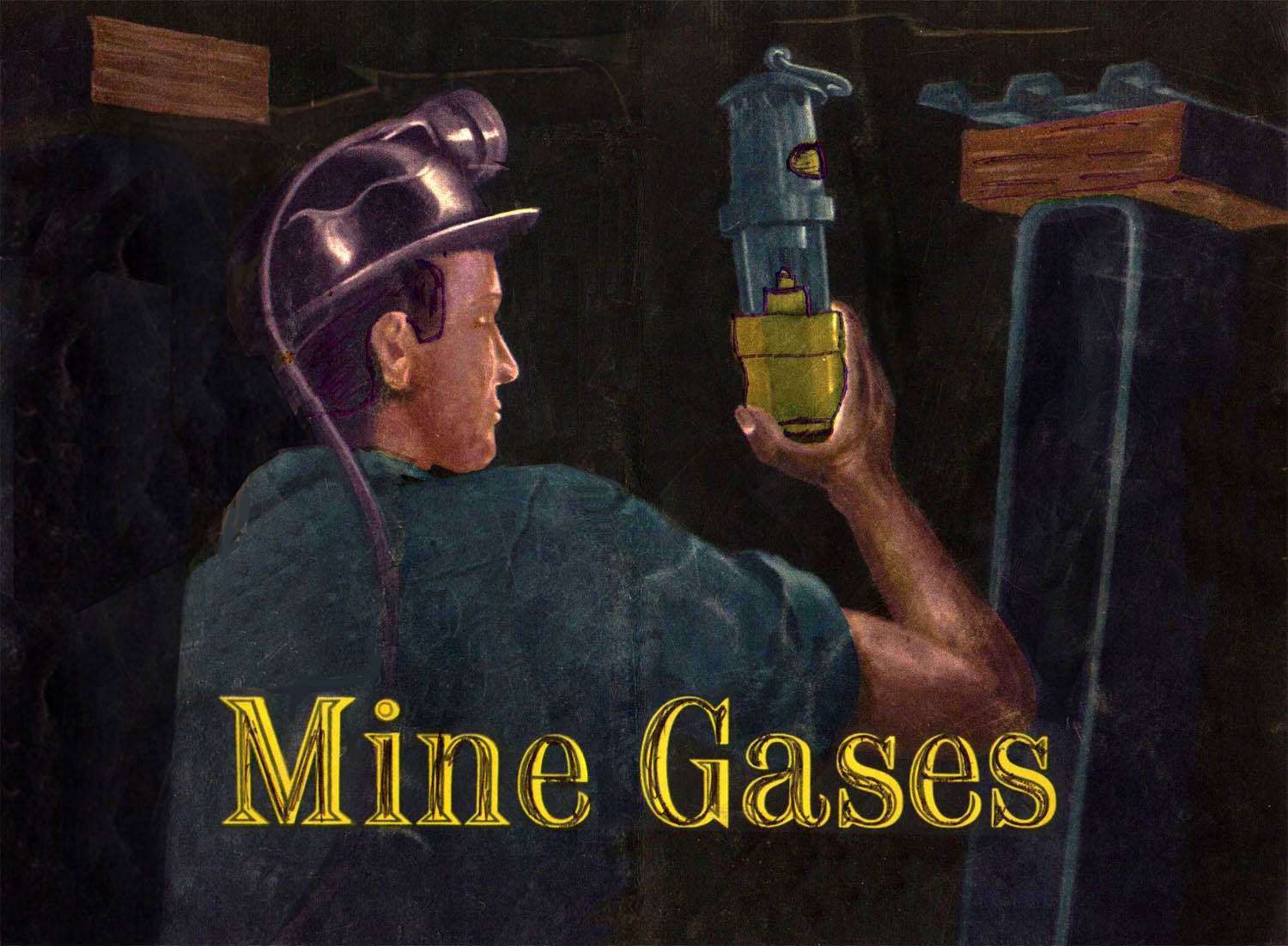


Mine Gases

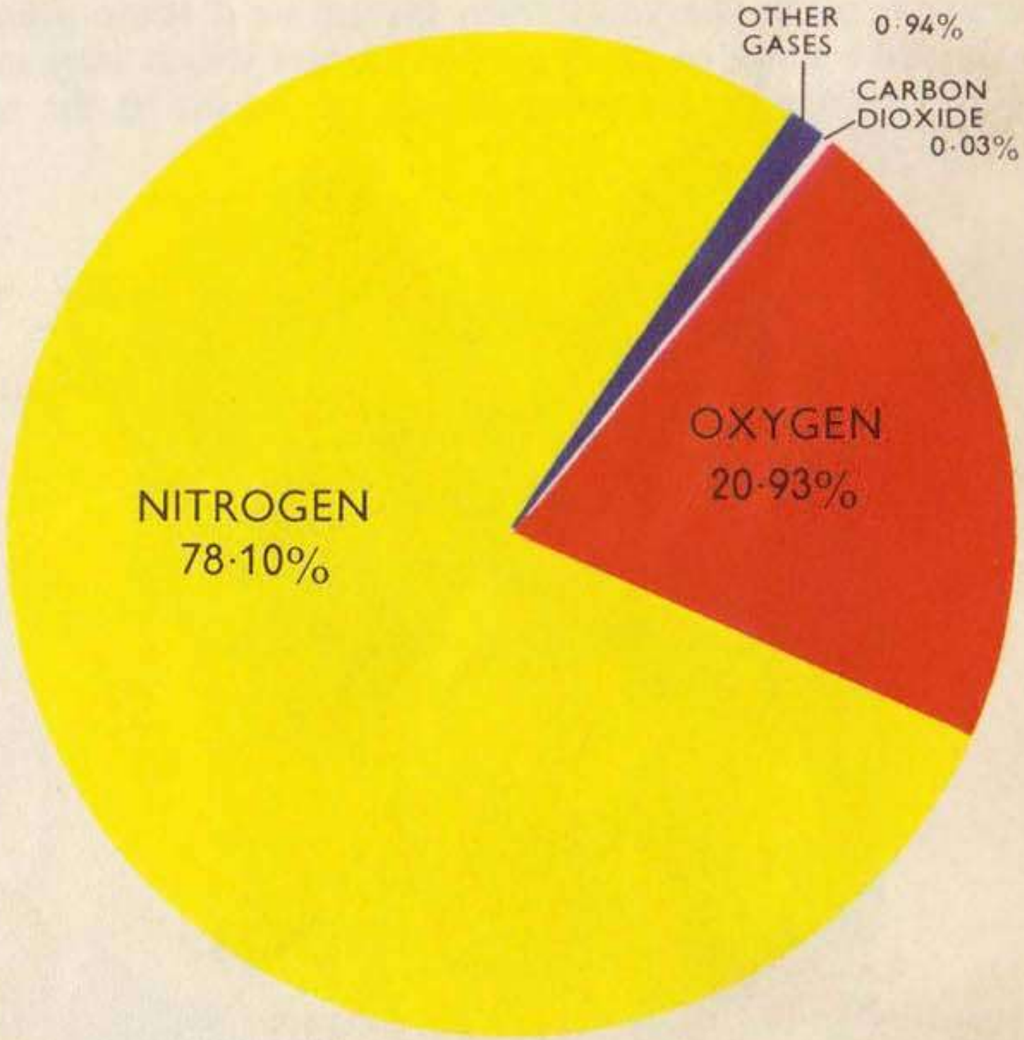
Mine Gases

The air we breathe is not a single gas but a mixture of several gases, the most important of which are Nitrogen, Oxygen and Carbon dioxide.

NITROGEN (N_2) constitutes almost four-fifths of the volume of the air. It has no colour, taste or smell. It is an inactive gas; a flame put in pure nitrogen will be extinguished and persons breathing pure nitrogen would suffocate. The remaining fifth of the air is almost all OXYGEN (O_2). It is a very active gas which is necessary for people to breathe and for keeping flames alight. It combines readily with nearly every other substance. It is slightly heavier than air, whereas Nitrogen is lighter.

CARBON DIOXIDE (CO_2), although present in the air in only a very small proportion, is essential for plant life and so for our own. It is colourless, has no smell but has a slightly acrid taste. It is one and a half times as heavy as ordinary air. It will not burn and will not support combustion or breathing. If air containing a high proportion of carbon dioxide is breathed the rate of breathing is increased, headache develops and unless fresh air is sought death occurs due to suffocation.

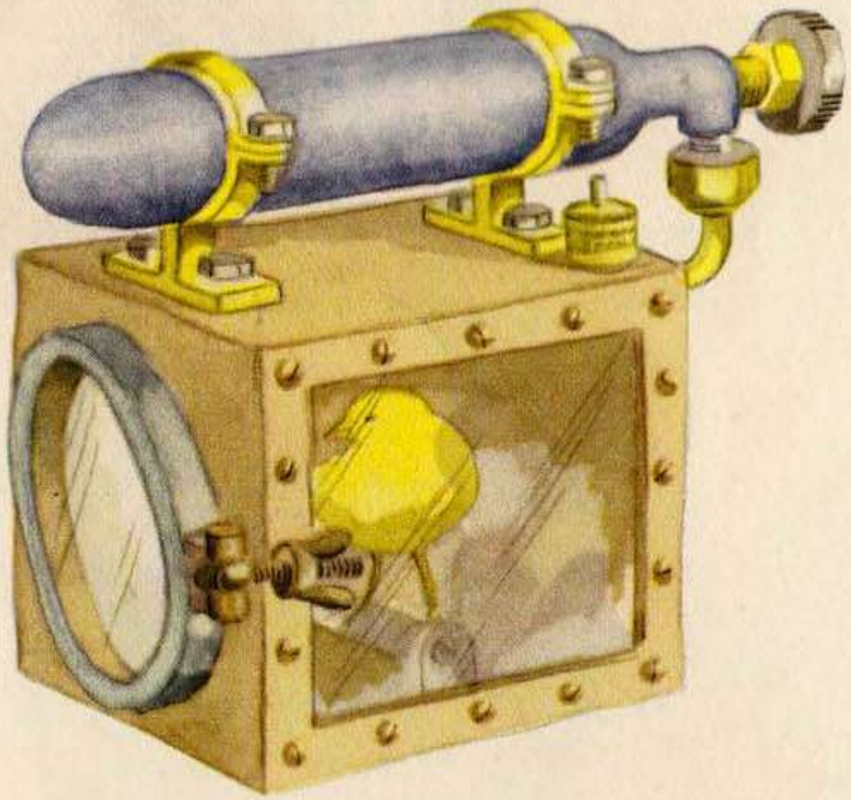
The proportions in which these gases are mixed in the air remain remarkably constant. These proportions may be disturbed by fires, explosions, eruptions of volcanoes and even by the breathing of plants and animals. These disturbances are extremely local and temporary; any unusual concentration of gas is quickly dispersed by the wind.



THE COMPOSITION OF NORMAL AIR

In the mine, too, the proportions are much the same provided a good flow of air through the workings is maintained. A man may work all his life in a mine and never come across an unusual concentration of any one of the gases mentioned in this book.

However, because of the confined space in the roadways and along the face, there is always the possibility of a concentration of one of the gases occurring if there is a breakdown in the ventilation system or if some unusual event like a fire or an explosion occurs which may make a big change in the composition of the air in the mine workings.



CANARY IN CAGE FOR TESTING FOR CARBON MONOXIDE

At high temperatures coal burns in oxygen but even at ordinary temperatures, oxygen, being a very active gas, combines with coal gradually; a slow process known as oxidation. Oxidation takes oxygen from the air and leaves a higher proportion of nitrogen and carbon dioxide than normal.

Sometimes because of the oxidization of coal, timber and other materials a good deal of oxygen, especially in old workings, may be removed from the air. The excess nitrogen and carbon dioxide may be mixed in different proportions depending upon the circumstances in which they were produced. The mining term for this mixture is BLACKDAMP. If excess nitrogen is present and little carbon dioxide, the mixture is lighter than air. If more than 6 per cent of carbon dioxide is present the mixture is heavier than air.

Reductions in the percentage of oxygen in the air can be detected by the flame safety lamp. When the oxygen content falls below $17\frac{1}{2}$ per cent the flame on a lamp burning oil is extinguished. Where spirit is used in the lamp the flame will cease to burn when the oxygen percentage falls below 16 per cent. An acetylene flame will continue to burn until the oxygen percentage is reduced to 12 per cent.

Concentrations of other gases not so commonly found in air may also be brought about by abnormal events which may occur in the mine.

When a substance containing carbon is burned, the carbon will be completely burned, if sufficient oxygen is present, to form carbon dioxide. If less oxygen is present, however, incomplete combustion may take place and

CARBON MONOXIDE (CO) will be formed. Gob fires, explosions of firedamp or coal dust will produce carbon monoxide in the mine. This gas is colourless and odourless. It is slightly lighter than air and will not support combustion, though it will itself burn at a high temperature and in the presence of oxygen, to form carbon dioxide. Since it is extremely poisonous it is the deadliest of gases ever found in mines. It gives little warning of its presence. Headaches may be the first symptom. If giddiness is felt fresh air must be reached immediately otherwise it may be too late to prevent death. The most practical means of detecting carbon monoxide is by its effect on small warm-blooded animals such as canaries, linnets and mice. These creatures are more quickly affected by carbon monoxide poisoning than are human beings. A canary will fall from its perch, overcome by the gas, before a man begins to feel anything unusual, but, when this occurs, he must get to fresh air without delay.

Sometimes, during shot-firing, cartridges of explosives are incompletely detonated; they merely burn slowly, giving off gases of OXIDES OF NITROGEN. These gases are highly poisonous and have a very irritating smell. So long as a good flow of air is maintained along the face the gases are quickly dispersed and rendered harmless. The gases are detected by smell and persons should not be allowed to return to a place where a shot has been fired until sufficient time has elapsed for the gases to clear. Diesel locomotives are producers of oxides of nitrogen, small quantities of nitrous oxide being found in the exhaust.

HYDROGEN SULPHIDE (H_2S) is a gas which is not found in all mines, but may be found where gob fires occur, or where the workings are damp and wet. Acid pit water and pyrites may produce the gas, which is colourless and has a strong smell of rotten eggs. If the gas is breathed, however, for a few minutes, the sense of smell is lost although the danger may still be present. Earliest effects are irritations in the nose and throat and inflammation of the eyes. The gas is poisonous and will burn. Chemical methods of detection can be used but these are not always handy and are usually unnecessary.

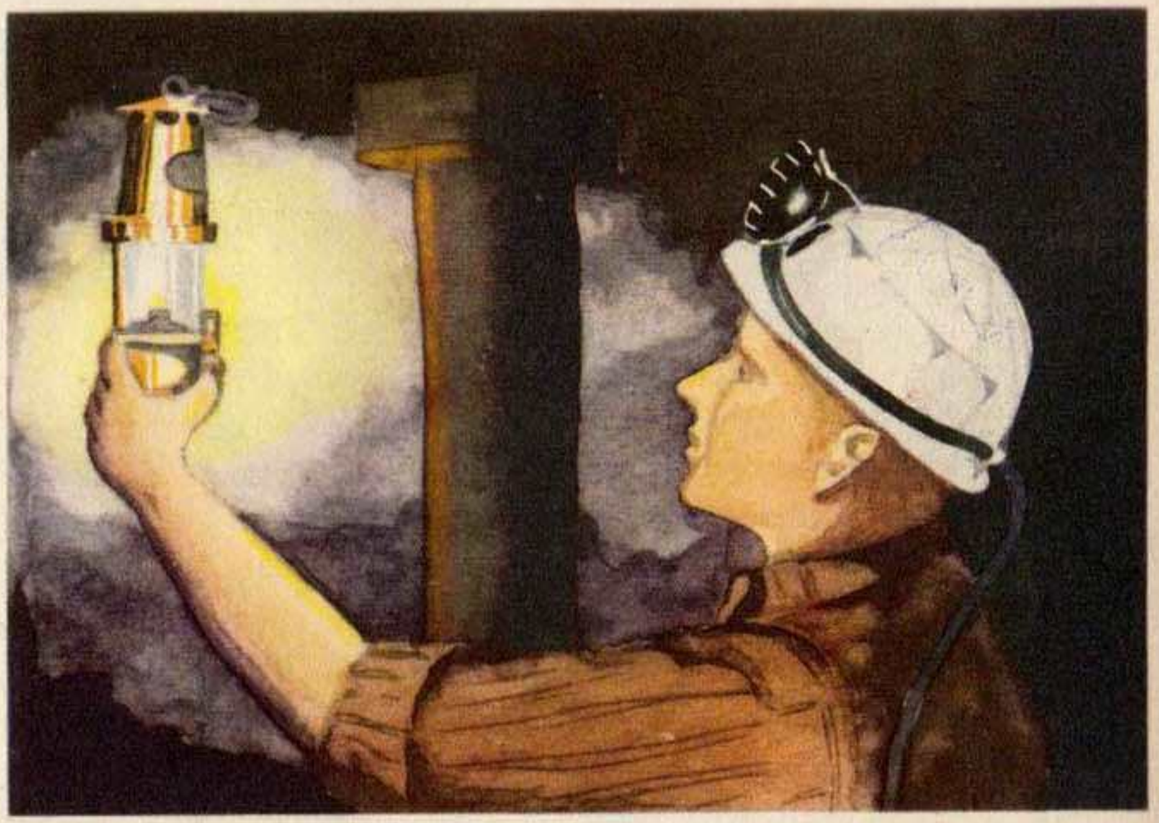
FIREDAMP, the main constituent of which is METHANE (CH_4), is a gas which was produced, we believe, as the coal was formed from decaying vegetable matter, trees and grasses. The gas is imprisoned or absorbed within the coal and the strata around the coal. Mining disturbs the strata and releases the gas. It may bleed off slowly, but sometimes it escapes with a hissing noise like gas from a gas jet. Such an escape of gas is known as a 'blower'.

Methane is colourless and has no smell, although fire damp may have a characteristic odour due to the presence of other gases mixed with it. It is not poisonous, but as it mixes with the air it may reduce the percentage of oxygen present to such an extent that suffocation may result. The gas is extremely dangerous because it can be set alight. It is therefore known as a combustible gas. When mixed with air in certain proportions the mixture becomes explosive, which means that once it is set alight the flame will pass in a flash in all directions throughout the gas. Because of the dangers of an ignition of firedamp tests are constantly made for it, with flame safety lamps and other detectors, in all mines in which it is likely to be found. Good ventilation of mine workings is, of course, the greatest safeguard against this and other mine gases.

THE INFLAMMABILITY OF FIREDAMP

A mixture of oxygen and a combustible gas will behave differently when ignited according to the proportions in which the gases are mixed.

If the mixture contains less than a certain percentage of combustible gas the mixture only burns near the source of ignition. When there is just enough combustible gas to cause the flame to pass slowly and completely through the mixture this percentage is known as the lower limit of inflammability. There is also an upper limit of inflammability, when so much combustible gas is present that there is only just enough oxygen to enable the gas to burn slowly and completely through the mixture. Between these two limits the mixture is explosive because the flame passes so quickly that there is a bang.



TESTING FOR FIREDAMP (see page 13)

It is because of the risk of igniting firedamp that it is strictly forbidden to have matches, cigarette lighters and so forth in gassy mines; that stringent regulations govern the use of electrical apparatus and the practise of shot-firing; that tests for gas must be made before men start or resume work in any working place and that great care must be taken to see that machinery works properly and does not become overheated.

The limits of inflammability of firedamp are:

Lower limit 5¼ per cent.
Upper limit 14 per cent.

Mixtures containing between 9 per cent and 10 per cent of firedamp are the most violently explosive.

There are many ways in which it is possible to set alight such a mixture of gases in a mine. Examples are:

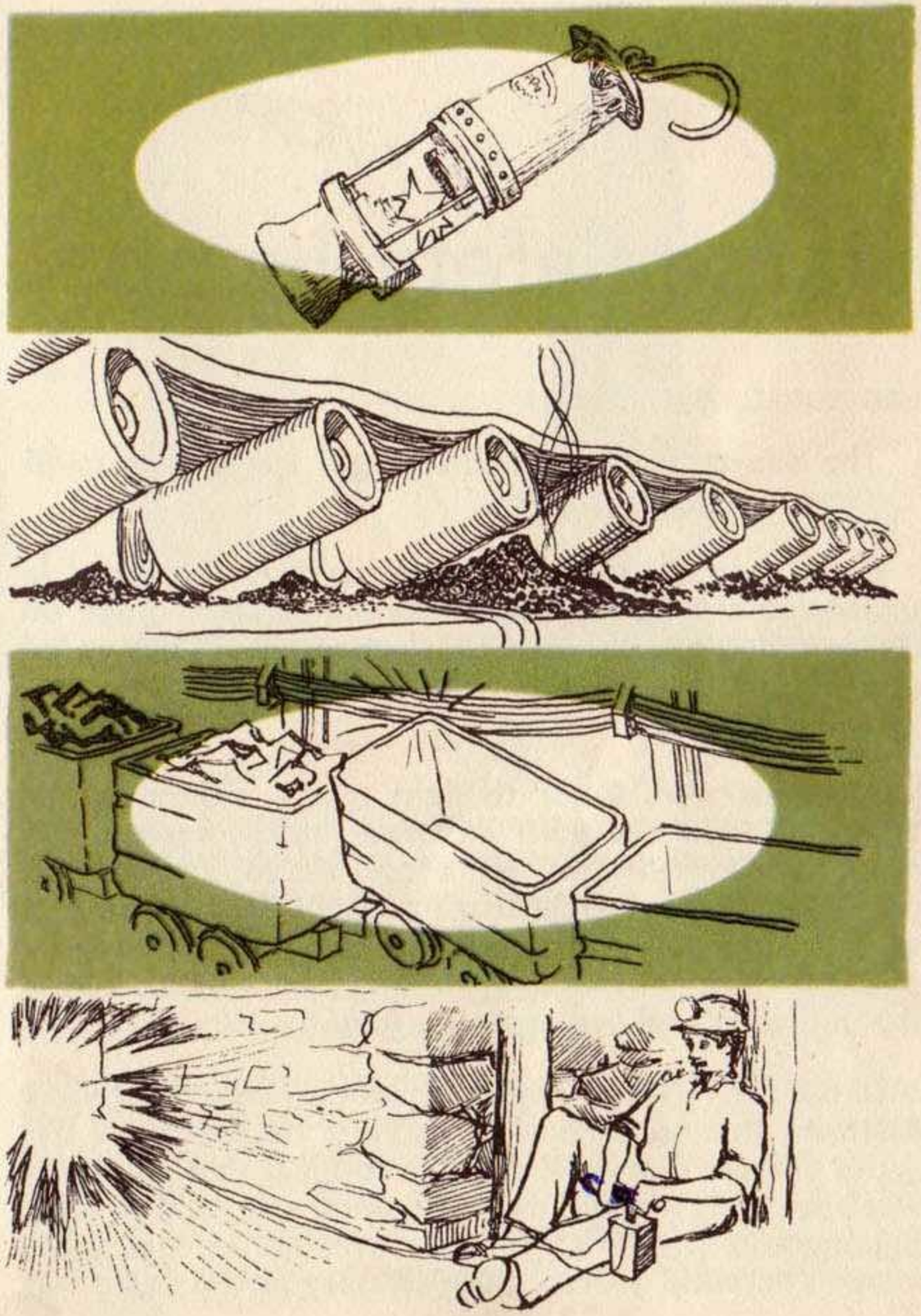
by flames – matches, cigarette lighters, damaged safety lamps, mine fires;

by overheated surfaces – lamp gauzes (i.e. hence the danger of raising lamps too far into a concentration of inflammable gas), filaments in broken electric bulbs, brake drums, conveyor driving heads and tension ends, rollers with defective or unlubricated bearings;

by friction sparks – sparks produced when rocks such as sandstone or pyrites are struck glancing blows by steel such as cutter or hand picks;

by electric sparks – produced from switchgear, damaged cables and signalling apparatus, faulty electrical equipment;

by explosives – heated particles projected from shot-holes and the ignition of firedamp in breaks or cracks in shot-holes.



Flame Safety Lamp

HISTORICAL DEVELOPMENT

The danger from inflammable gas has always made lighting in mines a problem.

Early in the history of mining, light was obtained in underground workings from flaming torches, crude oil lamps and tallow candles. These attempts at lighting led to explosions and many miners preferred to work completely in the dark.

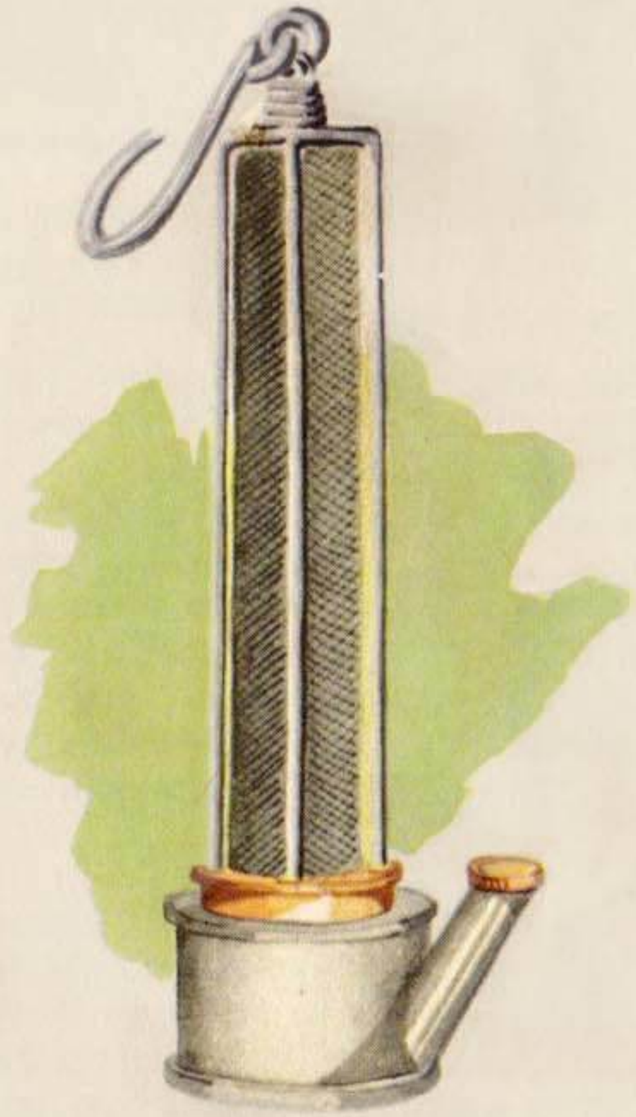
Attempts were made to light mines without actual flame. The devices tried included phosphorescent fish skins, mirrors reflecting lights from the top of the shaft and, much later, the Spedding Flint Mill. This contrivance was carried by a boy who accompanied a collier and produced a shower of sparks by turning the toothed wheel of the mill which rubbed against a flint.

In the early 1800's, as mines became deeper and more extensive, the explosions of firedamp became more frequent and the loss of human life so great that an outcry was raised. As a result more attention was paid to mine lighting and in 1813 Dr Clanny invented the first safety lamp. The lamp proved unsatisfactory as the flame was unsteady and unreliable and the user required an assistant to work the bellows to provide air for the flame to burn.

Following a serious explosion in Durham the Sunderland Society for the Prevention of Accidents in Mines invited Humphrey Davey, a famous scientist, to study the problem of firedamp explosions. During his experiments he found that, due to what he termed the cooling effects, flames would not pass through narrow tubes or through

SPEDDING FLINT MILL

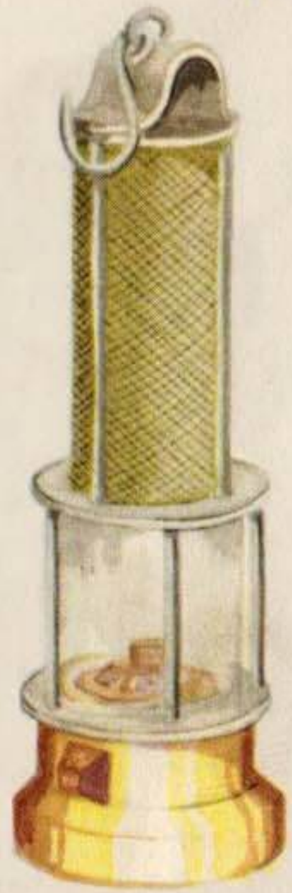
holes in plates of a certain thickness. In later experiments Sir Humphrey Davey found that flames would not pass through certain wire gauzes. In 1815 the lamp shown was made. It is an oil lamp with the flame completely enclosed within a single layer of wire gauze.



THE DAVEY LAMP

STEPHENSON'S LAMP

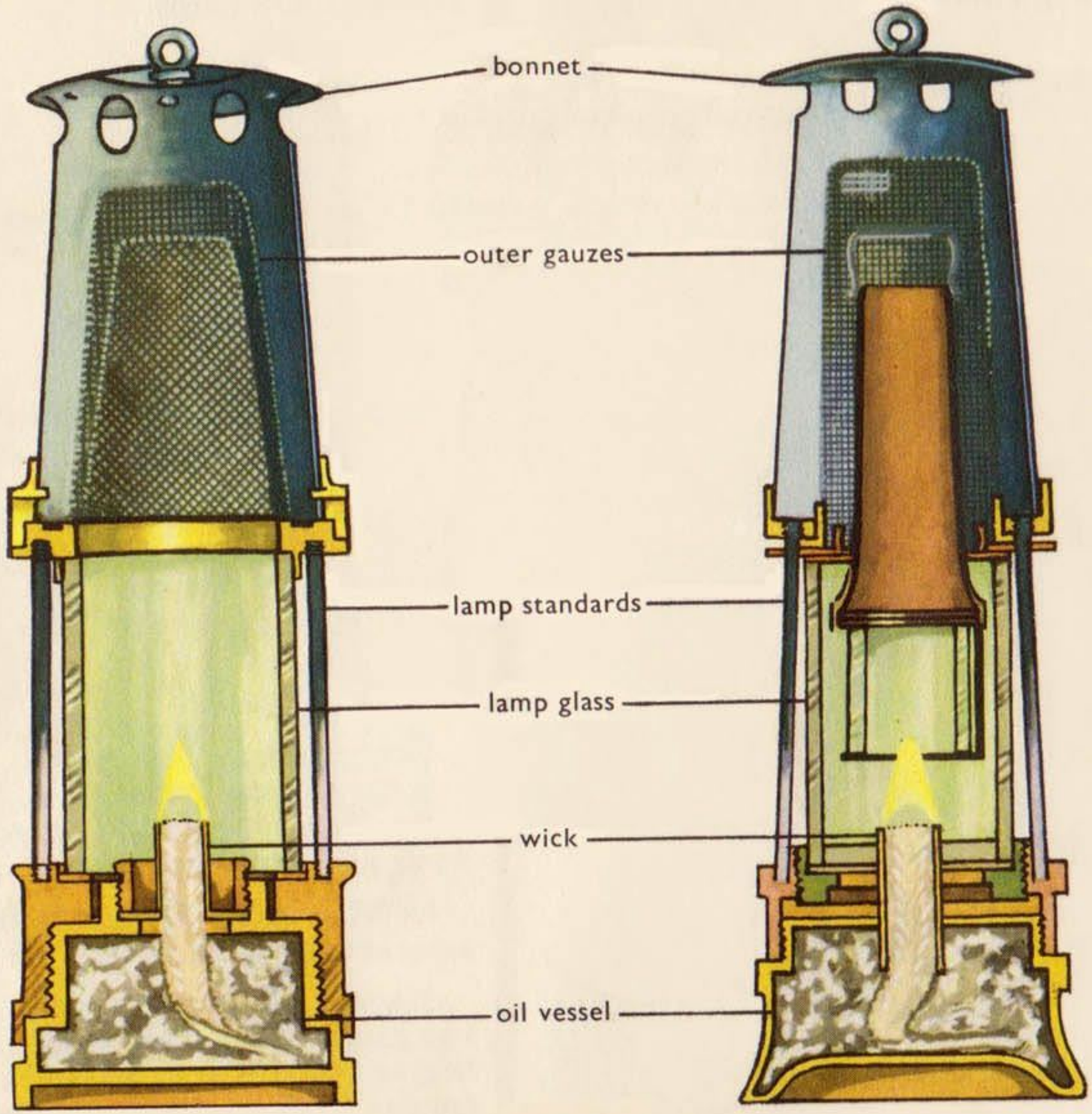
CLANNY'S LAMP



George Stephenson produced a lamp with a glass cylinder surrounded by an iron cylinder perforated with holes. Dr Clanny fitted a short glass cylinder round the flame and placed the gauze on top of the glass.

Dr Mueseler, a Belgian, added an internal chimney to separate the incoming fresh air from the spent air.

Marsaut, a French engineer, produced a lamp with two gauzes. He did so because he thought that the space between the two gauzes would become filled with gases coming from the flame which would no longer burn so that the layer between the gauzes would form an extra protection against igniting any inflammable gas outside the lamp.



MARSAUT LAMP

MUESELER LAMP

MODERN FLAME SAFETY LAMPS

Modern flame safety lamps are based on improvements of the Davey lamp made by Clanny, Mueseler and Marsaut. The modern lamps can be divided into two types:

1. The Marsaut lamp with two gauzes.

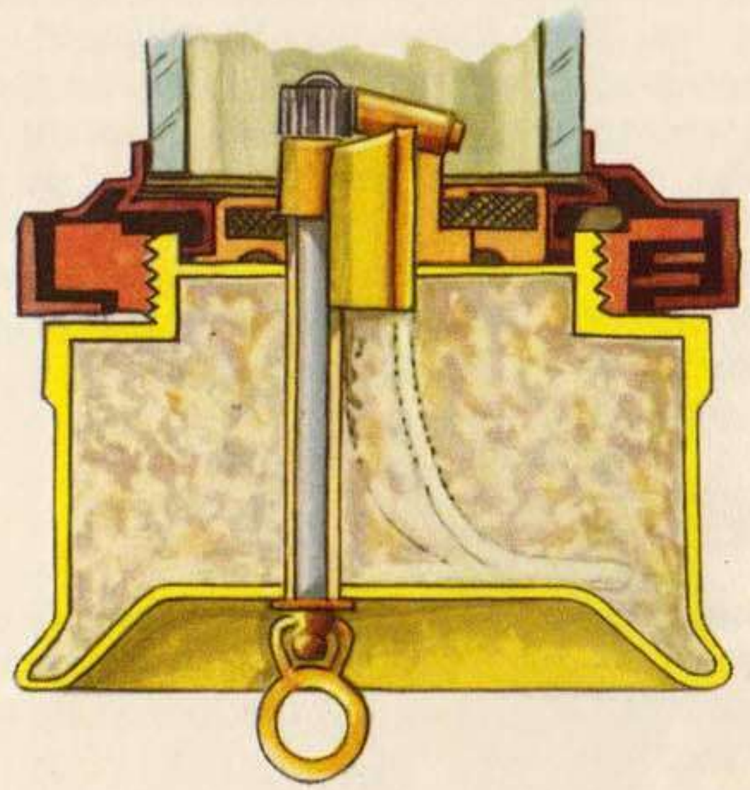
2. The Mueseler pattern with an internal combustion chimney.

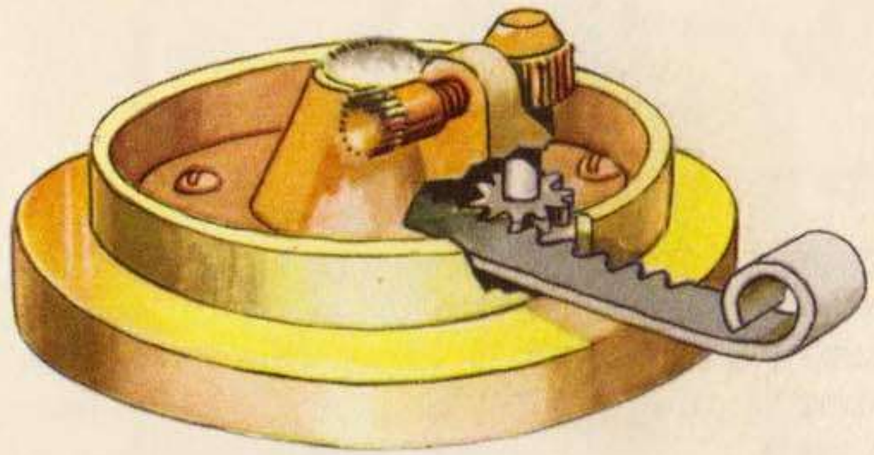
These two types can be further sub-divided as below:

(*a*) Fitted with an internal flint relighting device and shut-off ring or rings on the air inlets. – *For use by deputies and shot-firers when making statutory tests.*

(*b*) Other types approved by the Ministry of Fuel and Power after being tested for safety. They have steel or iron gauzes and are capable of giving light throughout the shift in accordance with the minimum standard and are not fitted with internal relighter device or shut-off rings on the air inlets. – *For use by competent workmen appointed by the manager. Such workmen will not be provided with any additional lamp without the written permission of the manager.*

The RELIGHTING DEVICES used in lamps indicated under (*a*) are similar in operation to a cigarette lighter mounted inside the lamp. A spark is produced near the wick when a toothed wheel is rubbed against a flint, the wheel being moved by means of a bar driven in by the hand or by turning a key attached to the side or base of the lamp. The relighter must only be used in fresh air.





The lamps indicated under (*b*) are fitted so that they can be relighted electrically without opening by means of a relighting device. These lamps may be relighted only at a properly appointed lamp station by someone specially authorized in writing by the manager to do so after careful examination of the lamp has shown that it is not damaged in any way. At the relighting station a battery is used to provide a current which will heat up a wire placed close to the wick. When sufficient heat is produced the fuel vapour above the wick is set alight.

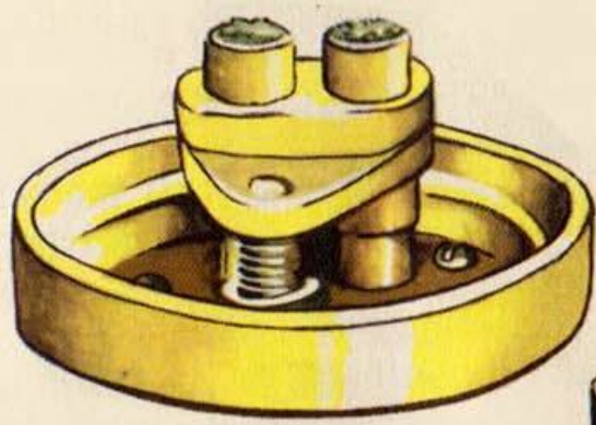
ROUND WICK

LOCKING DEVICES

All lamps must be fitted with an efficient locking device and it is an offence for any unauthorized person to unlock a lamp. Most modern safety lamps are locked by one of the following methods:

(*a*) A lead rivet or plug marked in such a way that interference with it can be detected.

(*b*) A magnetic lock which can only be unlocked at the lamp room on the surface.

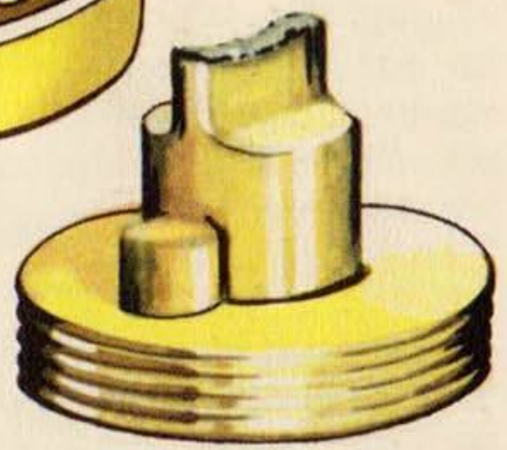


TWIN WICKS

WICKS AND FUELS

Wicks may be flat or round. In some lamps two wicks are provided. Flat wicks are usually $\frac{1}{2}$ in. to $\frac{5}{8}$ in. wide and round wicks usually $\frac{1}{4}$ in. in diameter. The flame safety lamp is often spoken of as an oil lamp because of the fuel used.

Most gas-testing lamps, however, use a 'spirit' fuel.



FLAT WICK

Examining a lamp

When the lamp is received it should be checked before being taken down the mine in the following ways:

1. See that the lamp is securely locked.
2. See that the glass is firm and not cracked.
3. See that there are no leaks in the seals above or below the glass (by blowing at them with the mouth between each pair of pillars).
4. Check that the wick adjuster and, if provided, the relighting mechanism are in order.
5. Check that, if provided, the air inlet shut-off ring or rings can be opened and closed.

When using a flame safety lamp no person shall place the lamp on its bottom unless it is necessary to do so for the safe performance of any particular work or unless authorized by the manager; and in all cases whilst a person is at work it should be placed at least two feet from the swing of the pick, hammer or other tool. It should be hung up in a safe place, where it can easily be seen by the man who is in charge of the lamp. Clothing must never be hung over a lighted lamp or even near to it. The heat from the lamp may be sufficient to scorch or set alight the material, so causing a grave risk of fire or explosion.

THE PENITENT

Testing for firedamp

In the early days of mining it was known that firedamp affected the flame of a candle, forming a bluish spire above the flame. A competent fireman was expected to understand how to 'try the candle'.

Although the flame lamp has been superseded by the electric lamp as a means of illumination, the flame lamp is still the simplest and most practical means of testing for firedamp, the gas being detected as it burns above a lowered flame.

WHERE TO TEST FOR FIREDAMP

(*a*) In the general body of the air, in roads, working places and main and branch airways.

(*b*) For accumulations of gas at the face of rippings, the ends of the face, the edge of the goaf, the face of rise headings, any blind end and any break, hole or cavity in the roof. Firedamp, being lighter than air, will tend to rise and particular attention should be given to cavities in the roof.

SETTING A TESTING FLAME

To set the flame for testing, carefully lower the wick until it is not more than $\frac{1}{10}$ to $\frac{1}{8}$ of an inch high and shows only a speck of yellow light. The glare from a larger flame will prevent the gas cap from being observed. When properly set, the lamp will show a small blue flame with a speck of yellow light in the middle. At the top of this a faint line of paler blue known as the fuel cap may be seen. Practice is needed to recognize it. If firedamp is present a larger blue area of flame is formed above the testing flame, its size depending on the percentage of firedamp present.

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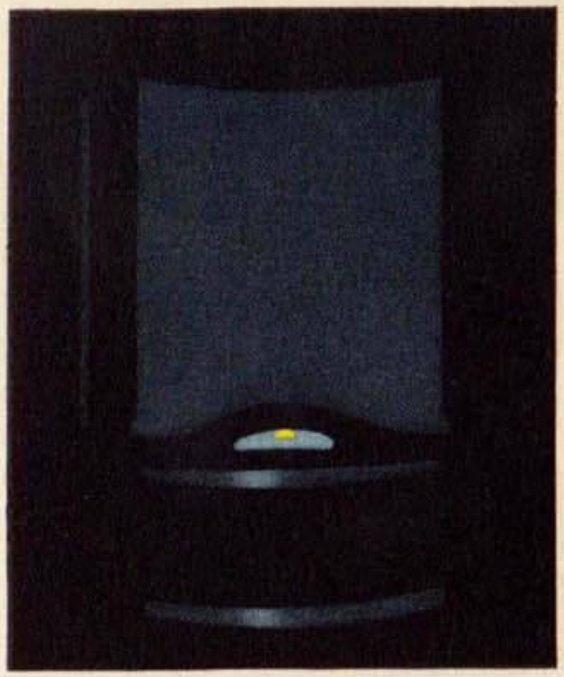


TESTING FLAME

How to test for firedamp in the general body of the air

(*a*) Check that the air inlet shut-off ring or rings, if provided in the lamp, are open.

(*b*) Hold the lamp by the base, set a testing flame and raise it carefully, keep the flame as far as practicable at eye level.

(*c*) Let a few seconds elapse to allow a good sample to enter the lamp

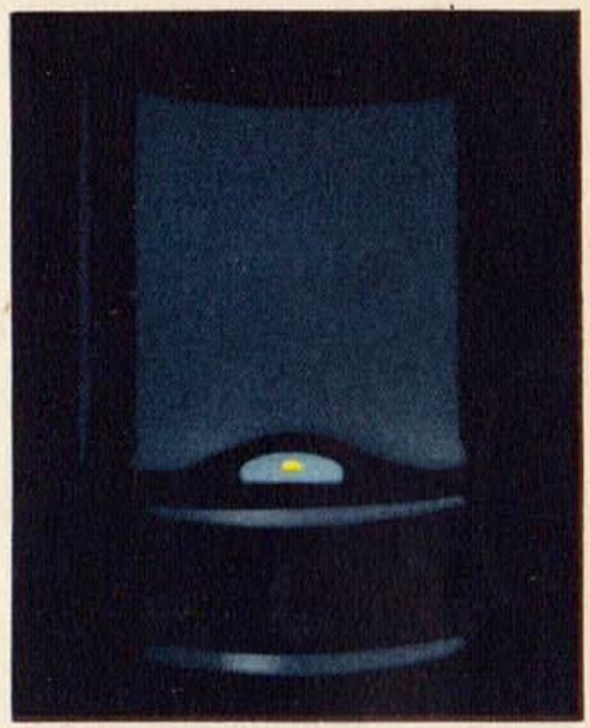
(*d*) Observe the flame. The percentage of firedamp present will be shown thus (on a flat wick):

(i) None. Flame will remain as set.

(ii) Approximately $1\frac{1}{4}$ per cent. A pale blue halo or gas cap will be just visible above the testing flame.

(iii) Approximately $2\frac{1}{2}$ per cent. The cap forms a complete triangle, the top being slightly rounded. It is not necessary to have a knowledge of a higher percentage than this as a lamp should be withdrawn immediately the percentage is indicated.

(iv) Approximately 3 per cent. The gas cap has become more pointed, the height being about half as much again as the length of the base of the flame. Illustrations of the percentages are given here to help the reader to distinguish $2\frac{1}{2}$ per cent from any higher percentages.

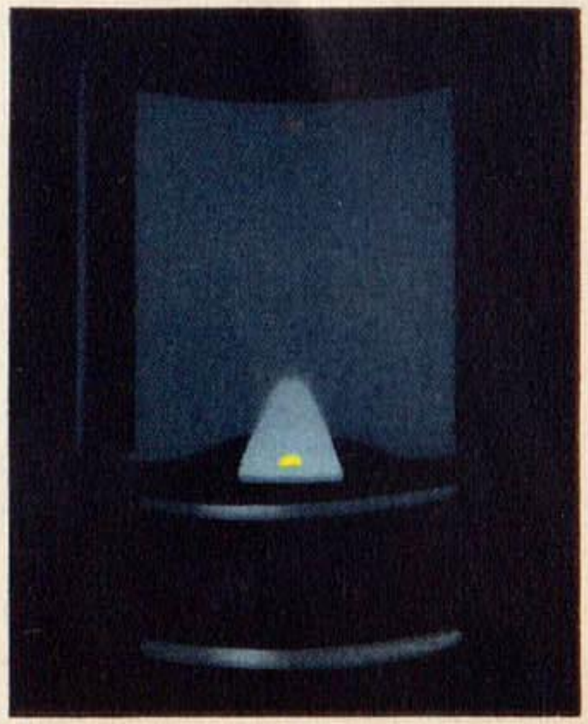


ABOUT

$1\frac{1}{4}$

PER CENT

FIREDAMP



ABOUT

$2\frac{1}{2}$

PER CENT

FIREDAMP

ABOUT

3

PER CENT

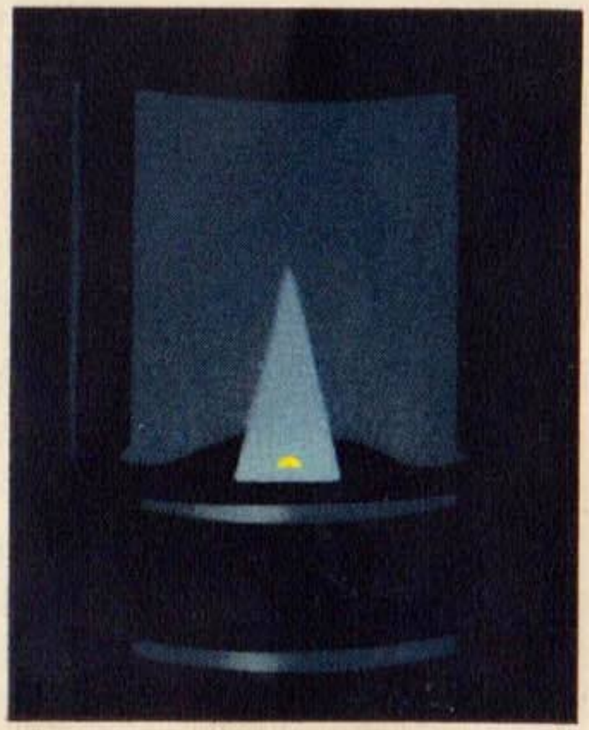
FIREDAMP

ABOUT

4

PER CENT

FIREDAMP



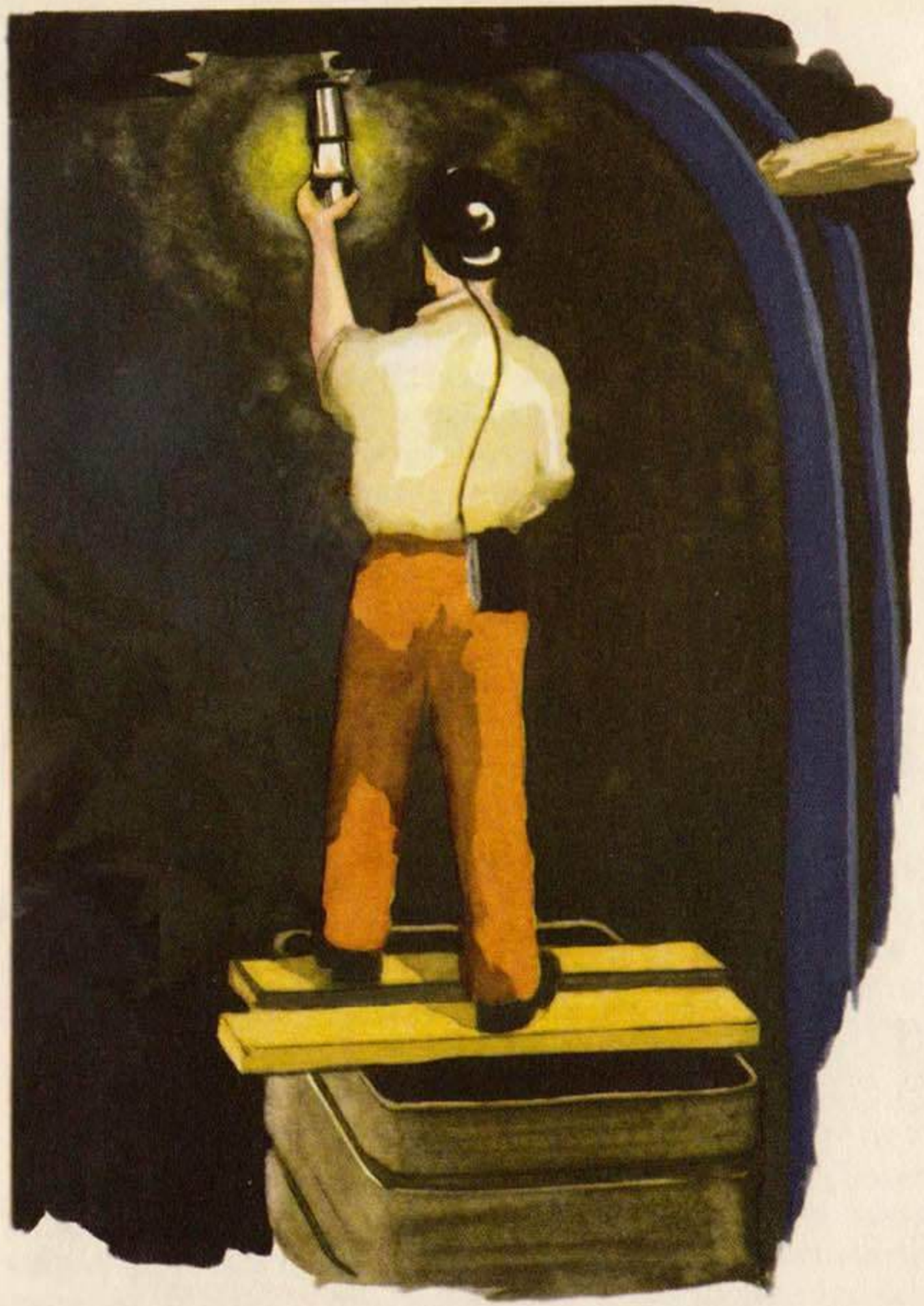
(v) Approximately 4 per cent. Now very pointed, height being about twice the length of the base of the flame.

(vi) Above 4 per cent the gas cap spires towards the top of the glass and possibly into the gauze. The concentration of gas is near the lower limit of inflammability. If the gas cap approaches the top of the glass, the lamp should be drawn back carefully (not jerked) into the fresh air, the flame at the same time being turned up. The mixture within the lamp may explode, putting out the testing flame if the lamp is left too long in the concentration.

Should the firedamp start to burn in the gauze, the lamp should be carried carefully to fresh air without jerking or rapid movement. No attempt should be made to blow out the flames. Lower the wick and cover inlet holes with cap, coat or scarf or something similar and smother the flames or even immerse the lamp in water.

If no gas cap is visible the lamp should be moved slowly across the place, keeping the flame under close inspection.

NOTE: The regulations say: No person shall, when trying or examining for the presence of gas with a safety lamp, raise the lamp higher than may be necessary to allow the presence of gas to be detected.



How to test for accumulations of firedamp

(*a*) Stand on some suitable support, if necessary, a ladder or an overturned or lockered tub.

(*b*) Use a flame of normal size or only slightly reduced.

(*c*) Close the air inlet shut-off ring or rings, if provided. This will cause the air to pass through the holes at the top of the lamp bonnet allowing a sample to be taken near to the roof or in any roof break or cavity.

(*d*) Hold the lamp by the base, raise it slowly and carefully to the roof. Where there is a cavity, pass the top of the lamp slowly into the opening.

(*e*) Observe the flame. If firedamp is present the flame will spire; if this is noticed withdraw the lamp slowly.

(*f*) If the flame does not spire, set a testing-flame and test for gas as explained on pages 14 and 15.

Action to be taken when firedamp is detected

BY THE DEPUTY

(*a*) If $2\frac{1}{2}$ per cent or more of firedamp ($1\frac{1}{4}$ per cent or more in naked light mines) is detected in the general body of the air, all workmen must be withdrawn and the supply of electricity cut off.

All approaches to the danger area should be fenced off and marked with danger notices.

(*b*) In all mines if $1\frac{1}{4}$ per cent, or more, firedamp is detected in the general body of the air, cut off the supply of electricity.

(*c*) If a deputy in charge of a deputy's district finds that at any place in an air current the firedamp content exceeds $1\frac{1}{4}$ per cent or any gas cap can be seen on a lowered flame of a safety lamp he shall at once:

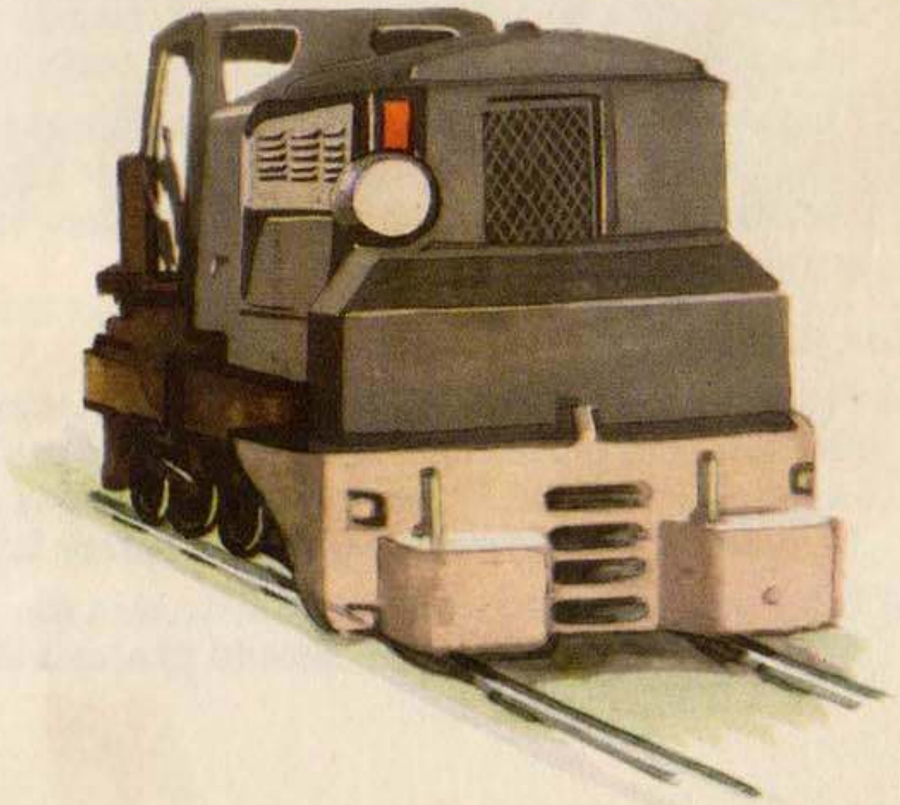
(i) ensure that no shot is fired, or shot-hole charged, in his district on the return side of that place;

(ii) notify the deputy in charge of each deputy's district which is part of the ventilation district concerned and on the return side of the place.

The deputy shall take steps to locate and remove any cause which may be impeding the flow of air through his district.

(*d*) Any prohibition of the charging of shot-holes or the firing of shots in places on the return side mentioned under (*c*) shall continue until, with respect to any place, the senior official on duty at the time has satisfied himself that the firedamp content in that place has been reduced below $1\frac{1}{4}$ per cent and has authorized the resumption there of shot-firing.

(*e*) Should any person report that $1\frac{1}{4}$ per cent or any indication of inflammable gas has been found in a locomotive haulage road, the information should



be checked at once and, if verified, the use of locomotives in that part of the road discontinued. No locomotive shall be used then except by the direction of the manager when he is satisfied that the firedamp content has been reduced below $1\frac{1}{4}$ per cent.

(*f*) Any deputy finding the presence of gas in the general body of the air shall immediately make a check of all ventilation arrangements, doors, regulators, etc, within his district to ensure that the flow of air is following its proper course. He should take steps to locate and remove any cause which may be impeding the flow of air through his district.

(*g*) By the erection of hurdle sheets or by the skilful use of brattice cloth the deputy may be able to divert some of the air current to dilute or reduce concentrations of gas.

(*h*) A senior official should be notified as soon as possible if any unduly large percentage of gas is discovered. VERY GREAT CARE must be taken when trying to disperse or dilute a heavy concentration.

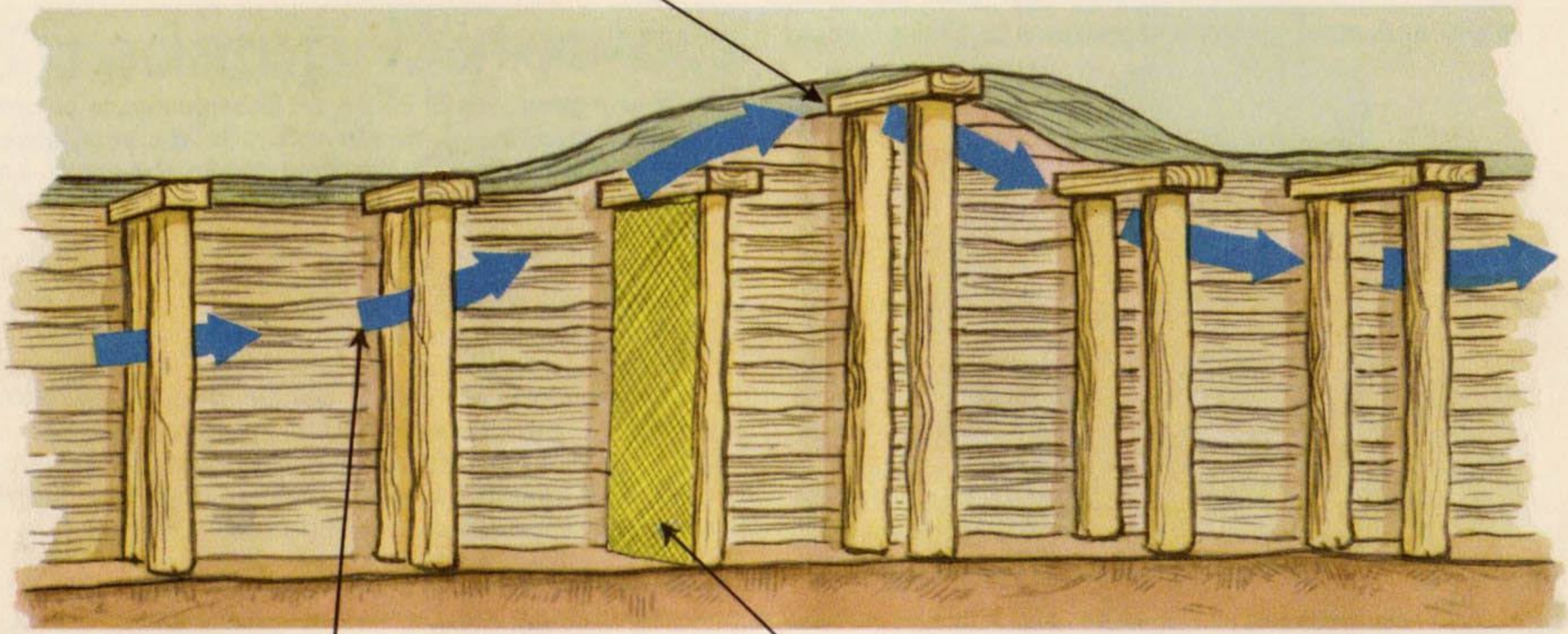
(*i*) On completion of his shift or inspection the deputy must make and sign an accurate report that gas has been detected, stating the steps he has taken to reduce or remove the concentration.

BY THE SHOT-FIRERS

(*a*) No shot shall be fired or shot-hole charged if, at any test, the percentage of inflammable gas present is found to exceed $1\frac{1}{4}$ per cent or if any gas cap can be seen on the lowered flame of a safety lamp.

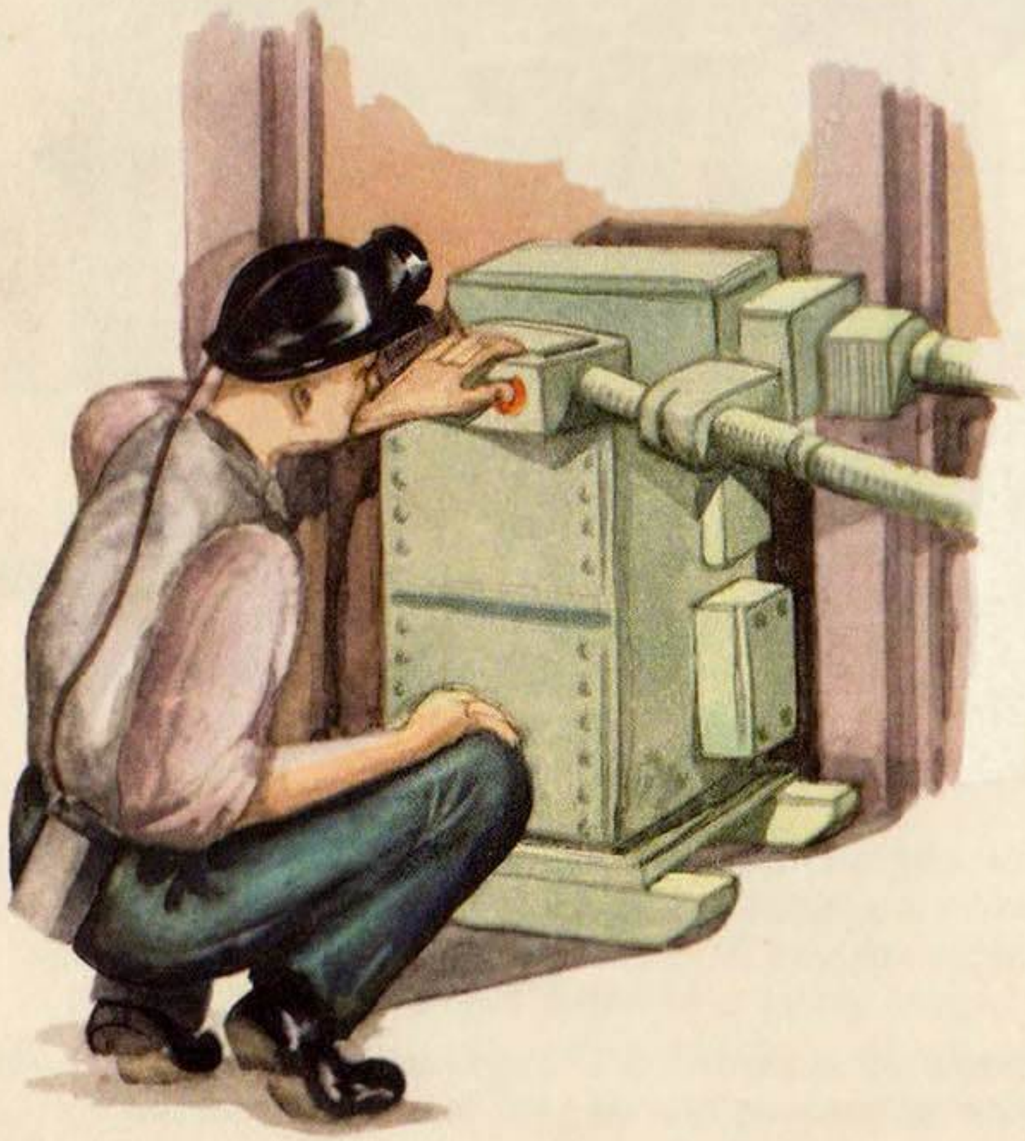
(*b*) If temporarily in charge of the district in the absence of the deputy, a shot-firer should proceed as would the deputy immediately gas is detected. He would warn persons concerned and take steps to remove the cause or effect a suitable remedy in order to reduce the concentration.

If not in charge of the district a shot-firer should report immediately any concentration of gas he finds to the deputy who should check the report. If, however, the concentration contains $2\frac{1}{2}$ per cent or more the shot-firer should remove himself and others from the area to a safe place.


FIREDAMP IN
ROOF CAVITY
AIR DIRECTED
INTO ROOF CAVITY
BRATTICE SHEET

BY PERSONS IN CHARGE OF ELECTRICAL EQUIPMENT

(*a*) If at any time in any place in the mine the percentage of inflammable gas in the general body of the air in that place is found to exceed $1\frac{1}{4}$ per cent, the electric current shall at once be cut off from all cables and other electrical apparatus in that place (other than telephones, or signalling wires or instruments) and shall not be switched on again as long as the percentage of inflammable gas exceeds that amount. (Electric hand and cap lamps should be left burning.)



BY ANY WORKMEN

(*a*) If any person shall cause, or become aware of, any obstruction in or interference with the ventilation, or of any stagnation or impurity in the air of any part of the mine, or of any dangerous defect in any part of the roof or sides, or of any other source of danger, he shall, if it falls within the scope of his duties to remedy such obstruction, interference, stagnation, impurity, defect or other source of danger, immediately proceed to take steps necessary for the purpose, and if not he shall immediately inform the manager, under-manager, deputy in charge of the district or some other official, and shall, if he is working at the place where the danger exists, cease all work at the place.

(*b*) Should any person find himself in the presence of inflammable gas, he shall not throw away his flame lamp or attempt to blow it out, but shall shelter it, hold the lamp near the floor, avoid jerking it, and take it steadily into fresh air. If the gas fires in the lamp where he cannot take it into fresh air, he shall smother out the light or extinguish it in water. He should immediately report the presence of the gas to the deputy in charge of the district.

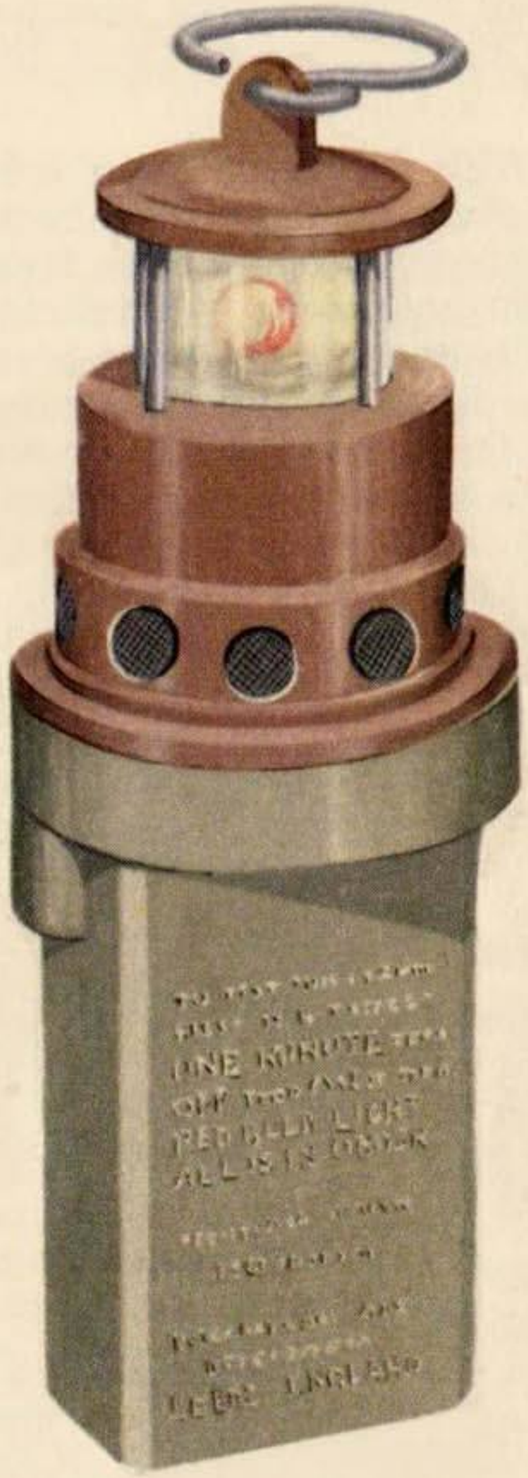
(*c*) No person shall brush or waft out gas, as this does not ensure that firedamp is removed permanently.

Firedamp Detectors

(1) AUTOMATIC DETECTORS

Beside the flame safety lamp, various forms of automatic detectors have been designed. These can be carried by the workmen and give indication when a given percentage of firedamp is present. They are often called 'alarms'.

Ringrose Alarm. The Ringrose Alarm looks like an oversized electric hand lamp and weighs about 6 lb. It is provided with two bulbs, one white and one red. The white bulb is used to give normal illumination. Inside the lamp is a porous pot in which is a filament, glowing continuously while the lamp is in use. If firedamp is present in the air, the filament glows more brightly, due to the burning of the gas around it. The burning of the gas causes a partial vacuum within the porous pot. Connected to the porous pot is a sensitive diaphragm, the sides of which are sucked in as the vacuum is formed. The side of the diaphragm is connected to an electric contact which is drawn towards another contact as the sides close. When the two contacts touch, the electric circuit to the white bulb is broken and the circuit to the red bulb is completed. The red bulb lights up, indicating



RINGROSE ALARM

the presence of firedamp. The detector can be set to operate when a certain percentage of firedamp is present in the air.

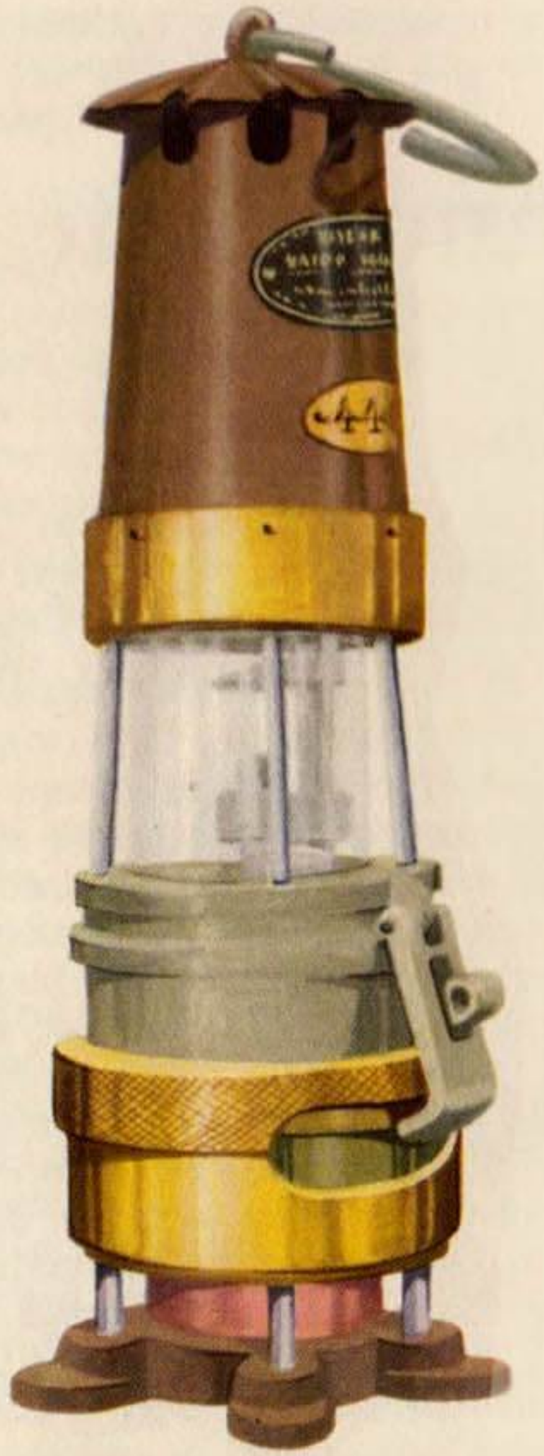
Spiralarm. This device consists of a flame safety lamp to which an electrical device has been added to give warning of the presence of firedamp. It can be set to show when a certain percentage of firedamp is present and depends entirely upon the increased heat produced when the mixture of firedamp and air burns above a normal flame. Above the flame is coiled a bimetallic strip, one end of which is almost touching an electric contact. The increased heat produced by the burning of the firedamp together with the fuel expands the strip and causes it to uncoil. An electric circuit is completed as soon as the strip touches the contact and a bulb housed in a red glass container lights up at the bottom of the lamp. The lamp can be set to operate when $1\frac{1}{4}$ per cent or $2\frac{1}{2}$ per cent of firedamp is present in the air.

(2) METHANOMETERS

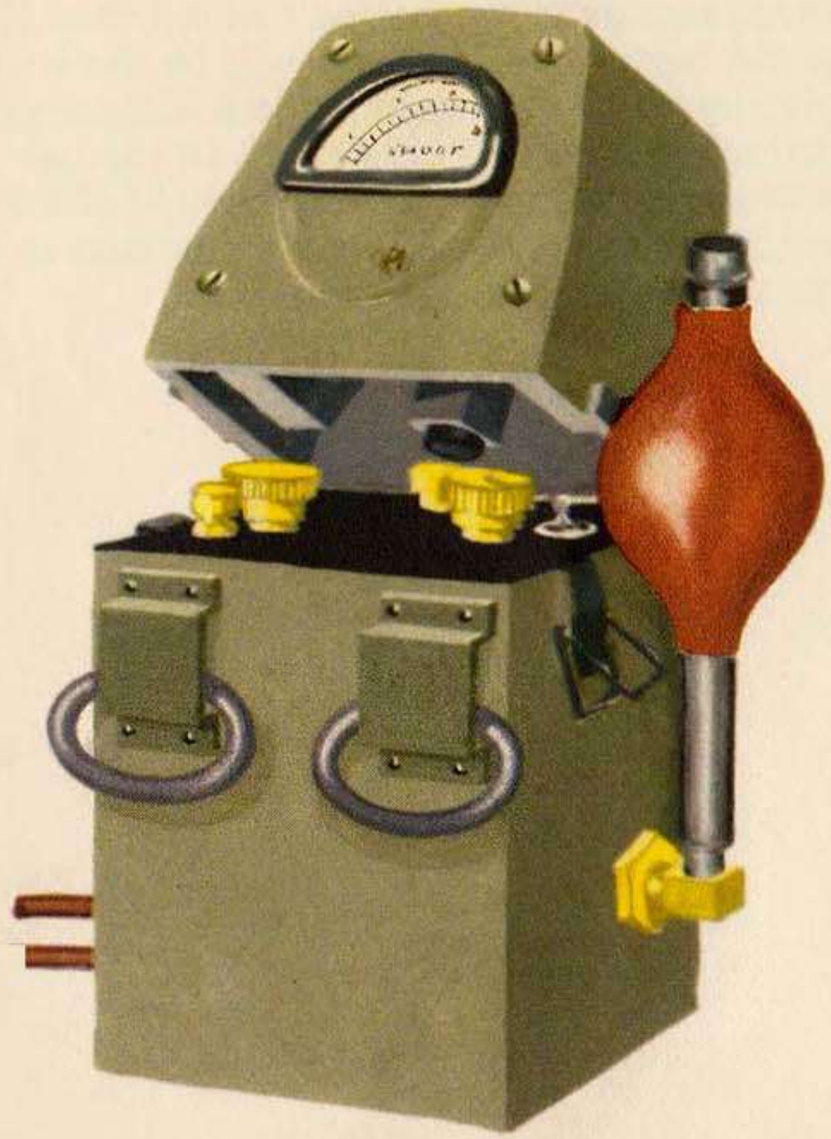
These are instruments which are used to measure concentrations of firedamp. They are usually carried by the Ventilation Officer when checking the ventilation of a district as he can take spot readings as he moves through the district.

The Ringrose Pocket Methanometer works in a similar way to the Ringrose Alarm.

The air to be sampled is pumped into the instrument, then, by turning a switch, the percentage of firedamp present in the sample is indicated by the highest point to which the liquid rises in the tube set against an illuminated scale.



SPIRALARM



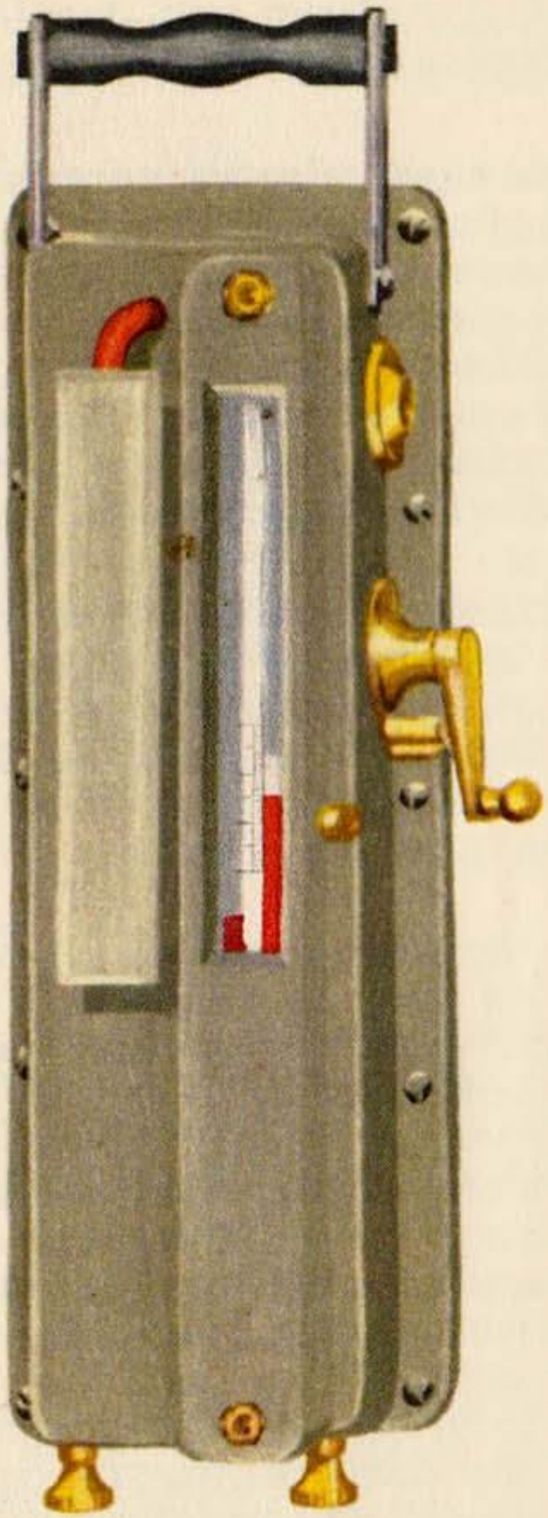
M.S.A. Type W8 METHANOMETER

The M.S.A. Type W8 Methanometer weighs $6\frac{1}{4}$ lb. and is attached by a second cable to a cap lamp.

A sample of the mine air is drawn into the instrument by means of a rubber bulb and the air passes over two filaments mounted in separate compartments. One filament is specially activated to promote the burning of firedamp. The burning of firedamp on this filament throws the circuit out of balance and causes a pointer to move along the meter face. The meter is marked off with two scales reading 0 to 2 per cent and 2 to 5 per cent firedamp.

The McLuckie Methanometer is contained in a metal case with an observation window. In the case is an accumulator, a combustion chamber fitted with a spiral platinum filament, a compensating chamber of the same size and a U tube containing coloured liquid with a scale fitted down the centre of the U.

A three-way tap is provided. In the first position, both chambers are open and a sample of the mine air is forced in by squeezing a rubber bulb several times. As a safety measure, the filament switch cannot be operated with the tap in this position. The tap is then turned to the second position, closing the chambers, and kept in this position for two minutes to ensure that the air in the two chambers is at the same temperature. The tap is then turned back to the first position momentarily and then returned to the second position. This is to allow the air in the two chambers to equalize at atmospheric pressure. With the tap still in the second position, the current is switched on and the filament can be seen glowing through the observation window. At the end of two minutes the current is switched off, any firedamp present having been burnt.



McLUCKIE METHANOMETER

The instrument is allowed to cool for a further two minutes, to enable any steam present to condense, and for the air in both chambers to settle at the same temperature. At the end of this period, the tap is turned to the third position connecting both chambers with the U tube. Any reduction in pressure in the combustion chamber brought about by the burning of firedamp will be shown by the liquid rising up the tube towards the combustion chamber, the reduction in pressure being equal to the gas burnt. Through the observation window, the height of the liquid can be read against the scale which is marked in tenths of one per cent from 0 to 3 per cent.

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