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L. FRENKEL

2,779,890

ARC LIGHT

Filed March 26, 1956

2 Sheets-Sheet 1

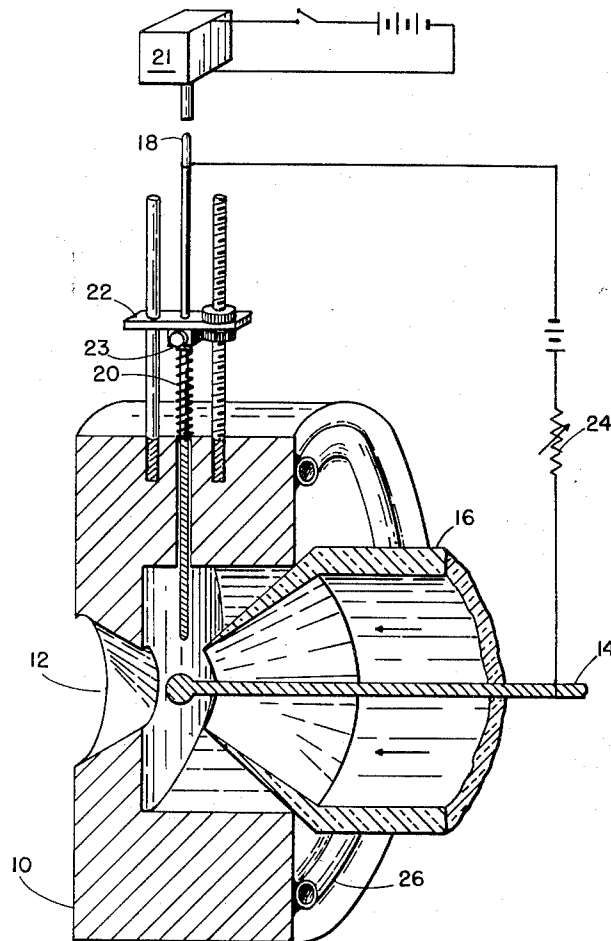


Fig. 1

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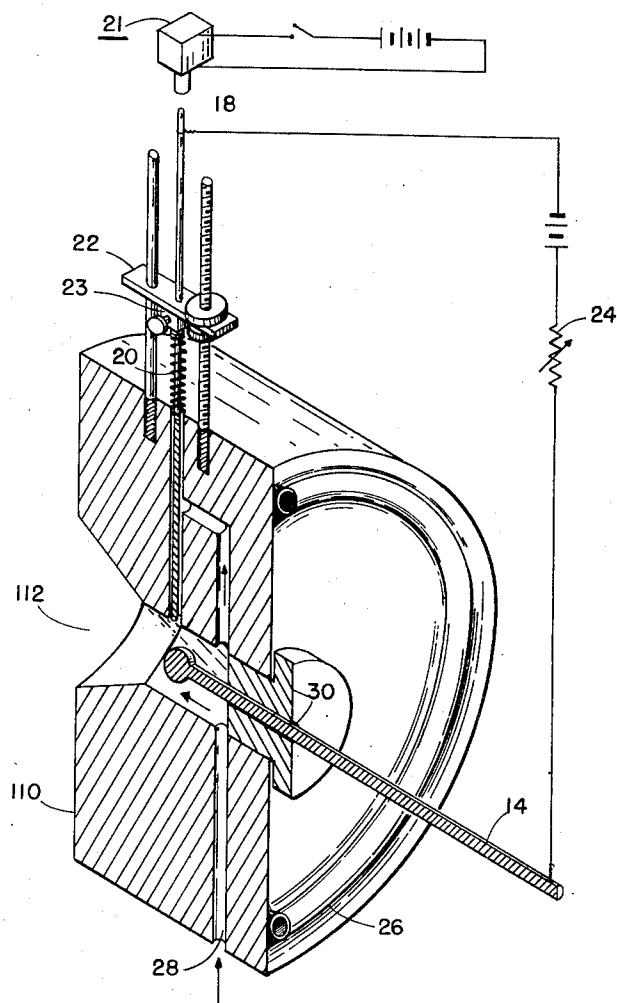


Fig. 2

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ARC LIGHT

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8 Claims. (Cl. 313-149)

This invention relates to arc lights, and more particularly to an arc light utilizing metal electrodes in an inert atmosphere.

Prior art arc lights used a carbon rod as the positive electrode, light being emitted from the incandescent crater formed at the end thereof. In order to approximate a point source, carbon rods of small diameters were utilized—but these had the disadvantage of being consumed very rapidly.

Another disadvantage of prior art arc lights was that the arc tended to strike the positive anode at various points around its periphery, thus producing a varying asymmetric source of light rather than a stable point source.

In order to overcome these disadvantages, the carbon rod was rotated and moved forward. Since small diameter rods were never absolutely straight, forward movement produced a transverse movement of the source, while rotation caused the light source to describe a small circle, and thus produced images that resembled doughnuts having a black center.

Another disadvantage of prior art carbon arcs was the presence of a luminescent flare which also produced light, causing a "tail" to project from the point source. A cure for this latter defect is disclosed in copending application entitled "Light Source and Method of Use," Serial No. 446,015, by Joseph Koosman, filed July 27, 1954, and assigned to the same assignee as the present application. Briefly, the invention disclosed in the Koosman application comprises the formation of the negative electrode from a carbon plate having a frusto-conical opening which flares away from the positive electrode, the apex of the hole being small enough to mask the flare, and the angle of the hole being suitable to utilize all the useful light emitted by the positive crater.

The principal object of my invention is to provide an improved source of light.

Another object of my invention is to provide an arc light which is substantially a constant point source.

Still another object of my invention is to provide a long-lived point source of light which does not require a rotating or feeding mechanism.

The attainment of these objects and others will be realized from the following specification, taken in conjunction with the drawings, in which:

Fig. 1 is a cross sectional view of a preferred form of my invention; and

Fig. 2 is a similar view of another embodiment thereof.

Briefly stated, my invention contemplates the formation of a metal-to-metal arc having cooling means and an inert surrounding atmosphere.

Referring now to Fig. 1, a plate 10, preferably formed of metal which is a good heat conductor (such as copper) contains a frusto-conical opening 12. Positioned coaxially with opening 12 is a rod 14, preferably of a material such as tungsten, surrounded by a ceramic tube 16 which is tapered down to a nozzle directed toward the end of tung-

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sten rod 14. The preferred arrangement has a close fit between the outside of ceramic tube 16 and plate 10, for reasons which will be hereinafter discussed. Plate 10 has another rod 18, of tungsten or other suitable material, which fits through the plate in such a manner that it may be moved to contact the end of rod 14. Since it is desired that rod 18 make only momentary contact with rod 14, a positioning device, such as spring 20 and adjustable stop 22, coacts with collar 23 which is attached to rod 18. A source of direct potential has its positive terminal connected to rod 14 and its negative terminal connected to rod 18.

In order to start the arc, rod 18 is displaced to momentarily touch rod 14. This may be done manually or mechanically, as for example by means of a solenoid arrangement 21. As rod 18 is withdrawn, an arc appears between the ends of the two rods. Since rod 14 is the positive electrode, electrons drawn from rod 18 strike the end of rod 14, causing the end thereof to become molten and incandescent, thus forming a point source of high intensity light which passes through frusto-conical hole 12. I have found that tungsten is a satisfactory material for rod 18, but under some conditions this electrode may advantageously be formed of material which has a different work function, for example, thoriated tungsten. Since any arc must have a limiting resistance, a variable resistance 24 is inserted in the electrical circuit. Adjustment of this resistance controls the current in the arc and therefore the size of the molten globule at the end of rod 14, and the light emitted thereby. To prevent the molten tungsten from oxidizing, an inert atmosphere is formed by passing a gas (such as argon) or a mixture of gases (such as helium and argon) through ceramic tube 16 in the direction indicated by the arrows. As the inert gas leaves the ceramic tube, it surrounds the molten ball, excludes oxygen, and prevents the ball from burning up. The close fit between ceramic tube 16 and plate 10 prevents the escape and waste of gas, and also prevents the sucking in of oxygen-containing air.

The slight fluorescent flare which is produced between the ends of rods 14 and 18 is outside of the frusto-conical angle and is therefore masked by the apex of the frusto-conical hole.

Most of the heat generated is absorbed by copper block 10, which may be made as massive as required. If necessary, tubing such as 26 may be fastened or brazed to plate 10, and cooling water passed through the tube. Additional cooling is effected by the gas flow through ceramic tube 16.

If an attempt is made to obtain more light from this source, the molten ball may become so large that surface tension will be unable to retain it in a spherical form, and the globule may then tend to droop, thus distorting the pin-point of light into a "football." This effect may be overcome by adjusting the flow of gas or, as a last resort, by positioning the entire arc source so that rod 14 is vertical.

In the embodiment of Fig. 2, the inert gas is introduced into channel 28 and follows the path indicated by the arrows. A major portion of the gas surrounds the end of positive rod 14, while a smaller amount of gas flows around rod 18. A positioning insulating collar 30 holds rod 14 in the required position. The operation is substantially the same as disclosed in connection with the previous figure.

Due to my invention, the arc is extremely stable. Since the incandescent globule is enclosed in an inert atmosphere, there is no oxidation or erosion. In addition, no feeding or rotating mechanism is necessary, as once started the arc will maintain itself indefinitely without adjustment. There is a further advantage in that this

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arc exists between two tungsten rods, and therefore no carbon or copper is vaporized to appear as an impurity as was the case in prior art arc sources.

The foregoing specification has disclosed the principles of my invention and two embodiments thereof. I desire, however, not to be limited by the foregoing disclosure but rather by the claims granted to me.

What is claimed is:

1. An open air arc light comprising in combination: a plate having an opening therethrough; a first electrode coaxially aligned with said opening; a second movable electrode positioned relative to said first electrode so that its end will contact the end of said first electrode adjacent said plate; positioning means for said second electrode; means producing a constant flow of inert gas to provide a blanketing non-oxidizing atmosphere around said arc.

2. An open air arc light comprising in combination: a metallic plate having an opening therethrough; a first metallic electrode coaxially aligned with said opening and substantially fixed in position; a second metallic electrode positioned to permit its end to contact the end of said second electrode adjacent said plate; positioning means for said second electrode; means producing an inert atmosphere surrounding said arc, said means including an inert gas discharge channel.

3. An open air arc light comprising in combination: a copper plate having a frusto-conical opening there-through; a first tungsten electrode coaxially aligned with said opening, the end of said electrode positioned substantially at the projected apex of the cone of said frusto-conical opening; a second electrode positioned perpen-

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dicular to said first electrode, and slidably mounted to contact said first end of said first electrode; positioning means for said second electrode; means, including an inert gas discharge channel, to produce an inert atmosphere to surround said arc.

4. The device of claim 3 wherein said second electrode is tungsten.

5. The device of claim 3 wherein said second electrode is of a material having a low work function.

10 6. An open air arc light comprising in combination: a metallic plate having a frusto-conical opening there-through; cooling means fastened to said plate; a first tungsten electrode positioned coaxially with said opening, the end of said electrode being positioned just within the projected apex of the cone of said frusto-conical opening; a second electrode positioned slidably within said plate to contact the end of said first electrode adjacent said plate; positioning means for said second electrode; a source of direct potential; a connection from the positive terminal of said source to said first electrode; a connection between the negative terminal and said second electrode; a source of inert gas; means discharging said gas to form an inert atmosphere surrounding said arc.

20 7. The device of claim 6 wherein said gas discharging means includes a nozzle coaxial with said first electrode and directed at said end of said first electrode.

25 8. The device of claim 6 wherein said gas discharging means includes a first path to surround said arc, and a second path to surround said second electrode.

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No references cited.