E. A. HAILWOOD.

APPARATUS FOR IGNITING MINERS' SAFETY LAMPS.

APPLICATION FILED OCT. 16, 1906.

990,859. Patented May 2, 1911.

4 SHEETS—SHEET 1.

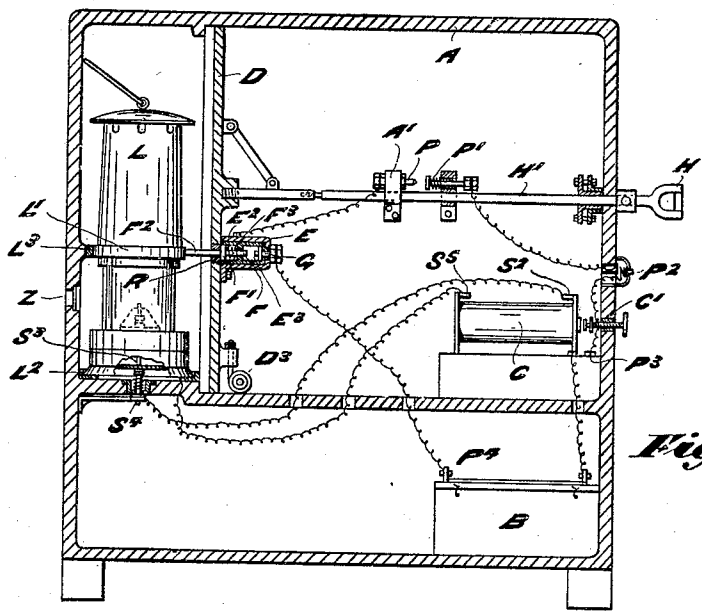

Fig. 1.

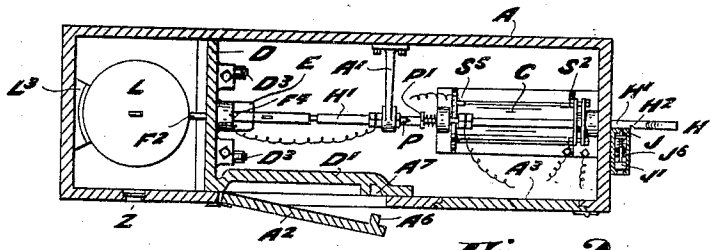

Fig. 2.

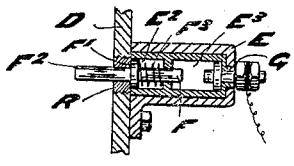

Fig. 3.

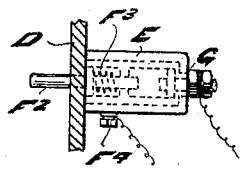

Fig. 4.

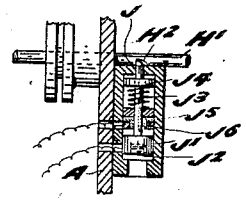

Fig. 5.

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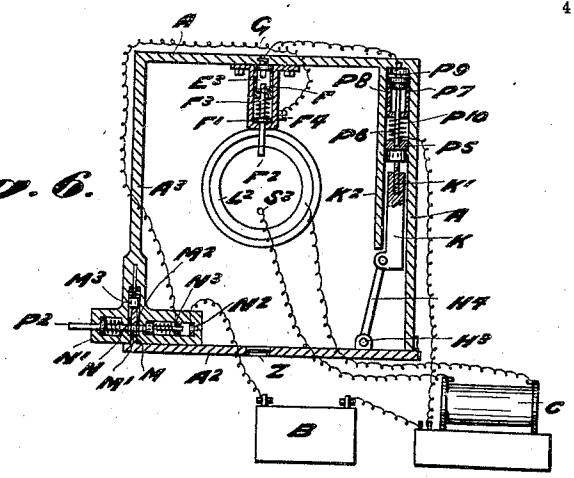
Fig. 6.



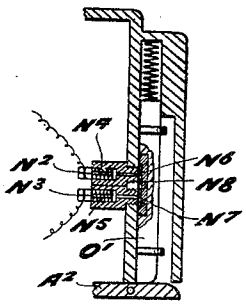


Fig. 8.

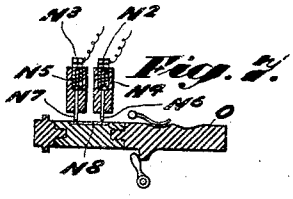


Fig. 7.

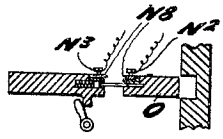


Fig. 7A.

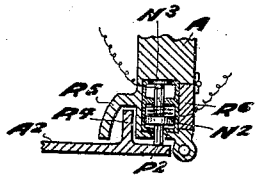


Fig. 10.

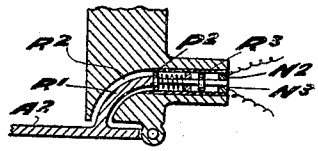


Fig. 9.

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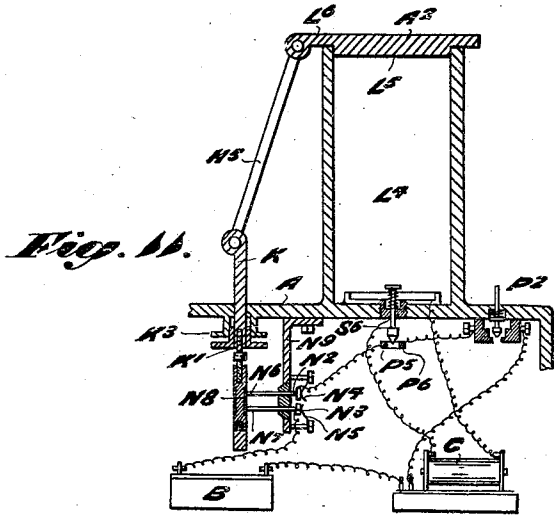

Fig. 11.

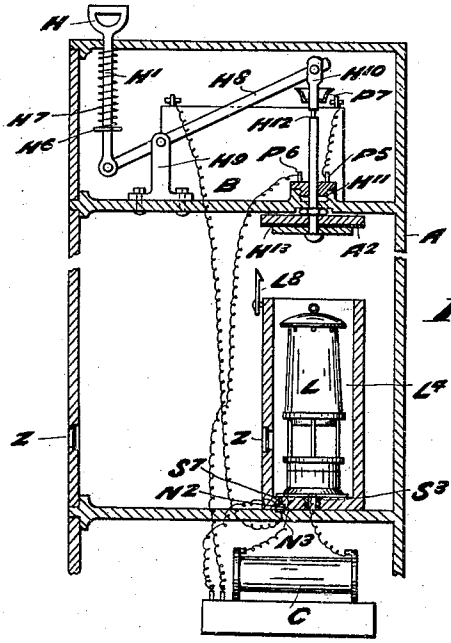

Fig. 12.

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4 SHEETS—SHEET 4.

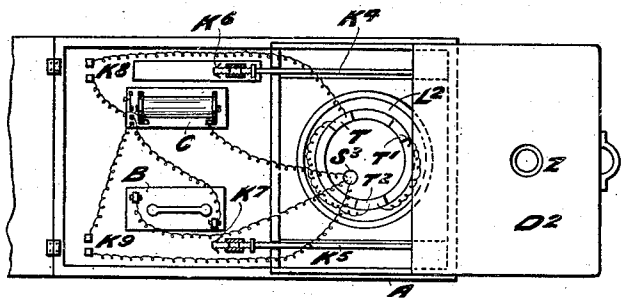

Fig. 13.

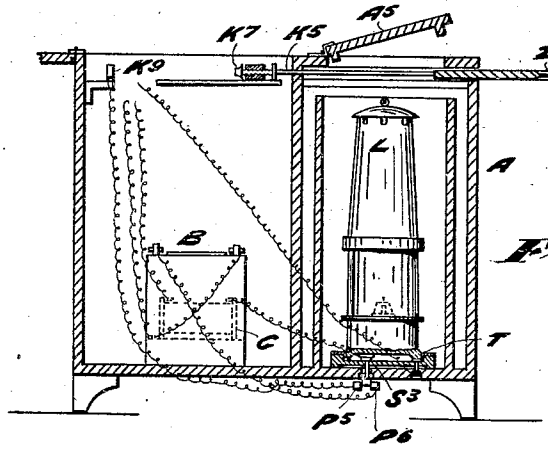

Fig. 14.

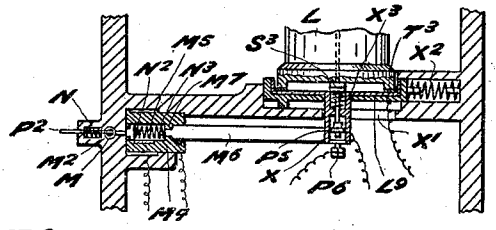

Fig. 15.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR IGNITING MINERS' SAFETY-LAMPS.

990,859. Specification of Letters Patent. Patented May 2, 1911.

Application filed October 16, 1906. Serial No. 339,266.

To all whom it may concern:

Be it known that I, ERNEST ARTHUR HAILWOOD, a subject of the King of Great Britain and Ireland, whose postal address is 3 Blenheim Terrace, Rooms Lane, Morley, in the county of York, England, have invented certain new and useful improvements in apparatus for igniting miners' safety-lamps, especially suitable for use in the underground workings of mines and in the like places.

The object of my invention is to construct apparatus for igniting miners' safety lamps in such a manner that it is impossible for an exposed electrical spark to be formed outside the apparatus, so that such apparatus can safely be used in any part of a mine.

In describing my invention in detail, reference is made to the accompanying sheets of drawings, in which,

Figure 1 represents a part sectional elevation of an underground miner's lamp lighting apparatus, fitted with one form of my improvement. Fig. 2 represents a part sectional plan of Fig. 1. Fig. 3 represents an enlarged detail of the switch or contact maker, shown in Figs. 1 and 2. Fig. 4 represents an elevation of the detail shown in Fig. 3. Fig. 5 represents an automatic lock switch hereinafter referred to. Fig. 6 represents a plan showing another form of my improvement. Figs. 7 and 7^a, represent enlarged details of a door switch or lock hereinafter referred to. Figs. 8, 9, and 10, represent details of further forms of door operated switches. Fig. 11 shows a part sectional elevation of another form of my improvement. Fig. 12 shows a further modification of my improvement in part sectional elevation. Figs. 13 and 14 show plan and elevation respectively of another modification. Fig. 15 shows a form of lock switch operating upon a sliding lamp recess or holder, as hereinafter described.

In carrying out my invention, in one form, (Figs. 1 and 2), I employ a rectangular box or case A of suitable size and material, such box being by preference, divided into three compartments, in one of which is placed an accumulator B, in another the coil C, of the pattern usually used in apparatus of this class. The lamp L in order to be lighted is placed in the other compartment. The latter compartment is in reality part and parcel of the second one, and is formed by the sliding door D, operated by a handle H on rod H^1, an example of construction being shown which will be readily understood from the Figs. 1 and 2. Attached to the casing of the box A is a bracket A^1 provided at its outward projecting end with a contact P, the rod H^1 sliding in a bearing in the said bracket. Attached to and moving with the rod H^1 is another contact P^1, such contact being by preference a spring one, as shown. These two contacts only engage with one another when the sliding door D is in the shut position. From the contact P^1 a wire leads to one terminal of a push P^2, the other terminal being connected at P^3 to a primary terminal on coil C, the other primary terminal being connected to the accumulator.

The door D is provided with an aperture in which is placed the push piece F^2 preferably of insulated material; such piece may be surrounded by an insulating ring R as shown in detail in Fig. 3. This contact piece is placed in such a position in the door D that when the lamp L is in the position shown in Fig. 1, it will press against, by preference, the ring L^1 of the lamp. The contact piece F^2 is attached to a boss F^1, and extension or contact F, such latter contact projecting into the recess E^2 in an insulated casing E, (which is, by preference, constructed of two hinged portions, in order that the contents may be readily accessible) attached to the door, such casing containing, by preference. two communicating recesses E^2 and E^3. In the recess E^2 is placed a spring F^3. A contact piece G is attached to the end of the casing, and is connected by a wire to the terminal P^4 of the accumulator. One end of the spring F^3 is connected to a terminal F^4 in the casing E and from there a wire connects to the contact piece P.

The lamp chamber is provided at its base with a metal or like disk L^2 into which the lamp base fits. To this disk one terminal of a wire from the secondary terminal of the coil is attached, the other end being con-

nected to the coil at S^5 as shown. In the base of the lamp chamber is placed an insulated spring contact piece or push S^3, such contact piece when the lamp is in position is pressed down on to the terminal S^4 of a wire which is connected to the coil at the point S^2 as shown, or the said contact piece S^3 may be connected direct to the coil. A preferably insulated stop or ring such as L^3 may be placed in the lamp chamber, in order to insure the lamp being placed in the correct position in the chamber between such point and the contact piece F^2.

The coil spring screw C^1 may protrude through the casing of the box A in order that the desired adjustment may be obtained from the outside.

To the door D is attached a portion D^1, by preference, of the shape shown in Fig. 2. This door slides along the casing A^3 of the box A, and protects the opening for the lamp admission door A^2, and prevents the mechanism from being tampered with when the door D is closed, or nearly so; such door A^2 being provided with a projecting portion A^6 which will enter a recess or the like A^7 provided on the door D in such a manner that when the lamp admission door A^2 is closed, as the projection A^6 engaging with the recess A^7 will prevent the door D from being moved, and thus the handle H and rod H^1 are locked.

Suitable doors may be provided for the coil and accumulator chambers, such doors being provided with fastening devices, the key of which will be in charge of those in authority, in order that the various parts may be readily accessible for repairs or change.

The rod H^1 may be provided with a notch H^2 in the same, with which will engage the end of the spring bolt J, when the door D is in the closed position, such bolt comprising an end J^1 having a threaded aperture J^2 thereon for the insertion of a key for the withdrawal of the bolt, a spring J^3 being placed around the bolt against the flange J^4 in order to insure its automatic operation. This automatic lock bolt may be connected to the primary wires, and the push P^2 discarded, the wires being connected as shown in Fig. 5. The block J^5 is an insulation block, contact being made between the bolt head J^1 and the ring J^6 when the bolt enters the recess H^2. The automatic lock bolt switch and push P^2 may be discarded, the primary wires being connected, or in one piece, or the lock bolt may be used simply as a fastening device to hold the handle against the liability of shocks, should explosions take place in the lamp chamber.

In operation, the handle H is pulled back to its utmost extent, the door A^2 opened, and the lamp inserted into position in its chamber thereby closing the secondary circuit of the coil; the handle is then pushed in until the push piece F^2 is pressed against the ring L^1 or other suitable portion of the lamp. A further movement of the door causes contact to be made of the primary terminals F and G. A still further movement causes the contacts P and P^1 to meet. The door D is thus finally closed and when the lock bolt J is used, the door is held in the closed position, and contact automatically made, or the push P^2 is operated, thus closing the final primary circuit, causing a secondary current to flow through the lamp, igniting the wick of same.

A suitable gauze or glass inspection window Z may be provided in the lamp chamber. The door D may be mounted on rollers or the like D^2 in order to reduce friction.

Another form of arrangement is shown in Fig. 6, wherein the lamp chamber only is shown in plan, the accumulator and coil being for convenience shown outside, though it will be understood that they may be placed in a chamber preferably below the lamp chamber. In the lamp chamber is formed the lamp ring L^2 and spring push S^3 substantially as before described. The admission door A^2 is hinged to the box or case A, in any well known manner, and is provided with a lug or lugs such as H^3 to which is connected one end of a link H^4, the other end being connected to a sliding bar or push K provided with an adjustable end K^1, such bar being mounted in a slide K^2 suitably attached to the interior of the box or case. When the door is in the closed position, as shown in Fig. 6, the end K^1 of the push K will have pushed forward the insulated head P^5 of the spring contact piece P^6, the other end P^7 working in an insulated groove or the like P^8. The end P^7 before mentioned will be in contact with the terminal P^9 at the end of the groove P^8, the spring P^{10} being compressed between the head P^5 and end of the groove P^8. All this mechanism may be inclosed by a suitable hinged and locked casing. The spring P^{10} is connected to a primary terminal on the coil C as shown. The terminal P^9 is connected to a terminal G at a point opposite the lamp center and ring L^1, or other suitable portion of the lamp, such terminal projecting into an insulated recess E^3 in a casing Q, suitably attached to the case or box. As will be seen the casing Q and terminals therein are practically the same as those shown in Figs. 1, 3, and 4, there being a push piece F^2 provided with boss F^1 and contact F. The spring F^3 has one end attached to a contact F^4 and from there a wire leads to one terminal N^3 of a push P^2 which may only be operated upon when the door is closed, as should the door be opened, the block M^3 will close the passage through

which the push bar N operates, the other terminal N^2 being connected to the accumulator B as will be seen from Fig. 6. The lamp disk L^2 is connected to a secondary terminal on the coil C. When the lamp is in position, the push F^2 will be forced back, and contact made between F and G, as described with reference to Fig. 1.

The details of the push above referred to can be seen in Fig. 6, and are as follows:— Attached to the door A^2 in a suitable position is a stud or the like M provided with an aperture M^1 therein, such stud working in a suitable groove or aperture M^2 formed in the side A^3 of the box A. In the said groove is placed a spring rod such as M^3, the end of which will engage the rod or stud M, when the door is closed, and compress the spring. When the door is closed, the aperture M^1 will be in alinement with the spring push bar N which works in a casing N^1 attached to or forming part of the side A^3 of the box A. On the operation of the push P^2 the bar N will pass through the aperture M^1, thereby locking the door in the closed position, and engage and press forward the termineral N^3 above referred to, causing such terminal to make contact with the terminal N^2 whereby the primary circuit is finally closed. Instead, however, of using the push P^2 and mechanism as shown in Fig. 6, the push may be discarded and the door or box A provided with a locking device, an example of which is shown in Fig. 7, in which case, the spring Q^5 is connected to one terminal N^3 in any convenient manner, the other terminal N^2 placed adjacent thereto and connected to the accumulator B as before described. These terminals may be attached to the door locking device in any convenient manner, and are provided with springs N^4 and N^5 operating thereon in such a manner as to force their contact points N^6 and N^7 outward. These points press against the lock bolt O and are so arranged that only when the bolt is shot both rest against an insulated block switch N^8 and thus make the desired contact, whereas should the bolt not be shot one contact point will rest on the block switch and the other on the bolt. By the last mentioned device, contact could be made should the bolt be shot when the door is open. This slight defect is overcome by the mechanism shown in Fig. 7^a, in which the bolt O is formed in two portions, one working in the other and kept apart by means of a spring. The switch block N^8 is divided into two portions, to each of which is attached a terminal, and only when the end of the bolt bears against a fixed end of a recess of correct depth can the parts meet and make the desired contact.

A somewhat similar device is shown in Fig. 8, such device is placed adjacent to the door hinge in such a manner that only the closing of the door allows the spring rod O^1 and block switch N^8 thereon to come forward and make the desired contact as shown.

Further devices attached to the door hinge for accomplishing the second or final contact are shown in Figs. 9 and 10, Fig. 9 showing the door provided with a quadrant R^1 working in a groove R^2 in the box casing, such quadrant when the door is closed, pressing the push P^2, causing the contact maker R^3 to complete the circuit between the terminals N^2 and N^3 through the medium of a spring and wire, the whole mechanism being carried in an insulated casing.

Fig. 10 shows the door provided with a guard R^4 engaging with a recess in a guard R^5 attached to the casing of the box A. A push P^2 having one end N^2 connected to the terminal G, (Fig. 6) but when used in place of the final break connected to the terminal or spring F^4, is pressed against the resistance of a spring against the other primary terminal N^3 by means of the door, and thus completing the circuit. The mechanism may be provided with a locked cover such as R^6, and it will be understood that where necessary all the other switch mechanism may be inclosed in cases provided with suitable locks.

Fig. 11 shows another form of apparatus, the box or case A being provided with a preferably circular lamp chamber L^4 provided with a door or lid A^2 having an under projecting flange L^5 in order to insure the tight closing of such door. The door is suitably hinged and provided with an extension L^6 to which is attached one end of a link H^5, the other end of such link being connected to the sliding bar or the like K working in a stuffing box such as K^3, and provided with an adjustable screw end K^1, such adjustable end being provided with a double thread, one end projecting into the bar K, and the other into the primary break block N^8. A bracket N^9 is attached to the case A in a suitable position, and carries thereon the terminals N^2 and N^3, springs N^4 and N^5 causing the contact points N^6 and N^7 to press against the break block N^8, the break block being so arranged that when the door A^2 is finally closed contact will be made between the points N^6 and N^7, and the block N^8, as before described; the remaining connections may be as before described or as shown, namely, the lamp L rests in a metal lamp ring L^7 to which is connected a secondary wire. The insulated lamp contact piece S^3 which is connected to the other secondary wire is provided with an insulated contact piece S^6 which when pressed down connects the two primary contacts P^5 and P^6, the latter being connected to one terminal of a push P^2, the other terminal of the push being connected to the primary

terminal of the coil C as shown, the push being operated last, and will only be effective when the lid or door A^2 is closed. The push P^2 as before described may be dispensed with, in which case, the closing of the door A^2 closes the final circuit.

A further modification is shown in Fig. 12, the case or box A having three compartments, in the upper one is placed the accumulator B. In the central one the lamp chamber L^4, and in the lower one the coil C. The handle H projects through the upper casing and the rod H^1 is provided with a flange H^6 between which and the casing is placed a spring H^7; the rod H^1 is attached to one end of a lever H^8 fulcrumed to the bracket H^9, the other end being attached to the rod H^{10} which passes through a stuffing box H^{11}, and is provided with a head or door A^2 substantially of the form shown, provided with a pad of felt or the like H^{13}. The rod H^{10} is provided with an insulated contact piece P^7 which when in the down position will connect the primary contacts P^5 and P^6. The said rod is provided with a cushioning device, such as H^{12}. That is to say, the rod H may be in two portions, one sliding inside, the other and a spring placed between the parts in order that a cushion or yielding effect may be obtained. When in the down position, the door A^2 will close the top of the lamp chamber L^4 and may be retained there by means of a spring catch such as L^8. The lamp rests in the lamp ring in the ordinary manner and presses down the secondary terminals S^5 and S^7, the latter terminals operating a primary switch consisting of terminals N^2 and N^3, substantially as shown in Fig. 9. The closing of the door A^2 makes the primary contact at P^5 and P^6, the lamp presses down the terminals S^7 and S^8, and thus the desired contacts are made, the lamp being lighted when the door is finally closed, and contact made at P^5 and P^6. Suitable inspection windows Z may be provided. It will be understood that the details of this mechanism may be departed from without affecting the principle of my improvement. For instance the lamp chamber may form part of the door A^2 and the base of the same may operate the necessary switches placed around the lamp ring. The handle H may be operated from the side or from the top. Further, the lamp chamber may be provided with an upper chamber containing carbonic acid gas, or water, and in the diaphragm joining the two chambers may be placed a safety valve, in such a manner that should an explosion take place in the lamp chamber, the safety valve would open and allow the carbonic acid gas or water to quench the flame. In place of moving the door A^2 on to the lamp chamber and closing the various circuits as before described, the door may be stationary, and the lamp chamber lifted by an arrangement of levers and rods against such door, such rods and levers being operated either by a handle or by an additional sliding door and the circuits thereby closed.

Figs. 13 and 14 show a further modified form of my apparatus consisting of two chambers, one containing the coil and accumulator, and the other the lamp chamber, the latter chamber is provided with a dust lid such as A^5. In the top or side of the case or box A is placed a sliding door D^2 having rods, pushes or the like K^4 and K^5 attached thereto, such rods being provided with contact pieces K^6 and K^7 to fit the secondary and primary breaks K^8 and K^9 respectively, when the door is pushed home. The contact pieces may be adjustably mounted on the rods or pushes, the rod K^5 being somewhat shorter than K^4 in order that the primary contact may be closed after the secondary one, or the breaks K^8 and K^9 may be so mounted that the rods may be of equal length, but the break K^9 will be slightly farther from the contact piece K^7 than the break K^9 is from the contact piece K^6. In the lamp holding ring or disk L^2 are formed a suitable number of contact pieces, such as T, T^1 and T^2. Each contact piece being in the form of a push making a break. All three contact pieces T, T^1 and T^2 are connected as shown, and one additional break formed between two of the said contacts, such as T and T^2, this break being filled by the lamp and the push contacts made by the pressure of the lamp, the circuit being completed in the following manner. One contact piece such as T^1 is formed of brass, or other suitable conducting material. The other contacts T and T^2 are insulated from the lamp bottom and from each other, and are in the form of a push, whereby a gap between two terminals is filled, somewhat on the lines as shown at S^6, in Fig. 11. Thus, should the contacts T and T^2 be operated without the insertion of the lamp, no current would pass, there being a break at T^1, which can only be filled by the lamp or a piece of conducting metal, that will close all the breaks at once; thus, it is difficult to tamper with the contacts and thereby effect sparking at this point. The contact T is connected to one terminal of the secondary break K^8, the other terminal being connected to the coil C as shown. A contact piece S^3 is provided in the base of the lamp disk, and connected to a secondary terminal of the coil C. When such contact piece is pushed downward, the same makes contact between two primary contacts P^5 and P^6, one of which is connected to the accumulator B, and the other to the primary break K^9 before mentioned, the other primary break being connected to a primary terminal of the coil C. The other coil pri-

mary terminal being connected to the accumulator. The pushing or closing of the door D^2 first causes the secondary break to be filled, the door being practically closed. A further movement of the door causes the primary break to be filled, and the lamp to be lighted.

Fig. 15 shows a form of a lock bolt switch similar to that shown in Fig. 6, but operating upon a sliding lamp recess L^9 in such a manner that should the push P^2 be operated, and no lamp be in position in the recess L^9 the recess would tend to slide out of position, with the result that the contact points N^2 and N^3 would not meet, that is to say, the final contact can only be made when the lamp is in position. The mechanism consists of the following parts. The push P^2 operating a push bar N through the aperture M^2 in the door bolt M, (only when the door is closed). The bar N in turn operates the terminal or contact N^2 contained in an insulated sliding sleeve M^4, a very strong spring M^5 being placed between the contact N^2 and the boss M^7 of the insulated sleeve, the contact N^3 being formed on a bar M^6 which will press against the projection X forming part of the lamp recess L^9, such projection passing through an aperture X^1 in the base of the lamp chamber. A light spring X^2 presses against the side of the lamp recess L^9 as shown. The lamp recess is provided with a contact ring or piece T^3 to which is connected a secondary wire. In the projection X is placed an insulated bush X^3 in which is placed the secondary terminal S^3 and primary terminals P^5 and P^6, the terminal S^3 making the contact between the primary terminals P^5 and P^6 when pressed downward by the lamp. It will be seen that the placing of the lamp L in the recess L^9 locks such recess in position and the push P^2 may be operated and the final contact made. The contacts N^2 and N^3 are connected to the primary wires substantially in the manner described with reference to Fig. 6, though sliding contacts may, if desired, be formed in the insulated sleeve M^4 as shown in Fig. 15.

It will be understood that the various contact makers and breakers hereinbefore described and shown may take other forms than those shown so long as their purpose is carried out, and further, many modifications may be made in the mechanism without departing from the principle of my improvement. The various switches or the like hereinbefore described may be contained in locked casings, such, however, for the sake of clearness have been omitted from the drawings.

The various compartments of the box or case A may be provided with suitable doors for the purpose of inspection and repair of the various working parts. Inspection windows Z may be placed where desired, and not of necessity in the positions shown in the drawings.

What I claim as my invention is:—

1. An apparatus for lighting miners' safety lamps comprising a casing adapted to receive the lamp, said casing being provided with an opening, a closure for said opening, and means for igniting the lamp, said means being operable only when said opening is closed by said closure.

2. An apparatus for lighting miners' safety lamps, comprising a casing adapted to receive the lamp, said casing being provided with an opening, a closure for said opening and means for igniting the lamp, said means being operable only when said closure is in its closed position.

3. An apparatus for lighting miners' safety lamps comprising a casing adapted to receive the lamp, said casing being provided with an opening, a closure for said opening and means for electrically igniting the lamp, said means being operable only when said opening is closed by said closure.

4. An apparatus for lighting miners' safety lamps comprising a casing adapted to receive the lamp, said casing being provided with an opening, a closure for said opening, a normally-open lamp-ignition circuit and means adapted to close said circuit, said means being rendered operable only when said closure is in its closed position.

5. An apparatus for lighting miners' safety lamps comprising a casing adapted to receive the lamp, said casing being provided with an opening, a door for said opening, a normally-open lamp-ignition circuit, a circuit-closer therefor, means for closing said door and simultaneously moving said circuit-closer to close said circuit, and means operatively associated with said circuit-closer for actuating the same only when the door is closed.

6. In an apparatus for lighting miners' safety lamps comprising a casing adapted to receive the lamp, said casing being provided with an opening, a door for said opening, a lamp-ignition circuit, a fixed contact in said circuit, a movable contact in said circuit normally spaced from said fixed contact, and means operable only when said opening is closed by said door to cause said movable contact to engage with said fixed contact to complete said circuit.

7. An apparatus for lighting miners' safety lamps comprising a casing adapted to receive the lamp, said casing being provided with an opening, door-closing means, a lamp-ignition circuit, normally spaced contacts in said circuit whereby the latter is normally open, and means operable only when the door is closed to cause said contacts to engage with one another.

8. An apparatus for lighting miners'

safety lamps comprising a casing adapted to receive the lamp, said casing being provided with an opening, a door for said opening, door-closing means, a normally-open lamp-ignition circuit, a fixed contact in said circuit, a movable contact in said circuit adapted to engage said fixed contact, said movable contact being operatively connected to said door-closing means and adapted to engage said fixed contact when said door-closing means has been actuated to cause the door to close the opening.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

ERNEST ARTHUR HAILWOOD.

Witnesses:

CLIVE WAUGH,

JOSEPH P. KIRBY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."