the flow of ozone is increased or diminished, charging the room or other place with more or less ozone, as desired.

When desired, the ozone may be conducted into a receptacle for curing or disinfecting meats, &c., or into a series of vessels containing oils, &c., to impregnate the same for remedial purposes, and taken into the stomach as well as the lungs. The same has been accomplished heretofore, but only by a long and tedious exposure of the same to the atmosphere.

The wonderful purifying properties of ozone are fully demonstrated on putrid meats or other decaying matter. By placing them in ozonized air they can be completely disinfected. The same results are achieved in treating drainage, and also decomposed manures. It is one of the most rapid oxidizers and bleaching agents known, and will purify five to six hundred times its volume of impure air. For treating whiskeys and other spirits it will be found to be an important purifying and expelling agent, and will destroy all the crude properties of such, ren-

dering the liquor soft, and giving what is called "age" to it, which has been usually left to time to accomplish.

Ozone is most abundant in winter, and especially in the morning, and it is, therefore, least formed and most consumed in summer, especially where pestilential and malarious exhalations abound; and it is evident, therefore, that hot countries must be most subject to epidemic diseases.

During the prevalence of cholera there is a complete absence of ozone, and it is declared by scientists that its absence is the predisposing cause of that epidemic. It is the ozone that makes the country and mountain air so healthful.

Nearly all these important uses and effects of ozone are well known to the scientific world, but the difficulty has heretofore been to control it. It has been possible to charge the atmosphere of a room with it, but it has been found impracticable to avoid its diffusion to an unsafe degree; and experiments have been made, and, perhaps, are being made, to introduce ozonized air into hospitals, ships, and other places liable to infection.

I believe that by my simple apparatus I have solved the difficulty. It is a desideratum long sought for, and which can be brought within the reach of a large class of the community, and which can be adapted to any location; and its action can be increased or diminished to any extent required, and will continue in uniform operation day and night without variation, so that different atmospheres can be enjoyed in different parts of the same house, if desired, and the variations of temperature in dwellings, &c., can be regulated, and any variety of climate produced to accommodate those who are very susceptible to its influences. It is so simple in construction and in working that any one can manage it.

Its efficient action both as a prophylactic and remedial agent, as not only forming a purer air in inhabited places, but destroying all foul gases and effluvias, makes it the great purifier of nature, and I believe is the only reliable agent that can make coal-mines perfectly safe by destroying the foul air and gases of the same.

Such are mainly the aims and objects of my apparatus for the generating, use, and control of ozone.

What I claim is—

1. Producing ozone from phosphorus, under pressure of water and air, in the manner and by the apparatus substantially as herein fully described.

2. The method of producing the current of air and current of water conjointly, to act on the phosphorus and to cleanse the ozone from impurities, by means of the reservoirs B F, pipes *b b' h i i'*, and tank C, arranged in the manner and operating substantially as herein set forth.

3. The siphon G, in combination with the reservoir F, for the purpose herein set forth.



4. The construction of the apparatus as a whole, consisting of the reservoirs B F, tank C, glass chambers D D<sup>1</sup> D<sup>2</sup>, or their equivalents, resting on the water and air-tight bottom E, the glass tubes *b' i' e f*, and pipes *b h i*, all arranged in the manner and for the purposes herein set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

P. A. ROYCE.

Witnesses:

J. R. DRAKE,  
ROBT. HENEAGE.

(29.)