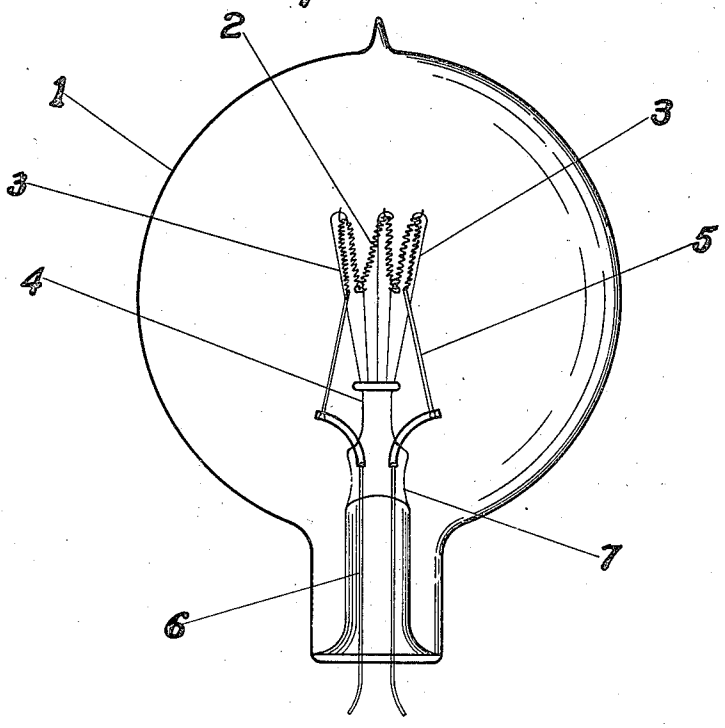
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ELECTRIC INCANDESCENT LAMP

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FIG. 1



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UNITED STATES PATENT OFFICE.

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ELECTRIC INCANDESCENT LAMP.

Application filed March 9, 1918. Serial No. 221,360.

To all whom it may concern:

Be it known that I, BENJAMIN E. SHACKELFORD, a citizen of the United States, and a resident of East Orange, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Electric Incandescent Lamps, of which the following is a specification.

This invention relates to improvements in incandescent electric lamps, and more especially to that type of lamp used for signalling purposes. In signal lamps, and particularly those used for daylight signalling, the principal requirements of a satisfactory lamp are, firstly; that it may be lighted and extinguished very rapidly so as to emanate a succession of distinct light flashes of sufficient beam candlepower or intensity as to be capable of being projected long distances, and secondly; that the lamp possess a useful life sufficiently long so as to make it practical.

An object of the invention is the provision of a lamp, which, among other things, will be characterized by the features of being capable of rapid incandescence and extinction when responding to a series of current impulses, thus producing in rapid succession, light flashes substantially synchronized with the current impulses.

Another object is the provision of a lamp having a high beam candlepower or high concentration so that when associated with an optical system, the light may be projected great distances.

Other objects of the invention have to do with various features of construction, combinations and arrangements of parts, hereinafter set forth and defined by the appended claims.

In the accompanying drawing, Fig. 1 is a view of a lamp embodying the invention.

According to this invention there is provided a lamp bulb, preferably spherical in shape, having a filament mounted therein of highly refractory material such as tungsten, and surrounded by an atmosphere of some gas having the property of high heat conductivity such as hydrogen. It is desirable that the filament be of the type known in the lamp art as a "concentrated filament," and that it be mounted near the center of a spherically shaped lamp bulb. It is also desirable that the gaseous filling within the lamp bulb be of a substantial pressure at the operating temperature of the lamp, so as to retard the vaporization of the filament, and also increase the cooling effect thereon.

Referring more particularly to the drawing the reference character 1 designates a lamp bulb, within which is mounted a filament 2 of the concentrated type, supported by supports 3 composed of any metal commonly used for supports and of such size that it is comparatively rigid, the supports extending from a stem 4 into which they are sealed. The filament 2 is positioned about the center of the bulb and is draped or held in saw-tooth formation between the hook extensions of the supports 3. The ends of the filament are secured to heavy nickel lead-in wires 5 tipped with tungsten or molybdenum, serving to carry current to the filament and conductors 6. The lead-in conductors 5 pass through the usual glass seal 7. It would appear that by supporting the filament 2 substantially centrally of the bulb 1, a better circulation of the convection currents set up within the bulb is obtained, with a consequent improvement in the cooling effect of the gaseous filling upon the filament.

Altho any gas having the property of high heat conductivity will serve as a gaseous filling for the bulb 1, for reasons to be explained it is preferred to use hydrogen. It was previously considered harmful to have hydrogen in the bulb for as there were very apt to be decomposable oxides of some sort therein, these were reduced by the hydrogen when the filament was heated and resulted in the formation of water vapor which was very objectionable and attacked the filament. According to this invention, however, lamps of this type containing hydrogen, unmixed with other gases, have been produced which have operated successfully for the purpose desired. There is a relation between the gas pressure within the lamp and such other factors as the kind of filamentary material used, the cooling effect exerted by the gas upon the filament, etc. It has been found by experiments that very satisfactory results are obtained when the pressure of the gas is, at the operating temperature of the lamp, substantially that of the atmosphere. The factors which determine the pressure of the gas are variable, and must be taken into consideration when

determining the same. For example, the conductivity of the hydrogen at the operating temperature of the lamp when under a given pressure, the temperature at which the filament is operated, etc. It is a well known fact that, at the expense of life, an incandescent lamp may be operated at a higher temperature than ordinarily is used with incandescent lamps. This results in an increased candlepower, and in more rapid lighting up of the filament and consequently higher beam candlepower.

The cooling effect of the hydrogen, due to its high conductivity of heat, effectuates the rapid cooling of the filament when the current is interrupted. The term conductivity as used herein, may be defined to include both convection and conduction losses which are occasioned by the presence of the hydrogen. What appears to actually take place when the filament is in an incandescent state, is a sudden heating of the gas immediately surrounding the filament, and since hydrogen is one of the light gases, the molecules thereof are comparatively free to move, thus permitting the instant formation of strong convection currents which in turn have a cooling effect upon the filament. It is, therefore, really the combined conduction and convection losses which produce the sudden quenching of the filament upon the interruption of the current, and this is the meaning desired to be imported wherever the term conductivity has been used.

It, therefore, follows that the construction of a lamp as contemplated by this invention, permits of the lighting and extinguishing of the lamp in rapid succession when responding to a series of current impulses. Tests have proven that with such a lamp, when in a circuit in series with an interrupter, such as a telegraph key, distinct light flashes may be caused to be given from the lamp at the same speed at which such a key is usually operated. A lamp made in accordance with this invention, when associated with an optical system, such as a reflector and condensing lens, has given off or produced light flashes which could be observed very distinctly by the naked eye on a clear day at a distance of ten miles or more, and of course, these flashes were visible at a much greater distance when viewed through a field glass or the like.

While this invention has been set forth and particularly described in a certain preferred embodiment, it will be understood that modifications might be made without departure from the spirit and scope thereof, and it is not wished that the invention be limited to the precise details of construction illustrated.

What I claim as my invention is:

1. An electric signal lamp comprising a substantially spherical envelope filled with hydrogen, at a substantial pressure, a concentrated tungsten filament therein mounted near the center of the envelope, capable of rapid incandescence and extinction when responding to a series of current impulses and thus adapted for producing in rapid succession, light flashes substantially synchronized with current impulses.

2. An electric signal lamp comprising a substantially spherical envelope filled with hydrogen at substantially atmospheric pressure when in operation, a concentrated filament of tungsten therein mounted near the center of the envelope and adapted to be rapidly incandesced to emit light flashes substantially synchronized with current impulses, the hydrogen at such a pressure, efficiently serving to retard vaporization of the filament.

3. An incandescent electric lamp, especially adapted for signalling purposes, comprising a bulb filled with hydrogen at about atmospheric pressure when the lamp is operated and a tungsten filament of the concentrated type therein, adapted for operation at a high temperature, the hydrogen serving to rapidly extinguish the filament when the current therethrough is discontinued and retarding excessive evaporation therefrom.

4. A high-speed electric signal lamp comprising a substantially spherical envelope containing hydrogen at substantially atmospheric pressure at the operating temperature of the lamp, a concentrated filament of tungsten therein mounted near the center of the envelope, the function of the hydrogen being to prevent evaporation of the filament and exert a rapid quenching effect thereon when de-energized, whereby the lamp is capable of emitting distinct light flashes in rapid succession when responding to current impulses.

5. The method of rapidly producing flashes of light comprising subjecting a concentrated filament of tungsten in an atmosphere of hydrogen at a substantial pressure to rapid current impulses at over voltage.

6. The method of producing a series of flashes of light substantially synchronized with supplied energy comprising supplying a series of impulses of current at an excess voltage, thereby giving a shock excitation effect, to a concentrated tungsten filament in an atmosphere of hydrogen under a substantial pressure.

7. The method of generating distinct flashes of light in rapid succession comprising subjecting a refractory metal filament in an atmosphere of hydrogen to current impulses at such a voltage as to produce the effect of a shock excitation, whereby rapid incandescence occurs in the filament followed by rapid extinction from the cooling effect of the hydrogen.

8. The method of rapidly signalling by means of light flashes comprising energizing a concentrated refractory metal filament centrally located in a substantially spherical bulb containing hydrogen at substantially atmospheric pressure when the filament is energized, by means of current impulses at excessive voltage following each other in rapid succession, whereby the filament is rapidly incandesced when an impulse is impressed and rapidly quenched by the hydrogen after the termination of the impulse.

In testimony whereof, I have hereunto subscribed my name this 13th day of February 1918.

BENJAMIN E. SHACKELFORD.