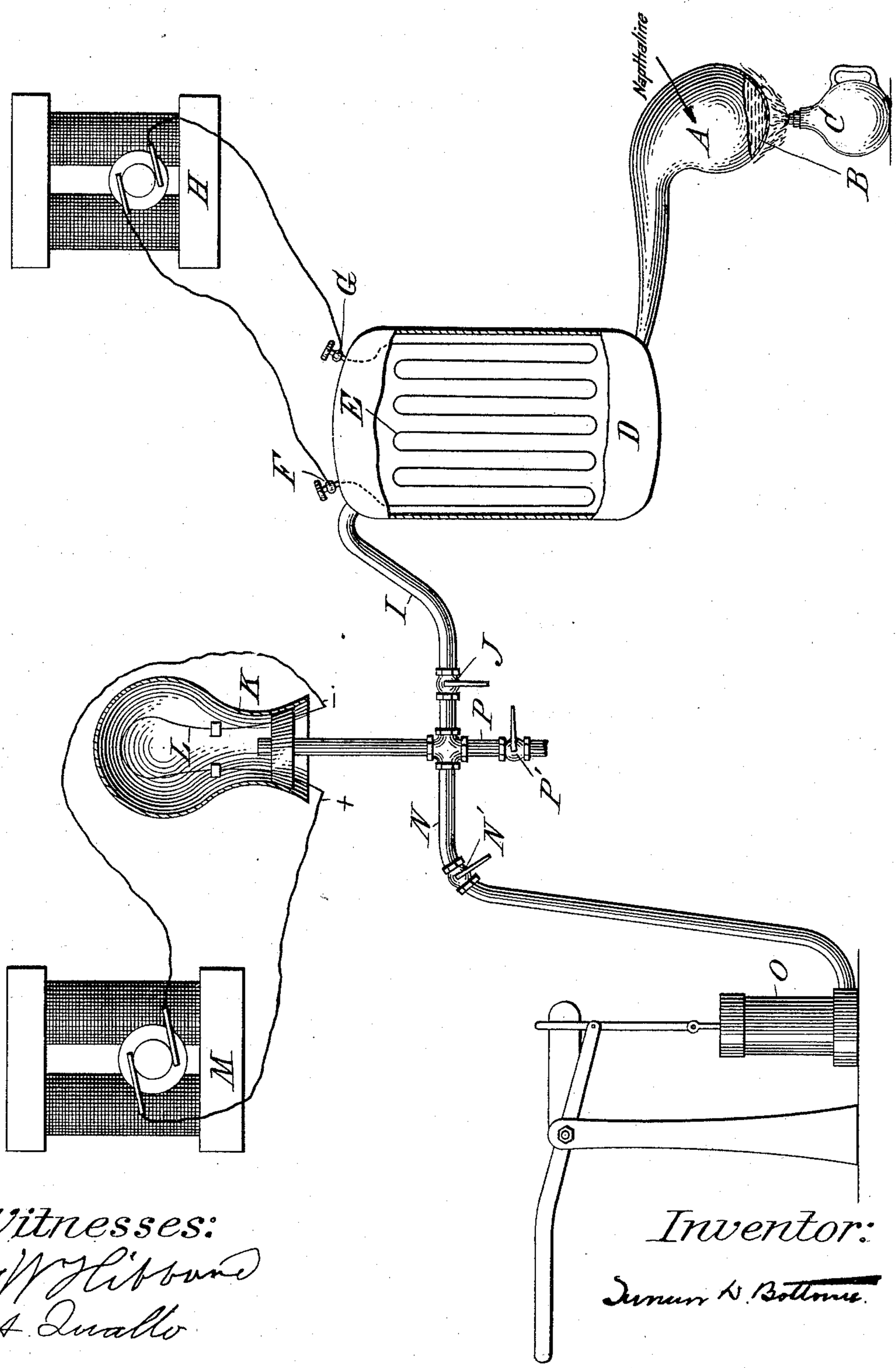
(No Model.)

T. D. BOTTOME.

MANUFACTURE OF INCANDESCENT LAMP FILAMENTS.

No. 408,286. Patented Aug. 6, 1889.



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MANUFACTURE OF INCANDESCENT-LAMP FILAMENTS.

SPECIFICATION forming part of Letters Patent No. 408,286, dated August 6, 1889.

Application filed April 16, 1889. Serial No. 307,460. (No specimens.)

To all whom it may concern:

Be it known that I, TURNER D. BOTTOME, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in the Method of Treating Incandescent-Lamp Filaments, of which the following is a specification.

This invention relates to an improved method of treating filaments for incandescent electric lamps and to the improved filaments produced thereby.

Briefly, it consists in electrically incandescing filaments in an atmosphere of pure, hot, and dry hydrogen obtained from the destructive distillation of a hydrocarbon compound, the object being to cause any metallic salt or compound present in a filament to be completely reduced to the metal, and thereby securing not only a perfect union between such metal and the carbon, but to cause them to become of greater density, and hence a better conductor of electricity.

In practically carrying my invention into effect reference may be had to the accompanying drawing, which forms a part of this specification and illustrates the apparatus used in carrying out my method.

A shows a retort within which is placed a quantity of some hydrocarbon—such as naphthaline ($C_{10}H_8$)—as shown at B. A lamp C is placed under the retort A, which serves the purpose of vaporizing the contained hydrocarbon B. The vapor from the retort A is conducted into a decomposing-chamber D. This consists of a closed vessel containing a long wire arranged in coils or strands, as shown at E. F and G are the terminals of the wire E, connecting with a suitable electrical source H. The wire E is caused to be heated electrically to bright redness, and when the vapor from the retort A is brought into contact with the red-hot wires it is at once decomposed into its elements—namely, hydrogen and carbon, the latter separating out as a bulky black powder, commonly known as "lamp-black." The hydrogen then passes onward through a tube I, having a gas-key J, by which the hydrogen may be admitted at will into a treating-chamber K, in which is placed the filament intended for treatment, as shown at L, which is provided with proper electric conducting-terminals + −, connecting with a suitable electrical source M. The tube N, having a gas-key N′, connects with the chamber K, and also with a vacuum-pump O, that is operated by suitable mechanical means. The tube P, having a gas-key P′, serves to let air into the chamber K when necessary.

In order to treat a filament, I will start, for instance, with a carbon fiber that has been impregnated with a metallic compound—a tungsten compound, for example; but I do not limit myself to any particular metallic compound, salt, or filament containing or not containing a metallic salt or compound. The impregnated filament is placed in the chamber K and electrically connected to the terminals + −. The gas-keys J and P′ are closed and N′ is opened, and the vacuum-pump O is put into action, which has the effect of exhausting the air from the chamber K. N′ is then closed and J is opened. This allows a portion of the heated hydrogen contained in D to be admitted into the chamber K. The key J is then closed and the filament L is slowly heated electrically to redness and allowed to cool. The chamber K is then again exhausted and more heated hydrogen is admitted and the filament is again electrically heated, but this time to incandescence, or to the highest possible temperature without causing destruction of the filament.

The above process may be repeated until it is certain that the metallic compounds in the filament have been completely reduced to the metal, and that the carbon has become dense throughout its structure. The treated filament is removed from the chamber K by opening the key P′, which admits air. The vessel is then removed from the plug or cork shown in the drawing. By alternately treating the filaments with the process for introducing the metallic compound into the carbon and subsequently incandescing the same electrically in heated hydrogen, as described, the filament can be regulated with regard to its electrical conductivity, and at the same time insuring density.

I am aware that there are cheaper and easier methods of producing hydrogen, among which may be mentioned its generation from dissolving iron or zinc in dilute sulphuric or hydrochloric acid; but the hydrogen obtained from such methods always contains a certain admixture of acid or aqueous gases or vapors, the presence of which for my purpose are extremely prejudicial, inasmuch as their action on an incandescent filament is to instantly oxidize portions of it, causing weak spots, and also in combining with the metal present to possibly form an irreducible metallic compound, thereby resulting in an imperfect filament. The hydrogen obtained from the destructive distillation or decomposition of a hydrocarbon is free from such acid or damp vapors, the hydrocarbon being composed solely of hydrogen and carbon in varying proportions. Should a trace of carbon enter into the chamber K along with the hydrogen, the only injury done would be for the carbon to combine with the exterior portion of the metal on the filament to form a metallic carbide—such as an iron or platinum carbide—which would merely flake off, doing no further damage.

I am aware that filaments heretofore have been electrically treated in an atmosphere of a hydrocarbon vapor for the purpose of depositing pure carbon on the surface of the filament, this determining largely the electrical resistance of the filament; but the above treatment was not for the purpose of causing the structure of the filament itself to become dense, but rather to fill the exterior interstices of the filament with pure carbon in a hard state and to form a shield or wall of hard carbon around the softer and porous filament. My process differs from such in the respect that I use simply pure hot hydrogen, which is known to be a reducing agent. By causing the filament and its contained metallic compound to be heated to redness in hydrogen causes the metallic compound to decompose, leaving the metal free and in combination or associated with and through the structure of the carbon. In the second and subsequent treatments of the same in hydrogen the filament, together with the metal, is brought to a temperature at which the metal softens, melts, or possibly boils, and the carbon itself becomes soft, (as may be easily proved from the fact that a carbon filament heated to high incandescence may be bent in any shape desired without rupturing it.) On cooling the whole shrinks to form a very dense and tough fiber of good electrical conductivity. Subsequent treatments of the filament by introducing the metallic compound and in turn decomposing the compound to its base or metal does not so completely enter into the structure of the carbon as in the first instance, as the filament has become so dense from the previous treatment as to refuse to absorb much more metal into its structure; but in this case the metal forms a shield or wall around the filament and for some purposes acts with decided benefit to the filament by forming or acting as a protective envelope of metal, and also it tends largely to increase the conductivity of the filament.

The apparatus shown in the drawing illustrates the working of the invention; but I do not limit myself to any special form of apparatus, as other arrangements may be constructed for serving a similar or the same purpose.

What I claim as my invention is as follows:

1. The process of reducing metallic compounds contained in carbon filaments to the metal, consisting in electrically heating the said carbon in an atmosphere of pure dry and heated hydrogen, substantially as described.

2. The method of treating incandescent filaments, consisting in heating them by electrical means to a temperature at which the carbons become soft in an atmosphere of pure hot dry hydrogen.

3. The method of regulating the electrical conductance of a filament for an incandescent electric lamp, consisting in alternately submitting the same to a treatment incorporating a metallic compound and subjecting the same to a high temperature by electrical means in an atmosphere of heated hydrogen obtained as a product from the destructive distillation of a hydrocarbon, substantially as herein described.

4. The method of treating filaments, consisting in toughening them throughout their structure by electrically heating them until they become soft while inclosed in a chamber containing pure dry and heated hydrogen, as described.

Signed at New York, in the county of New York and State of New York, this 15th day of April, A. D. 1889.

TURNER D. BOTTOME.

Witnesses:
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