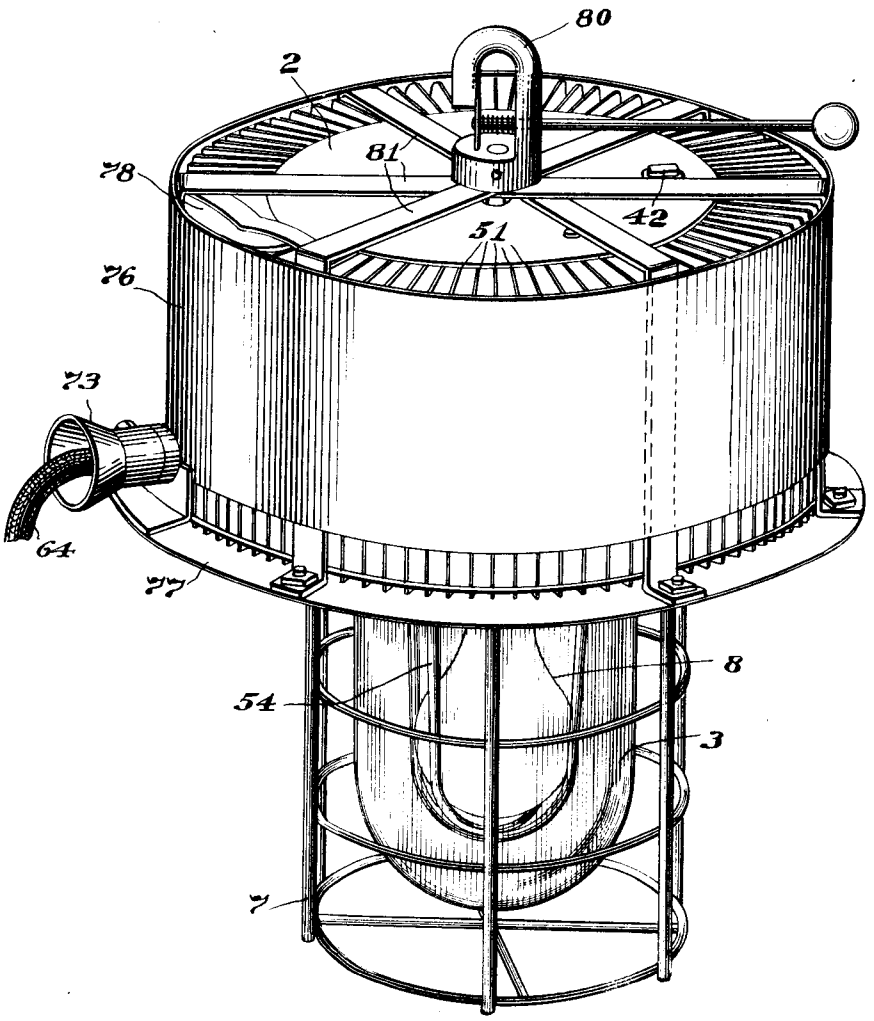
July 11, 1933. G. WHEAT 1,918,223

MINE LAMP

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Fig. 1



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MINE LAMP

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Fig. 2

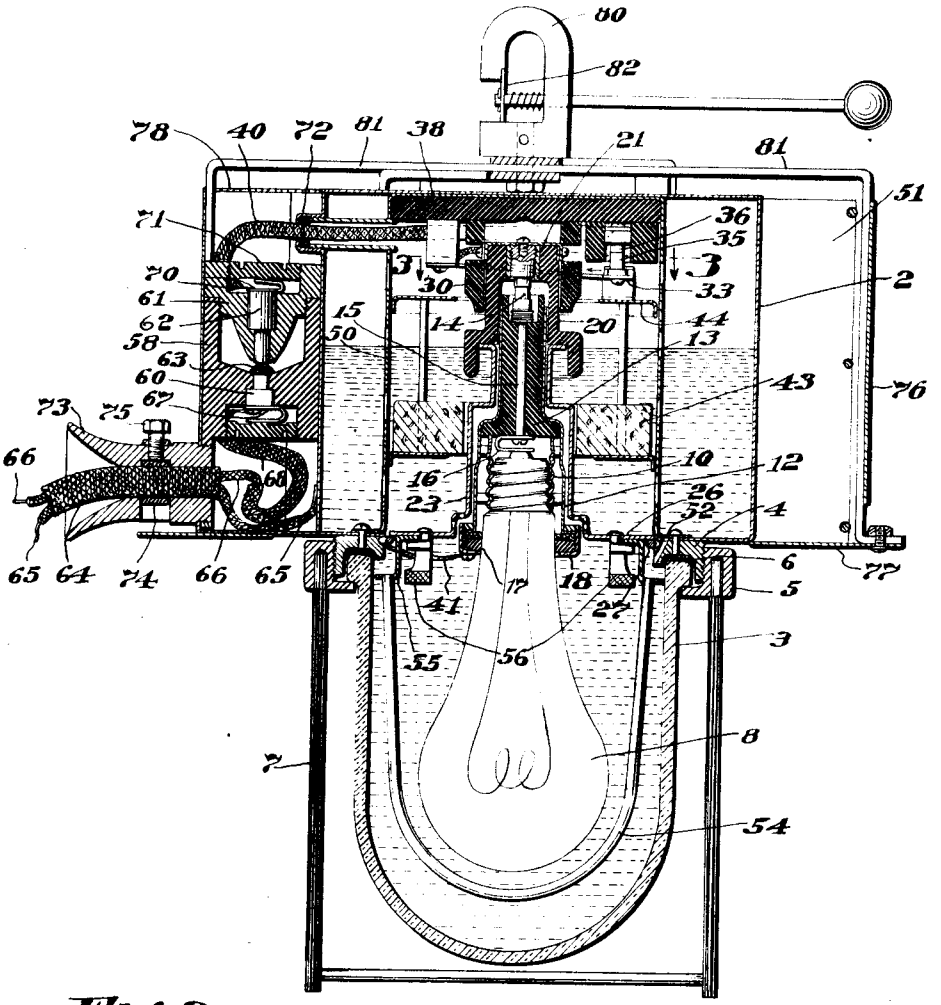


Fig. 3

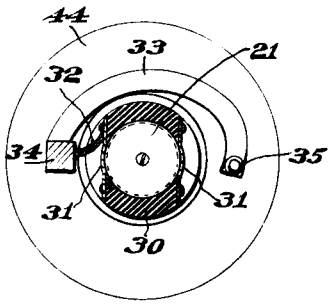
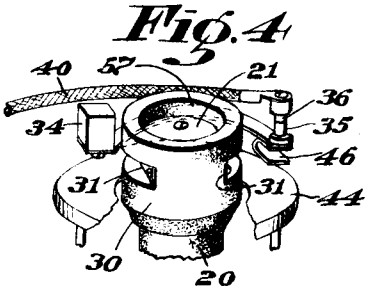


Fig. 4



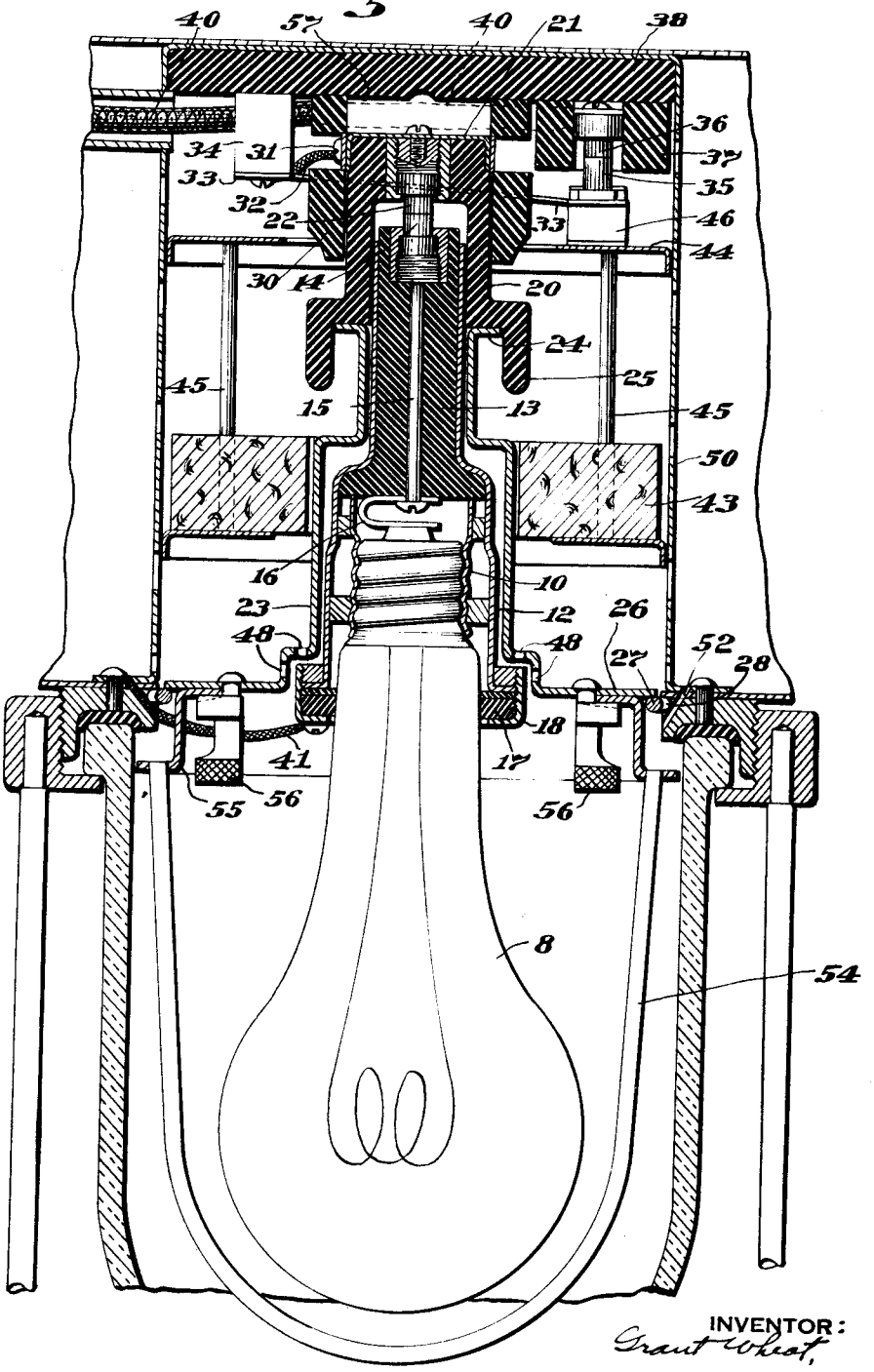
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MINE LAMP

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Fig. 5



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1,918,223

UNITED STATES PATENT OFFICE

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MINE LAMP

Application filed April 18, 1931. Serial No. 531,156.

This invention relates to lamps of that class known as mine lamps or safety lamps and which are designed to be used in mines or other locations where there is great danger of explosions occurring due to the presence of dust or highly combustible gases or vapors.

At the present time the best method of providing illumination in mines where the danger of explosion from the causes above mentioned must be guarded against, is afforded by relatively small electric lamps furnished with power by a portable storage battery. The most common form of such equipment consists of a lamp worn on the miner's cap and supplied with current from a small storage battery which he carries slung from his belt. In lamps of this type the lamp bulb usually is so mounted that if it becomes broken, it is instantly ejected from its socket and the lamp circuit is opened so quickly that the danger of igniting gas is substantially eliminated. These lamps have been used in mines for many years and have proved much superior to the earlier forms of miners' lamps.

In recent years the demand for better illumination in the mines has become more insistent, and it has been proposed to use relatively large and much more powerful electric lamps located in normally stationary positions in the mine where they will furnish much better illumination than that afforded by the cap lamps. This demand has grown rapidly since it has become a more common practice to use trolley lines in mines and since, as a consequence, power has been distributed in the mines at voltages similar to those used above ground. It is impractical, however, to use electric lamps of the common commercial sizes, such as fifty and one hundred watt electric lamps and larger units, in mines where there are explosive gases because of the danger of creating an explosion if the lamp becomes broken. The arrangements for ejecting the lamp bulbs from their sockets are not effective under these circumstances because the filaments will remain hot for a sufficient length of time after the current has been cut off to ignite the gas or other explosive mixture. There is, therefore, so far as I am aware, no lighting equipment available to supply this demand for greater illumination which is also safe to use in explosive gases.

The present invention deals especially with this requirement. It aims to devise a lamp structure which will supply the increased illumination desired, while at the same time being perfectly safe to use in mines where there are explosive gases.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a perspective view of a lamp structure constructed in accordance with this invention;

Fig. 2 is a vertical, central, sectional view of the apparatus shown in Fig. 1;

Fig. 3 is a horizontal, sectional view approximately on the line 3—3. Fig. 2;

Fig. 4 is a perspective view illustrating details of the lamp receptacle and the fixture with which it cooperates; and

Fig. 5 is a vertical, sectional view on a larger scale of the lamp socket member and adjacent parts.

The lamp structure shown comprises a container adapted to hold a body of water and an electric lamp mounted to burn in a submerged position in said body of water. The container includes a tank 2 preferably made of metal and a bowl 3 removably secured to the bottom of said tank, the bowl being made of glass or other translucent material. The tank may conveniently be of cylindrical form. A grooved ring 4 is secured to the bottom of the tank to receive the upper edge of the bowl 3 and is externally screw threaded to receive an internally threaded, flanged, clamping ring 5 which serves to draw the thickened and flanged upper edge of the bowl upwardly against the seat formed for it in the ring 4, a gasket 6 of rubber or other yielding material being interposed between said seat and the edge of the bowl. Preferably

the ring 5 carries a heavy wire frame 7 which serves both as a guard for the bowl 3 and also as a support for the apparatus.

An electric lamp 8 is mounted in an inverted position in the container 2—3, the greater part of the bulb of the lamp being located in the bowl 3. Preferably a standard base lamp is used and is of such a size as to give a very considerable amount of light. For example, the lamp should give seventy-five or one hundred candle power, or even more. It is held submerged in the water in the container.

The supporting means shown for the lamp includes a socket 10 made of sheet metal and internally threaded to receive the standard screw threaded lamp base. This socket is mounted rigidly in, but is spaced from, a metal shell 12 having a relatively long shank, as clearly shown in Fig. 2, and the entire upper end portion of this shell is occupied by an insulator 13 made of some waterproof substance, such as hard rubber, vulcanite, or the like. A contact 14 preferably made of carbon is secured in the upper end of the insulator 13 and is connected by a rod 15 with a contact 16 mounted at the lower end of the insulator and adapted to engage the central end terminal of the lamp 8. This whole assembly for supporting the lamp base may be aptly termed a "socket member".

It is desirable to exclude water from the lamp base and for this purpose a packing 17, preferably consisting of soft rubber, is arranged to engage the neck of the lamp bulb and is compressed against the bulb by a packing ring 18 which is screw threaded on the lower end portion of the shell 12. With this arrangement it is a simple matter so to compress the rubber packing 17 that it will form a substantially water tight connection with the neck of the lamp bulb 8 and thus will prevent water from leaking upwardly into the socket member. The upper end of the socket member is effectually closed by the insulator 13.

The shell 12 is slidably mounted in a tubular receptacle 20, preferably made of insulating material which will not be affected by the water. The upper end of this receptacle is covered by a metal cap 21 and it carries a central contact 22, preferably made of carbon, this cap being connected to the collar 21 and being so positioned as to engage with the contact 14 on the upper end of the socket member.

Normally the receptacle 20 is held in the position in which it is shown in Figs. 2 and 5 by means of a metal sleeve 23 which is stepped in diameter, as best shown in Fig. 5, the upper end of this sleeve being flanged, as illustrated at 24, and fitting within a skirt 25 formed on the lower end of the receptacle 20. The lower end of the sleeve 23 is given a flattened plate-like formation, as shown at 26, and forms a horizontal partition which partly separates the chamber in the tank 2 from that in the bowl 3. This sleeve is supported by a wire spring ring 27, portions of which rest in a groove 28 formed in the inner surface of the ring 4, while other portions project inwardly from the ring and serve as supports for the edge of the plate-like part 26 of the sleeve 23.

The upper end of the receptacle 20 is positioned in an approximately cylindrical hole in a fixture 30 made of insulating material, this fixture being slotted, as best shown in Figs. 3 and 4, to receive two spring plates 31—31 which normally bear against the opposite sides of the metal cap 21 on the receptacle 20. A flexible conductor 32, Figs. 3 and 5, connects one of these plates 31 with another spring plate 33, one end of which is secured to the lower side of an insulating block 34, while the opposite end carries a carbon contact 35. This contact is adapted to engage with a stationary carbon contact 36 which is secured in an aperture formed in an insulating block 37 fastened to an insulating plate 38 to which the block 34 and fixture 30 also are secured, the block or plate 38 being fastened securely in the tank 2.

Current is conducted to the carbon contact 36 by a supply conductor 40 and normally flows through the contact 35, spring strip 33, conductor 32 and strip 31 to the cap 21 of the receptacle. From this cap the current passes through the carbon contacts 22 and 14 to the rod 15, and thence through the spring contact 16 to the central terminal on the lamp base. The opposite terminal of the base is in intimate contact with the socket 10 which has a direct metal connection with the shell 12, and this shell is connected by a flexible conductor 41 to the tank 2. In other words, the socket 10 and shell 12 are grounded.

The shell 12 of the socket member is mounted to slide up and down freely in the receptacle 20, although it may be guided somewhat also in this movement by the walls of the sleeve 23. With this arrangement, therefore, the contacts 14 and 22 are held in circuit closing relationship solely by the buoyancy of the lamp bulb 8. If the bulb becomes broken from any cause, it will immediately drop, thus opening the lamp circuit at the contacts 14 and 22. The breaking of the bulb immediately allows the water to rush into contact with the filament in the lamp and it can reach the filament so much more quickly than can the surrounding atmosphere that any danger of the filament igniting a combustible gaseous atmosphere is effectually avoided.

The tank 2 is kept tightly closed, a screw threaded plug 42, Fig. 1, being provided in the top of the tank to tightly close the filling

opening. It is contemplated, however, that there will be a very gradual loss of water, and since it is desirable to maintain the lamp bulb completely submerged and to keep an abundant supply of water in the tank 2, a float operated switch is provided to open the lamp circuit in the event that the supply of water in the container becomes depleted. This switch includes the contacts 35 and 36 previously referred to. The spring 33 which carries the lower contact 35 is so biased that it tends to depress the lower contact. They are normally held closed, however, by a float 43 which carries a raised sheet metal platform 44 spaced from the float by rods 45. A U-shaped spring 46, Figs. 4 and 5, is secured to the spring 33 just under the contact 35. Normally the lower end of the spring 46 is engaged by the platform 44, carried by the float 43, and is pressed upwardly so as to hold the carbon contacts 35 and 36 in engagement with each other. If, however, the level of the water drops below a predetermined point, the float 43 will drop, thus allowing the spring 33 to move the contact 35 away from the contact 36 and open the lamp circuit.

Since considerable heat is generated by the electric lamp, particularly if gas filled lamps of sizable wattages are used, and since it is desirable to keep the tank closed, and therefore to prevent the escape of water vapor, means have been provided to promote the circulation of water in the container, and a radiator has been associated with the tank to dissipate the heat at such a rate that excessive heating of the parts will not occur. The water immediately surrounding the bulb 8 is heated more rapidly than that in any other part of the container, and holes 48 are formed in the sleeve 23 so that this water can pass through the holes as it flows upwardly along the lamp bulb and into the tank 2. As it rises it can flow outwardly through numerous holes formed in the cylindrical partition 50 which serves as a support for some of the parts and also as a guide for the float 43. The radiator comprises a series of fins 51 brazed, welded, or otherwise secured to the outer wall of the tank 2 and preferably projecting from this tank in a radial direction. These fins serve to radiate the heat quite rapidly to the surrounding atmosphere. The cooled water settles to the bottom of the tank and flows into the bowl 3 through a series of holes 52 which connect the chamber in the tank with that in the bowl 3. The cooler water flows down the inner wall of the bowl and is later heated up by the lamp and recirculated.

By using a construction of this nature and maintaining a sufficient body of water in the lamp structure, heat can be radiated at such a rate that the temperature of the water will not rise sufficiently to injure any of the parts of the apparatus or to build up any substantial vapor pressure in the tank. It is contemplated, however, that other arrangements for radiating the heat from the container can be adopted, such for example, as causing the water to circulate through a coil of pipe positioned between the tank 2 and bowl 3, or locating a series of vertical tubes in the tank through which a circulation of air from the bottom to the top of the tank can occur.

The exclusion of the water from the base of the lamp 8 due to the presence of the gasket 17 prevents the water from reaching the sealing cement used to fasten the lamp base to the lamp bulb which might result in dissolving the cement and loosening the bulb.

It may happen that the entire lamp structure will be dropped, thus breaking the bowl 3 and perhaps also the lamp 8. This may result in seriously dislocating parts of the circuit connections or lamp supporting arrangement upon which reliance is placed to guard against creating an explosion. If the lamp supporting mechanism has been subjected to a shock sufficient to derange the parts in any way, or if the electric lamp itself has not been broken, it is important that the circuit connection shall be held open so that the miner cannot use the lamp. He is provided with emergency equipment and he should use that instead of using this lamp structure when it has been broken and when, consequently, some of the safety features may not be in operation.

It is chiefly for this reason that the upper end of the receptacle 20 has been mounted in the fixture 30 in the manner above described, and the contacts 21 and 31 have been used. In order to interrupt the engagement of these contacts under the circumstances just described, a guard 54 made of wire or the like is provided inside the bowl 3 where it partly surrounds the bulb 8, and this guard is secured by a sheet metal ring 55 to the base 26 of the sleeve 23. The ring 55 is detachably secured to the part 26 by two cams 56 both pivotally secured to the base plate 26. These cams are cut away on one side so that when they are in the position shown in Fig. 2 they lock the guard 54 and its supporting ring 55 to the plate 26, but when they are given a half turn they release the guard.

If the lamp should be dropped, as above described, thus breaking the bowl 3, the blow on the guard 54 would be transmitted from the sleeve 23 to the receptacle 20, thus driving this receptacle upwardly and forcing the cap 21 into the space 57, Figs. 4 and 5, in the fixture 30. This would break the engagement of the contacts 21 and 31, thus opening the lamp circuit. In addition, the aperture 57 in the fixture 30 is made of such dimensions that the cap 21 can be forced into it only by the application of some pressure, so that the cap

will be held frictionally in this space and can only be removed by someone who is familiar with the internal arrangement of the lamp structure, such for example, as the repair man at the lamp house. This avoids any substantial danger of the miners putting the lamp into commission again through their own efforts when it has once been broken due to causes likely to injure or derange the internal parts of the apparatus.

In order to permit the convenient replacement of the lamp bulb 8 in case it burns out, and to prevent the miners from using the lamp structure in an inverted position when the bowl 3 has been broken but the structure of the lamp otherwise remaining uninjured, a mercury switch is provided which controls the supply of current to the switches or contacts above described and which permits the use of the lamp structure in its normal or upright position, but automatically opens the lamp circuit when the lamp structure is moved into a horizontal, inverted, or any other position substantially different from normal. This switch is shown in Fig. 2. It comprises a cup 58 made of suitable insulating materials, such as vulcanite, hard fibre, or the like, with a contact 60 projecting through its bottom. A cover 61 is screwed into the top of the cup 58 and has a contact 62 extending through it. The cup is adapted to contain a quantity of mercury, such as that indicated at 63, and the bottom is tapered or rounded so that the mercury tends to run to the center where it will electrically connect the two contacts 60 and 62 so long as the switch is held in an upright position. Any movement of the switch substantially out of this position, however, will result in the mercury leaving the contacts and opening the lamp circuit.

In replacing the lamp bulb 8 when it has been burned out, the lamp structure is inverted, thus causing the water in the bowl 3 to run into the tank 2. The guard 7 then is unscrewed from the tank, the bowl 3 and internal guard 5 are removed, after which the lamp bulb 8 with its entire socket member can be taken out. The packing ring 18 next should be unscrewed sufficiently to release the pressure of the packing 17 on the neck of the bulb, and the bulb then can be unscrewed from its socket 10 and replaced by a new one. The parts then may be reassembled. It will be observed, however, that so long as the lamp structure remains inverted, all of the parts beyond the mercury switch are maintained electrically "dead" so that there is no danger of creating a spark in disconnecting any of the parts or in opening the contacts which normally control the lamp.

The current supply cable 64 is led into the apparatus at a point closely adjacent to the mercury switch 58, and it includes a ground wire 65 and a live wire or power wire 66. The ground wire 65 is soldered to the outside of the tank 2, as shown in Fig. 2. The power wire is led through an aperture in the mercury switch 58 to a spring clip 67 which is held in engagement with the contact 60 by a screw threaded plug 68.

At the upper end of the switch the wire of the conductor 40 is soldered to a similar spring clip 70 which is likewise held in engagement with the contact 62 by a screw threaded plug 71. The conductor 40 is led through a stuffing box 72 in the wall of the tank 2 into the interior of the tank, this stuffing box serving to prevent any substantial escape of water vapor from the tank or to permit the entrance of outside air or gas into the tank.

The cable 64 is led through a clamp secured rigidly in the wall of the tank and consisting of a body 73, a ring 74, and a set screw 75 which bears against said ring and serves to clamp the cable by deflecting the cable out of its straight path. In other words, it puts a kink in the cable and this kink is confined between the walls of the body 73 and the ring 74.

In order to protect the mercury switch 58 from the mischievous tampering of the miners, it is located in a substantially inaccessible position in the lamp structure. That is, a pocket is provided for it between certain of the heat radiating fins 51, and it is positioned between the wall of the tank 2 and the outer shell 76 which surrounds the fins. The top and bottom of the pocket are closed by plates, the bottom one soldered in place, the top plate being shown at 78. This mercury switch may be replaced with any other suitable type of gravity switch designed to perform substantially the same functions.

An annular plate 77, the lower side of which serves as a reflector, is secured to the lower edges of the fins 51 and to the bottom of the tank 2.

It is contemplated that in using this apparatus the entire lamp structure will be suspended from a bracket or hook which may be fastened to one of the mine props. For this purpose the apparatus is equipped with a hook 80 which is secured to a series of radiating straps 81, these straps extending downwardly just inside the shell 76 and being bolted to the plate 77 previously referred to. The hook is equipped with a spring pressed latch 82 for preventing accidental release of the lamp structure from its supporting bracket. The lamp may, however, be conveniently released from its supporting bracket and carried to a safe place during the firing of a "shot".

The invention thus provides a lamp structure in which electric lamp bulbs capable of giving abundant illumination may be supported, while at the same time affording ample protection against explosion. If the

lamp bulb or the bowl 3 should be come broken for any reason, the lamp circuit is immediately opened and the filament is instantly cooled by the inrush of the surrounding water in which it is submerged. At the same time precautions are taken to avoid any danger of producing sparks or exposing a hot lamp filament due either to accidents which must be expected to occur or to mischievous tampering by the miners themselves.

While I have herein shown and described a preferred embodiment of my invention, it is contemplated that the invention may be embodied in a considerable variety of other forms without departing from the spirit or scope thereof. It will also be understood that while the liquid in the container is herein referred to as "water", the water may be replaced with any suitable liquid, and the term "water", therefore, is herein used in a generic sense to include such other liquids.

Having thus described my invention, what I desire to claim as new is:

1. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a translucent portion, an electric lamp mounted in said container in position to direct its rays through said translucent portion, said lamp including a bulb, means for supporting said lamp with the greater part of said bulb submerged in the water in said container, and circuit connections for supplying current to said lamp including contacts normally held in circuit closing relationship by the buoyancy of said bulb.

2. A mine lamp structure according to preceding claim 1 having additional means for controlling the supply of current to said electric lamp in response to variations in the quantity of water in said container.

3. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a translucent portion, an electric lamp mounted in said container in position to direct its rays through said translucent portion, said lamp including a bulb, means for supporting said lamp with the greater part of said bulb submerged in the water in said container, and circuit connections for supplying current to said lamp including circuit controlling means governed both by variations in the quantity of water in said container and also by predetermined changes in the angular position of the lamp structure.

4. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a translucent portion, an electric lamp mounted in said container in position to direct its rays through said translucent portion, said lamp including a bulb, means for supporting said lamp with the greater part of said bulb submerged in the water in said container, and circuit connections for supplying current to said lamp including means for automatically opening the lamp circuit when the lamp structure is inverted.

5. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a translucent portion, an electric lamp mounted in said container in position to direct its rays through said translucent portion, said lamp including a bulb, means for supporting said lamp with said bulb submerged in the water in said container, and circuit connections for supplying current to said lamp including means for automatically opening the lamp circuit when the lamp bulb becomes uncovered with water either due to changes in the position of the lamp structure or to a drop in the level of the water in said container.

6. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a translucent portion, an electric lamp mounted in said container in position to direct its rays through said translucent portion, said lamp including a bulb, means for supporting said lamp with the greater part of said bulb submerged in the water in said container, and circuit connections for supplying current to said lamp including a switch for opening the lamp circuit automatically when the lamp structure is swung into positions substantially different from normal and a second switch for automatically opening the lamp circuit when the supply of water in said container becomes depleted.

7. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a translucent portion, an electric lamp mounted in said container in positon to direct its rays through said translucent portion, said lamp including a bulb, means for supporting said lamp with the greater part of said bulb submerged in the water in said container, and circuit connections for supplying current to said lamp including a mercury switch for automatically opening the lamp circuit when the lamp structure is moved into certain predetermined positions.

8. In a mine lamp structure, the combination of a container adapted to hold a quantity of water and including a translucent portion, an electric lamp mounted in said container below the level of the water therein, and means for promoting circulation of the body of water in said container, said container being constructed to present a large radiating area to the surrounding air in proportion to the volume of water contained therein.

9. In a mine lamp structure, the combination of a container adapted to hold a quantity of water and including a translucent portion, an electric lamp mounted in said

container below the level of the water therein, said container being constructed to facilitate the circulation of the water therein due to the heat generated by said lamp, and a radiator associated with said container to cool the circulating water.

10. In a mine lamp structure, the combination of a container adapted to hold a quantity of water and including a metal tank and a translucent bowl secured to the bottom of said tank, an electric lamp mounted in said bowl and substantially surrounded by the water in said container, said container being constructed to facilitate the circulation of the water therein due to the heat generated by said lamp and said tank having heat radiating fins projecting therefrom.

11. In a mine lamp structure, the combination of a container including a translucent bowl, an electric lamp mounted in said bowl and including a lamp bulb provided with a base, said container being adapted to hold a body of water in position to submerge the greater part of said bulb and in contact with the bulb, circuit connections for supplying current to said lamp, and means for protecting said base from water.

12. In a mine lamp structure, the combination of a container including a translucent bowl, an electric lamp mounted in said bowl and including a lamp bulb, said container being adapted to hold a body of water in position to submerge the greater part of said bulb and in contact with the bulb, a socket member for said lamp, and a receptacle having a contact to engage a cooperating contact on said socket member, said socket member being slidably mounted in said receptacle, whereby said contacts will normally be held in circuit closing relationship by the buoyancy of said bulb.

13. In a mine lamp structure, the combination of a container including a translucent bowl, an electric lamp mounted in said bowl and including a lamp bulb provided with a base, said container being adapted to hold a body of water in position to submerge the greater part of said bulb, a socket member in which said lamp base is mounted, and a receptacle having a contact to engage a cooperating contact on said socket member, said socket member being adapted to exclude water from said lamp base.

14. In a mine lamp structure, the combination of a container including a translucent bowl, an electric lamp mounted in said bowl and including a lamp bulb provided with a screw base, said container being adapted to hold a body of water in position to submerge the greater part of said bulb, a socket member including a fitting for receiving the screw threaded base on said bulb, circuit connections for conducting current to said lamp including a contact mounted in said container for engaging a contact on said socket member, and means for guiding said socket member to enable it and said bulb to rise and fall with predetermined variations in the level of the water in said container.

15. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a tank and a bowl removably secured to the lower side of said tank, an electric lamp including a bulb, means for supporting said lamp in said bowl with said bulb substantially submerged in water, said lamp bulb being removable by inverting the lamp structure and removing said bowl, and a gravity switch for automatically holding the lamp circuit open while said lamp structure is inverted.

16. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a tank and a bowl removably secured to the lower side of said tank, an electric lamp including a bulb, means for supporting said lamp in said bowl with said bulb substantially submerged in water, said lamp bulb being removable by inverting the lamp structure and removing said bowl, and circuit connections for supplying current to said lamp including a gravity switch for automatically holding the lamp circuit open when the lamp structure is inverted and additional circuit controlling devices located between said gravity switch and said electric lamp.

17. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a tank and a bowl removably secured to the lower side of said tank, an electric lamp including a bulb, means for supporting said lamp in said bowl with said bulb substantially submerged in water, said lamp bulb being removable by inverting the lamp structure and removing said bowl, circuit connections for supplying current to said lamp including a gravity switch for automatically holding the lamp circuit open when the lamp structure is inverted, and means for supporting said switch in an inaccessible position in the lamp structure.

18. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a translucent portion, an electric lamp mounted in said container in position to direct its rays through said translucent portion, said lamp including a bulb, means for supporting said lamp with said bulb in contact with and submerged in the water in said container, a guard for said bulb, circuit connections for supplying current to said lamp, and means arranged to be operated by a movement of said guard out of its normal position for opening said circuit.

19. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a tank and a bowl removably secured to the lower side of said

tank, an electric lamp including a bulb, means for supporting said lamp in said bowl with said bulb in contact with and substantially submerged in water, a guard mounted in said bowl, circuit connections for supplying current to said lamp, and means arranged to be brought into operation by a movement of said guard out of its normal position for opening said circuit and holding the circuit open.

20. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a translucent portion, an electric lamp mounted in said container in position to direct its rays through said translucent portion, said lamp including a bulb, a receptacle for said lamp, a fixture in which said receptacle is slidably mounted, said fixture and receptacle being supported in said container, circuit connections for supplying current to said lamp including cooperating contacts on said receptacle and fixture normally held in engagement with each other, and a guard in said container connected with said receptacle to cause a movement of said guard out of its normal position to move said receptacle in said fixture sufficiently to break the engagement of said contacts and thereby to open said lamp circuit.

21. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a translucent portion, an electric lamp mounted in said container in position to direct its rays through said translucent portion, said lamp including a bulb, and means for supporting said lamp in said container with the greater part of said bulb submerged in the water in said container, said means comprising a hollow socket member having a seat to receive the base of said lamp and means for holding a packing in contact with the neck of said lamp bulb to substantially prevent the water from leaking along the neck of the bulb into the interior of said socket member.

22. In a mine lamp structure, the combination of a container adapted to hold a quantity of water and including a translucent bowl, means for supporting said bowl in an approximately upright position, an electric lamp mounted in said bowl below the level of the water therein, means for supplying electric current to said lamp including an electric switch and means for automatically opening said switch when the supply of water in said container becomes depleted, and cooling means associated with said container but additional thereto for conducting heat away from said body of water at a rate substantially greater than that afforded by the container itself.

23. In a mine lamp structure, the combination of a container adapted to hold a body of water and including a translucent portion, an electric lamp mounted in said container in position to direct its rays through said translucent portion, said lamp including a lamp bulb provided with a base, means for supporting said lamp with the greater part of said bulb submerged in the water in said container, said means including a socket in which said base is mounted, circuit connections for supplying current through said socket to said lamp including contacts normally held in circuit closing relationship by the buoyancy of said bulb, and means for protecting said base from the water in said container.

24. In a mine lamp structure, the combination of a container adapted to hold a quantity of water and including a translucent portion, an electric lamp mounted in said container below the level of the water therein in position to direct its rays through said translucent portion, and cooling means associated with said container but additional thereto for conducting heat away from said body of water, said container having parts cooperating with said cooling means to promote the circulation of said water in said container.

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