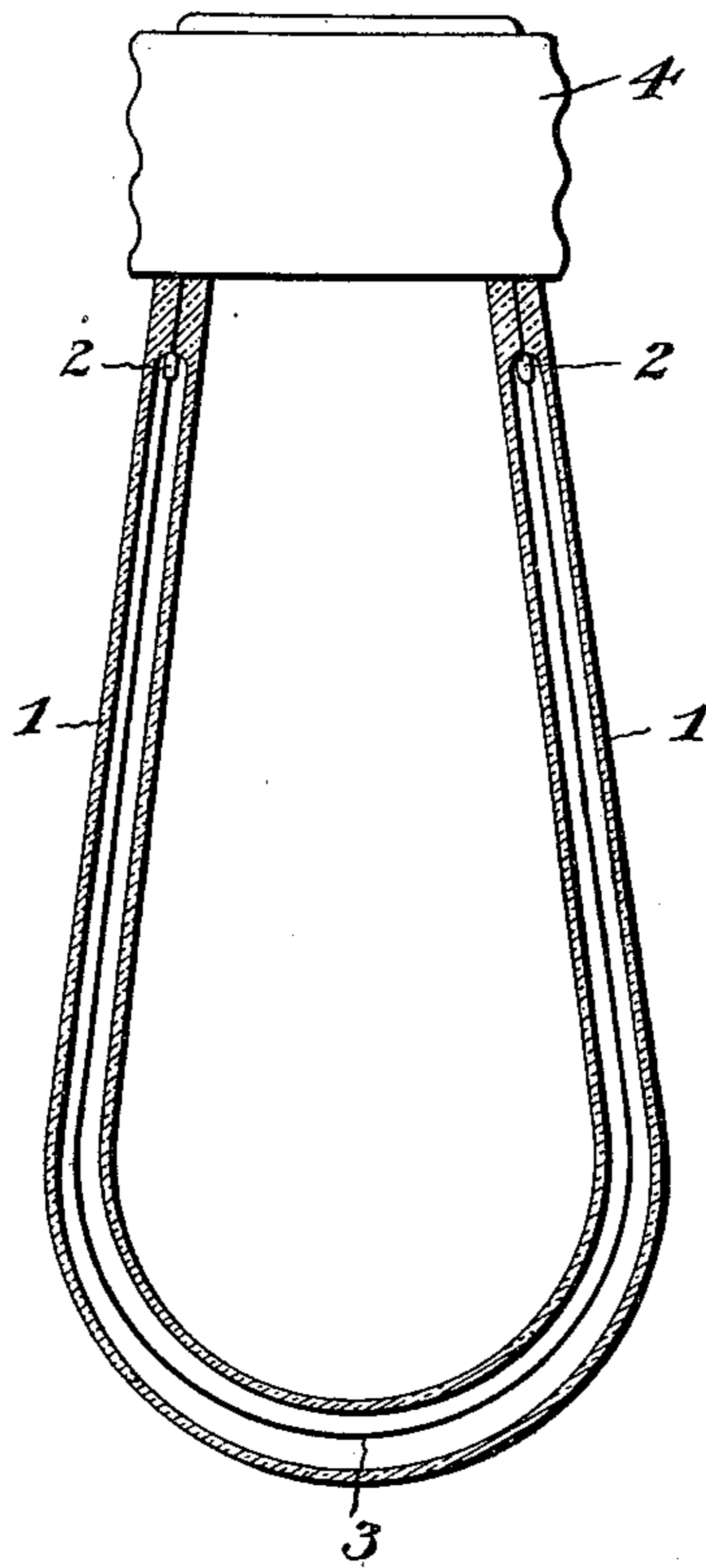


No. 672,019.

Patented Apr. 16, 1901.

A. SINDING-LARSEN.  
ELECTRIC INCANDESCENT LAMP.  
(Application filed Oct. 2, 1899.)

(No Model.)



Witnesses:  
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# UNITED STATES PATENT OFFICE.

ALF SINDING-LARSEN, OF FREDRIKSVÆRN, NORWAY.

## ELECTRIC INCANDESCENT LAMP.

SPECIFICATION forming part of Letters Patent No. 672,019, dated April 16, 1901.

Application filed October 2, 1899. Serial No. 732,379. (No model.)

*To all whom it may concern:*

Be it known that I, ALF SINDING-LARSEN, a citizen of Norway, residing at Fredriksværn, Norway, have invented certain new and useful Improvements in the Art of Making Electric Incandescent Lamps; and I do hereby declare the following to be a full, clear, and exact description of my said invention, such as will enable others skilled in the art to which it appertains to make and use the same.

As is well known, in all incandescent electric lamps now in use the carbon or other filament is inclosed in an exhausted glass bulb to prevent the combustion of the film, which would take place if oxygen were present. Referring to the drawing, in which like parts are similarly designated, I have shown in place of the ordinary pear-shaped bulb a tube 1, in which are sealed the leading-in wires 2, the filament 3 connecting them and the ordinary lamp-socket at 4. The tube contains a gas inactive chemically on the filament and under pressure above atmospheric. The disadvantages inherent in these lamps are also well known—namely, the evaporation of the filament whereby a film of carbon is deposited upon the inner surface of the bulb, thus interfering with the free transmission of light. The tendency of the carbon filament to vaporize at the high temperature to which it must be heated to produce a good light is of course increased *in vacuo*, so that the full illuminating power cannot be obtained, because if the filament is heated to that degree at which it will give its full illuminating power the vaporization of the carbon, especially at its weaker points, causes the same to break in a comparatively short time. To guard against this, it has heretofore been proposed to replace the atmospheric air by hydrogen—that is to say, instead of using an exhausted bulb some hydrogen was introduced into the same; but this has not proven of practical advantage.

The object of my invention is to avoid the vaporization of the carbon filament by filling the bulb with an indifferent gas or vapor under sufficient pressure to prevent such vaporization. By an "indifferent gas or vapor" I mean such as are indifferent to carbon, both physically and chemically—that is to say, a gas or vapor that will not chemically react

upon the carbon or combine therewith. In this manner I not only increase the efficient life of the lamp, because the vaporization of the incandescible body is practically avoided in such a dense atmosphere, but I am enabled to increase the illuminating power of the lamp in that I am enabled to heat the incandescible body to a much higher degree than is otherwise possible without danger of destroying such body. The pressure of the indifferent gas or vapor should be exerted upon the surface of the incandescible body only, because should such a gas or vapor penetrate into the incandescible substance the results aimed at could not be attained, the object in inclosing the filament in an atmosphere under pressure being to compress the carbon, and thus prevent disintegration. I have found that with either nitrogen or argon or a mixture of the two gases under sufficient pressure the desired result will be produced. The formation of an indifferent atmosphere within the lamp can, however, be greatly facilitated by introducing into the same a sufficient quantity of mercury, which when vaporized will result in an atmosphere of the required density or pressure. I am thus enabled to make use of bulbs of a form different from those hitherto used—as, for instance, of U-shaped tubes—the leading-in wires to which the carbon filament is connected being secured in the ends of the legs of the tube, the mercury being introduced into the tube before exhausting the same, and vaporized afterward by heat from the filament to produce the desired high-pressure indifferent atmosphere.

Inasmuch as there is no pressure in the bulb or tube after exhausting and on turning on the current and as the filament might be injured, if current of the usual strength were sent therethrough at once, I prefer to interpose a resistance in the connections, so that the filament will first be heated to red heat until the mercury is vaporized, after which the full current can be sent through the lamp, though this is not necessary when a gas under pressure, as nitrogen or argon or a mixture thereof, is used. The same results may be obtained in a simpler manner by providing means for connecting two lamps or two series of lamps either in series or in parallel, so that at the

beginning the two lamps or the two series of lamps may be connected in series until the mercury is vaporized and then in parallel.

Having thus described my invention, what  
5 I claim as new therein, and desire to secure by Letters Patent, is—

1. In incandescent lighting, the improvement which consists in inclosing a filament in an atmosphere of mercury under a pressure  
10 greater than the pressure causing the deposition of incandescible substance on the bulb, substantially as set forth.

2. In incandescent lighting, the improvement which consists in inclosing an incandes-  
15 cible filament in an exhausted bulb, and vaporizing within said bulb mercury sufficient

to produce a vapor at the incandescent temperature under a pressure greater than atmospheric pressure.

3. In incandescent lighting, the improvement which consists in inclosing a filament in an atmosphere of a gas chemically inactive on the substance composing the incandescible body and under a pressure above the vapor-pressure of said body, substantially as set  
25 forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ALF SINDING-LARSEN.

Witnesses:

ALFRED J. BOYN,

JOHN P. BORDEWICH.