(No Model.)

C. F. BECK.

INCANDESCENT LAMP.

No. 303,358. Patented Aug. 12, 1884.

Fig. 1.

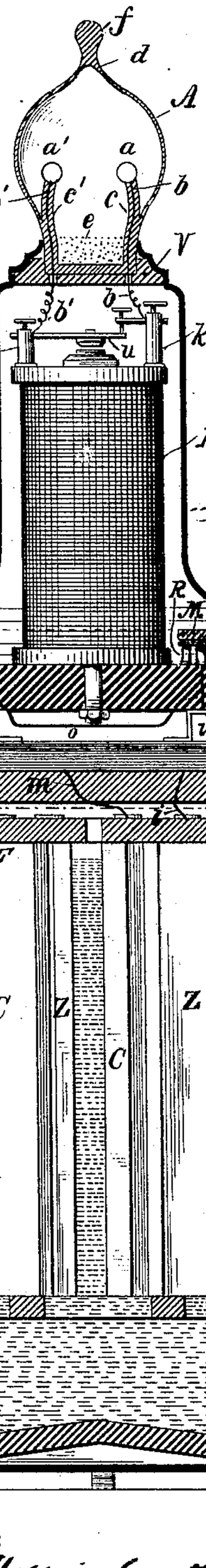


Fig. 2.

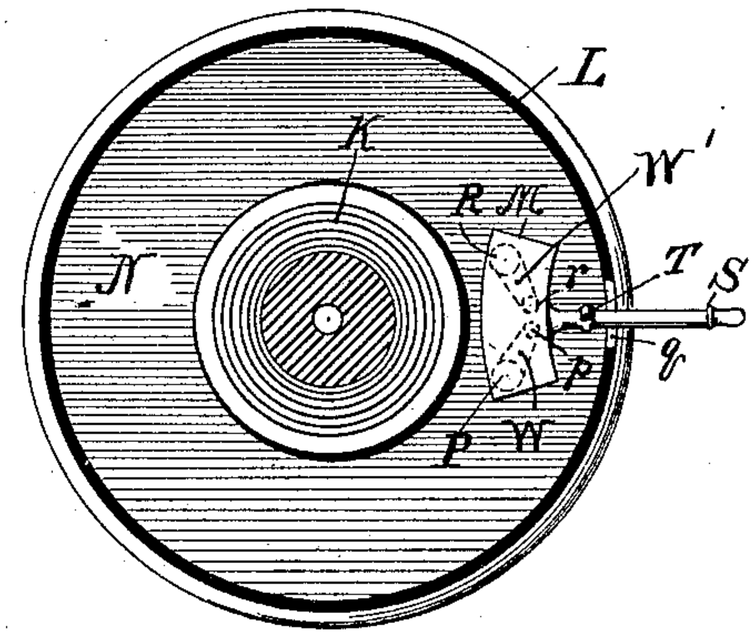


Fig. 3.

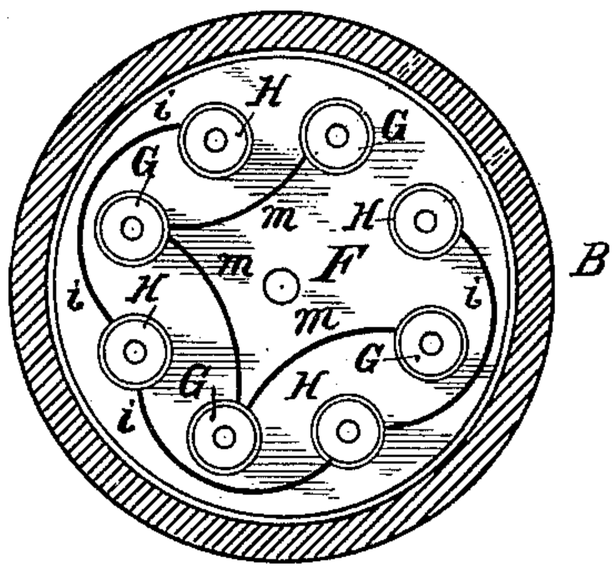
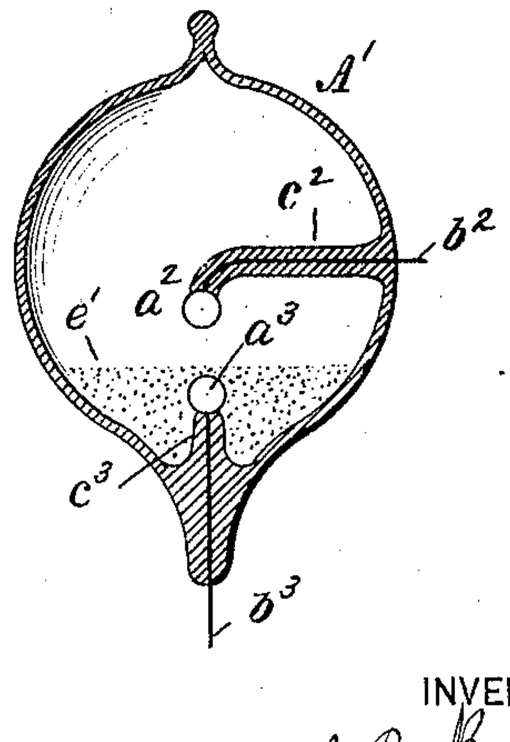


Fig. 4.



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INCANDESCENT LAMP.

SPECIFICATION forming part of Letters Patent No. 303,358, dated August 12, 1884.

Application filed July 5, 1884. (No model.) Patented in France April 25, 1884, No. 100,171.

To all whom it may concern:

Be it known that I, CHARLES FREDERICK BECK, of Paris, in the Republic of France, have invented certain new and useful Improvements in Electric Lamps.

The following is a specification of my said improvements, reference being had to the accompanying drawings, wherein—

Figure 1 represents a central vertical section through a lamp embodying my invention. Figs. 2 and 3 are horizontal sections on the lines *x x* and *y y*, respectively; and Fig. 4 is a central vertical section through the lamp-globe, showing a modified arrangement of the electrodes.

In an application of even date herewith filed by me in the United States Patent Office I have described and claimed improvements in the art of electric lighting, which consists in subjecting comminuted particles of solid material to the action of an electric discharge in a confined inert atmosphere, said particles being supplied to and maintained in the path of discharge by suspension in said atmosphere.

One advantage of my said improvement is that the electric sparks yielded by an ordinary galvanic battery and induction-coil, when utilized in the manner described, will produce a steady and intense light, and I am thereby enabled to employ a comparatively weak current of electricity, thus not only effecting great economy in the production of the light itself, but permitting the embodiment of the source of electricity as well as the lamp proper in a compact form.

The present invention claimed herein relates to an apparatus suitable for carrying out said system; and it consists, primarily, in the combination of the following elements, viz: a closed translucent envelope or globe charged with a chemically-inert gas, and containing also a quantity of comminuted refractory material which possesses proper electrical resistance to become incandescent when subjected to the action of an electric discharge, one or more pairs of electrodes within said globe, and having connections leading to an exterior source of electricity, which consists of a galvanic cell, condenser, induction-coil, and a circuit-breaker suitable for inducing a rapid succession of discharges or sparks between said electrodes.

The details of the invention relate, chiefly, to the convenient embodiment of the lamp in portable form, and will be hereinafter pointed out.

In the drawings, A, Fig. 1, represents a glass globe, preferably constructed in the ordinary manner, in which globes for incandescent electric lamps are made, and having the usual aperture at the point *d* for exhausting the contents. Within the globe are the electrodes, consisting of platinum balls, *a a'*, provided with platinum wires, *b b'*, respectively, which pass out through the bottom of the globe, those portions of the wires *b b'* which are within the globe A being insulated by glass sleeves *c c'*, respectively, which are hermetically sealed at one end to the surface of the globe, and at the other to the neck or base of the electrodes *a a'*. The atmosphere of the globe A having been exhausted by any suitable means—such as, for instance, an ordinary mercurial pump—I introduce into the interior a quantity of pure and perfectly dry charcoal reduced to an impalpable powder, (indicated by the dotted surface *e*,) and then charge the remainder of the globe A with nitrogen gas rarefied to about one-half its normal density, and allow a very small quantity—in fact, a mere trace—of metallic mercury in the form of vapor to enter therewith. I deem nitrogen gas best adapted for this use, because, while affording a suitable medium for suspending the solid particles in the path of the electric discharge, it is chemically inert, or incapable of injurious action upon the surrounding elements, and permanent, or not decomposable under the action of electricity. Any other gas or vapor possessing these characteristics and affording a suitable vehicle for the solid particles might, however, be substituted. The vapor of metallic mercury introduced in the exceedingly minute quantity mentioned I have found to enhance the operation of the lamp, probably by increasing the conducting-power of the atmosphere within the globe. The charcoal which I consider best adapted to the purpose is that made from loose cotton or "batting" purified and dried as perfectly as possible and reduced to an impalpable powder. Calcined magnesia or other suitable oxide in a comminuted state may also be used as the incandescent medium. After

charging the globe as described, I seal it hermetically, as shown at *f*, and mount it upon a suitable base, V, supported by a metallic shell, L, which serves to inclose the induction apparatus. The lower portion of the shell L fits snugly within the top of the jar or vessel B, containing the galvanic cell, and rests, as shown, upon the rim of the jar B. The elements of the galvanic cell (represented by C and Z) are suspended from a vulcanite disk, F, by screw-caps G H, respectively, and may be also braced at their lower ends by means of an annular plate, E. The disk F is secured to the depending rim of the shell L, to which is also attached, at a slight distance above, a second disk, I, also of vulcanite, and supporting a condenser, J. The condenser is formed in the ordinary manner of alternating sheets of metallic foil and insulating material, the details of which, being well understood, need not be particularly described. The wires *i m* from the galvanic cell pass through the disks F and L, and are connected with the condenser in the usual manner. Above the condenser is a vulcanite cap, N, which fits within the shell L and supports the induction-coil K and automatic circuit-breaker *u*, which may be of any of the well-known forms suitable for producing a rapid succession of discharges or sparks. Wires *o w* lead from the poles of the condenser J through the cap N to terminal points *r p*, respectively, mounted upon the cap N, and adjacent to said points are two other terminal points, R P, respectively, which are connected with the primary of the induction-coil. The circuit between the points R and *r* and between P and *p* is established or broken at will by means of a switch consisting of a segment of vulcanite, M, on the under side of which are two strips of copper, W W′, respectively. The segment M is mounted upon a handle, *s*, which projects out through an opening, *q*, in the shell L, and is pivoted at T. When the switch is in the central position indicated in Fig. 2, the circuit with the coil K is established by means of the strips W W′; but by turning the handle *s* in either direction the circuit is broken. The wires *c c′*, leading to the electrodes *a a′*, are connected by means of the binding-posts *k k′* with the secondary coil.

The galvanic battery which produces the current may be of any of the well-known types, and I therefore do not deem it necessary to give a detailed description thereof. The use of a "dry pile" is, however, advantageous when the lamp is intended to be portable.

The operation of the apparatus is as follows: The switch M being turned so as to establish the circuit, and the battery having been set in operation, a rapid succession of discharges or sparks takes place between the electrodes *a a′*. This action induces a circulation of the atmosphere within the globe A, disturbing the fine particles of carbon and carrying them in suspension into the path of the electric discharge. They are there located by the passage of the current, and as the circulation continues and the particles are repeatedly subjected to this action their temperature rises, so that ultimately those at any given moment in the path of the discharge become temporarily incandescent, presenting the appearance of a luminous mist of great brilliancy, and if the succession of the discharges be sufficiently rapid the effect is that of a fixed light.

I contemplate various modifications in form and arrangement of the apparatus above described. Thus, in Fig. 4 the electrodes a^2 a^3 are arranged in a vertical line within the globe A′, their respective connections b^2 b^3 being insulated by the sleeves c^2 c^3 and the powdered material *e′* being disposed around and upon the lower electrode, a^3. So, also, two or more pairs of electrodes provided with suitable sources of electric supply may be arranged within the same globe. I therefore do not desire to limit my claim to the precise form and arrangement specified. Furthermore, I am aware that it is not new to produce flashes of light by passing an electrical discharge through rarefied gases confined in a translucent envelope, as in the case of the well-known Geissler tubes; and I am also aware that the brilliancy of the ordinary arc light between carbon points is commonly attributed to the passage of incandescent particles between the poles. The former of these methods differs from my invention, in that the atmosphere of the Geissler tubes, &c., has not been charged with the solid particles necessary for the production of an incandescent medium, and in the case of the arc light the movement of the particles is not only due to a different mode of operation from that of my method, but involves, essentially, the gradual consumption of the electrode itself, so that the action cannot be permanent, whereas in my invention the solid material, having been previously comminuted, undergoes no change in use. I therefore disclaim the methods and apparatus of which, on the one hand, the Geissler tube and on the other the simple electric arc between carbon-poles are the type.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an electric lamp, the combination of the following elements: a closed translucent envelope or globe charged with a chemically-inert gas, and containing also a supply of comminuted refractory material capable of being rendered incandescent by the action of electrical discharges, a pair of electrodes arranged within said globe, and provided with conducting-wires which extend outside thereof, and a suitable induction apparatus connected with said wires, the whole operating substantially in the manner set forth.

2. The hereinbefore-described portable electric lamp, consisting of the following elements in combination, viz: a jar or vessel containing a galvanic cell, a condenser mounted thereon and in circuit with the poles of said cell, an induction-coil and circuit-breaker, also mount-

ed upon said vessel, and having a suitable switch for establishing and interrupting circuit with said condenser, and a closed translucent globe, also mounted upon said vessel, and containing a pair of electrodes connected with the secondary circuit of said induction-coil, said globe being charged with a chemically-inert gas and with a supply of comminuted refractory material capable of being rendered incandescent by the electric discharge, the whole arranged and operating substantially as set forth.

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Witnesses:
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