lined with plush. For a youthful married woman this would prove a most successful toilette.

There is much that is new in the style of dress worn by the standing figure who is holding up some tapestry for inspection. The seal-brown plush bodice and train, the large point-lace collar, the folded satin waist-belt, the folded satin tablier with *flot* bows of the two materials, and the rich lace that is turned back on the train, the dark background showing off its design to advantage, all help to make up very picturesque attire.

The young lady who is looking at the tapestry wears the popular demi-toilette of the season—namely, a broché bodice, and a skirt that may be velvet, or gauze, or barège, or any of the intermediate materials, such as satin or faille. The model is blue broché, well covered with red and gold flowers; the skirt is blue velvet and satin, with red and blue bows. The Medici collar has a lace ruche inside. The last figure in the group illustrates a toilette of pale heliotrope and violet satin, made with much casing or gathering, white lace and *flot* bows. For a slight woman this is an exceedingly pretty dress. The three single figures in outline are all attired for walking. There is a young lady in an ulster of heather tweed, with a plush-lined hood, and a plush Tam o' Shanter cap—the inevitable Scotch bonnet widely patronised in England. A little girl of six, in a dark green foulé frock, with crimson satin gathered front, and a crimson and green plush bonnet, forms the second subject. And, lastly, there is a black velvet walking-dress, with a peep of crimson plush at the foot of the skirt, and a glimpse in the linings of the drapery and in the hood; jet agrafes and chenille and jet fringe make up the rest of the trimming to an exceptionally handsome winter costume.

THE GATHERER.

A Chemical Lung.

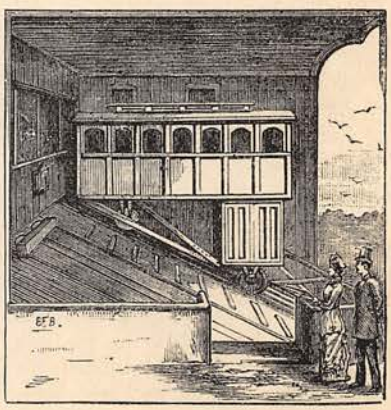
Most of the plans hitherto proposed for ventilating public halls, theatres, churches, tunnels, and other close places have involved the expulsion of the foul air and the admission of fresh to supply its place; but Dr. Richard Neale has ventured to call in the aid of chemistry for the purification of the air already contained in the building. His idea is, in fact, to make a kind of "chemical lung," which will effectually absorb the carbonic acid and sulphurous gases which are given off by living persons and artificial lights. Dr. Neale is of opinion that the noxious fumes which render the London Underground Railway so disagreeable to travel by, might be abolished by a process of this kind. In proof of it he exhibits the following experiment:—Sulphurous acid and water are mixed in a flask to imitate the air in the Metropolitan tunnels, and a small quantity of caustic soda in solution is added. On agitating the flask for a few seconds, the sulphurous smell is charmed away. Again, if into the same flask a current of carbonic acid is passed until it is so strong as to extinguish a lighted taper, a few shakings of the flask will be sufficient to allow the soda to absorb so much of the gas that on reintroducing the taper it will burn brightly. To apply this process to the Underground Railway, Dr. Neale proposes that each train should have its locomotive fitted with a tank containing a strong solution of caustic lime, or soda, through which the smoke could be made to pass before being discharged into the atmosphere of the tunnel. In this way the carbonic acid gas and sulphur could be eliminated. Further, there might be a special truck attached to the train, open at both ends and containing inside flat trays of the same absorbent substances. The plan is certainly worthy of trial, and objection cannot easily be urged against it on the score of cost.

Refuge Caves for Miners.

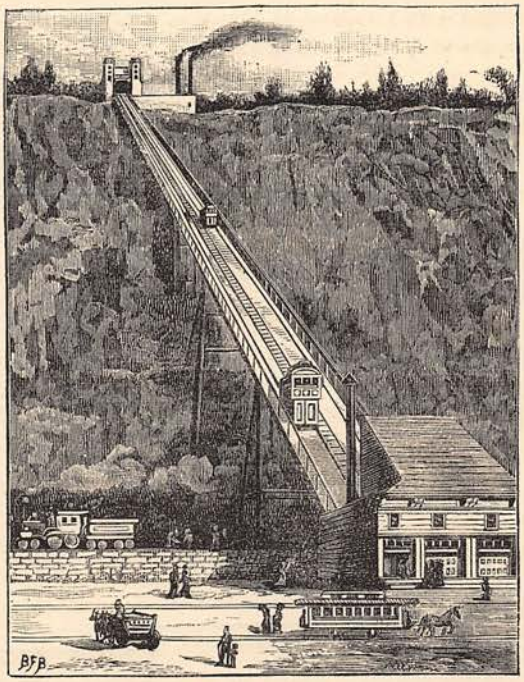
The disastrous explosions which every now and then occur have suggested to Mr. Latimer Clark, C.E., the advisability of providing caves of refuge down in the galleries of all coal-mines, to which the colliers might flee for safety either before or after a catastrophe. Each cave would be closed by a tight-fitting door, to keep out the foul gases of the drift it was annexed to; and air-pipes for the supply of fresh air would communicate with the surface. There the imprisoned miners by the help of a stock of biscuits, water, and candles, could live tranquilly until the relieving party arrived.

A Steep Railway.

In certain parts of the United States the growth of towns has been so rapid that, in several instances, natural features — such as hills, or even mountains—at one time regarded as beyond the sphere of



occupation have in a short period been covered with a dense mass of inhabitants. The spectacle of a town with a steep hill in perhaps its busiest quarter, though unusual, presents some disadvantages, but with their characteristic enterprise our "American cousins" have faced engineering difficulties of the gravest description and triumphantly overcome them all. It is now becoming customary, in the special circumstances alluded to, to lay down a railway for the purpose of climbing the hills, and a glance at the accompanying wood-cut will explain how the ascent is effected. This view represents the line belonging to the Duquesne Incline Plane Company, at Pittsburg, Pa., and having for its object the surmounting of the hill known as Mount Washington, which overlooks the site of the historical fortress that played so prominent a part in the years preceding the Declaration of Independence. The perpendicular height reached by the line is 400 feet, the length of incline is 703 feet, and the rate of ascent is 30½ degrees. The roadway consists of a double line, one car ascending while its companion descends, and *vice versâ*. The motive-power is a double engine of 70 horse-power, situated at the top of the incline. Motion is communicated to the cars by a large drum carrying steel wire cables of 1¼ inch diameter. A safety cable of 1¼ inch diameter is also constantly used. Each cable is 900 feet long and able to bear a perpendicular strain of 50 tons, the working strain, however, amounting to only one-fifth of that quantity. Should the driving cable break, the safety cable is at once tightened by special appliances and the cars are stopped. The cars accommodate twenty-five passengers, and the security of this mode of climbing hills, although apparently not unattended by danger, may at once be inferred from the fact that though 500,000 persons have already patronised the line not one individual has been injured.



A STEEP RAILWAY.

Making Paper Waterproof.

The following is a new German method for making paper waterproof:—To a weak solution of ordinary glue add a little acetic acid; then make another solution by dissolving a small quantity of bichromate of potash in distilled water. Mix these two liquids well together, and then draw the sheets of paper to be made waterproof through the mixture. After this it is only necessary to hang up the sheets to dry. As regards the proportions of the chemicals, about 5 per cent. of acetic acid and 7 per cent. of saturated solution of bichromate of potash will answer very well.

A New Dye from Poplar-Wood.

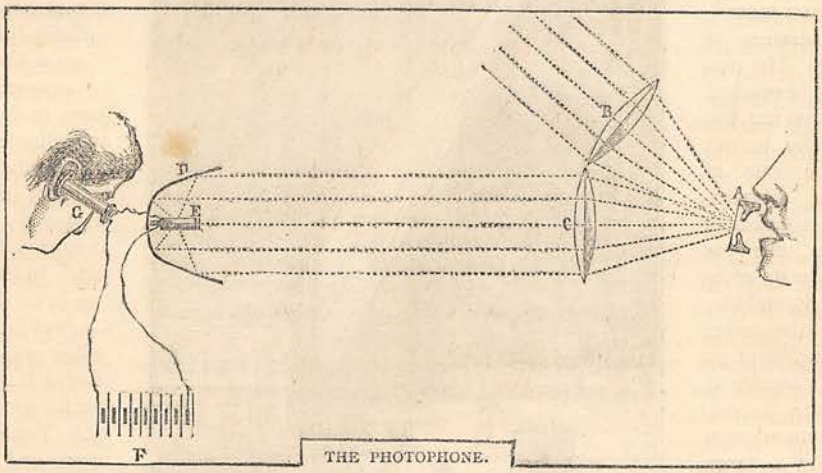
A fine golden-yellow dye, which has received the name of "Ericine," is now made in America from the young wood of poplar-trees. The shoots and twigs of poplar are cut off and crushed, then boiled in alum-water, in the proportion of ten pounds of wood to one pound of alum and three gallons of water. The boiling occupies about half an hour, the liquor is then filtered off. In the act of cooling it clears and thickens, throwing down a greenish-yellow deposit of resinous matter. When sufficiently clear the liquor is again filtered, and then left exposed to the air for three or four days more, according to the state of the weather. Under the action of the light and air, it quickly oxidises and assumes a rich golden tint. In this condition it can be used for dyeing all kinds of fabrics. To give yellow and orange-yellow shades, it is used by itself; but for green it is mixed with Prussian blue, for brown and tan it is mixed with oak-bark, and for scarlet and orange tints it is blended with cochineal. For wall-papers and hangings it makes a warm and quite innocuous yellow colour.

Lightning Photographs.

The duration of a lightning-flash was estimated by Sir Charles Wheatstone to be less than a millionth of a second, and hence it is that the extraordinary sensitiveness of photographic plates to light impressions is indirectly demonstrated by the photographs recently taken by Mr. R. Crome, of Liverpool, by means of the lightning-flash. Some of the flashes were rendered on the gelatine plates employed with very great definiteness, but the surrounding objects illuminated by the discharge were rather feebly displayed. Mr. Crome concludes therefrom that, though the rays of the lightning-flash are very active, there is not an adequate volume of light to illuminate a landscape with sufficient clearness to allow of a successful photograph of it being taken; but perhaps if still more sensitive plates were employed, better results would follow.

The Photophone.

Some of our readers may have heard that Professor Graham Bell, the well-known inventor of the speaking telephone, had deposited a sealed packet with the Franklin Institute of America, containing an account of a new discovery by him, which was thought to bear upon the problem of transmitting light along a wire to a distant place by means of electricity. At the late meeting of the American Association for the Advancement of Science, this communication was made public by Professor Bell, and though it does not show how images can be transmitted by telegraph as was expected, it nevertheless divulges a very interesting discovery, which may be regarded as a step towards the invention of a veritable telephote, or light telegraph. This is nothing less than the transmission of telephonic messages, both in music and speech, along a beam of light in lieu of a metal wire. By the heliograph a series of light signals can be flashed for a distance of 100 miles or more in a clear atmosphere such as that of Algeria or Afghanistan ; each flash of the light constituting an element in the letter signalled. But Professor Bell, by an ingenious refinement of the heliographic process, has succeeded in transmitting not merely crude mechanical signals, but all the vibrations of the human speech. This he has done by means of the speaking telephone, and the property possessed by selenium of varying in its electrical conditions under the influence of light. This much being premised, we may now turn to the figure which represents the arrangement of apparatus termed the "photophone."



THE PHOTOPHONE.

On the right is the transmitter of the sounds to be despatched, whether vocal or instrumental, and on the left is the receiver. The transmitter consists of a vibrating diaphragm, A, fitted with a mouthpiece, and similar to the plate of a speaking telephone. A beam of light from any source sufficiently bright is concentrated on the diaphragm, A, by the lens, B, and the diaphragm, which is silvered so as to reflect the light, is placed in such a position relative to the lens, B, as to project the light along a line joining the axis of another lens, C, and the axis of a parabolic reflector, D, placed at the distant station, and forming part of the receiving apparatus there. The object of the lens, C, is to render the divergent rays proceeding from the diaphragm parallel, in order that when they strike the interior of the reflector, D, they shall be again reflected to a single focus, wherein is placed a small selenium cell, E, which is electrically sensitive to light. This selenium cell is connected in the circuit of a voltaic battery, E, and a speaking telephone, G. If, now, a person speaks or makes a sound into the mouthpiece of the transmitting apparatus, the vibrations of the diaphragm, A, will undulate the beam of light thrown from it, and these undulations travelling along the parallel beam to the reflector at the receiving station, will be directed upon the selenium cell through which the electric current from the battery is flowing. The consequence will be that they will vary the internal resistance of the selenium to the passage of the current, and in this way modify the strength of the current flowing through the telephone. In short, the current in the telephone will ebb and flow in sympathy with the waves of light, that is to say, with the vibrations of the diaphragm, hence it follows that the sounds heard in the receiving telephone are an imitation of those uttered at the transmitter.

About fifty different forms of photophone have been devised by Professor Bell, but these are simply modifications of that described. The extreme distance through which the instrument will work successfully has not yet been determined, but it is believed that it will be limited only by the difficulty of adjusting the instruments at widely different stations, and the penetrative power of light. Musical sounds can, of course, be transmitted with equal facility ; and a system of audible telegraphic signals could be sent, which might be interpreted according to the well-known Morse code.

Cinchona in Bengal.

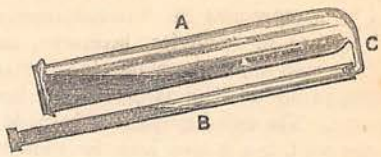
Quinine, the tonic principle of cinchona bark, is one of the most valuable remedies known, and it is grati-

fying to learn that it has been successfully acclimatised in India. The Bengal plantations are now paying handsomely. During the past year, about a million young trees have been planted, and nearly 400,000 lbs. of bark have been collected. A large portion of this yield has been sent to London, for sale and manufacture into quinine; but the greater part has been made use of in the Government hospitals and dispensaries throughout India. Not only is the Government enterprise a commercial success, but inasmuch as it renders the market less dependent upon the forests of South America for this precious drug, it is likewise a benefit to the world at large.

New Sea-Sounders.

Sir William Thomson has of late years given his great abilities chiefly to the improvement of the means of navigation. His patent compass is now being fitted on all the best steamers, including the Czar's yacht, *Livadia*, and his wire sounding apparatus for ascertaining the depth of the sea is also in request, especially for ships engaged in laying submarine cables, and mail steamers approaching dangerous coasts. Its great merit consists in the rapidity with which a sounding can be taken, owing to the small resistance offered by a wire compared to a hemp rope in being pulled aboard after the sounding-lead attached to it has reached the bottom. By its means "flying" soundings can be readily taken while the ship is going at full speed. It is a great advantage for rapid soundings to have a gauge which will of itself tell the depth without reckoning the length of wire paid out, for that is greatly in excess of the actual depth; and Sir William Thomson has devised two different gauges. One consists in sinking along with the lead a very fine capillary tube of glass coated internally with chromate of silver. The tube is open at its lower end for the sea-water to enter and rise in the bore. As it rises it discolours the internal coating, changing the yellow chromate into white chloride of silver. The height to which it rises is, of course, proportional to the pressure, and the extent of discolouration is therefore a measure of the depth. A simpler gauge has, however, been quite recently invented by Sir William. As shown in the figure, it consists of two glass tubes, A and B, one wide and the other narrow, connected by a cross capillary tube, C. The open mouth of A is covered with a cotton cloth, and that of B by a plug. When the tubes are lowered with the lead into the sea, the water forces its way through the cloth in the tube, A, and thence through the capillary passage, C, into the narrow tube, B. The quantity forced through the capillary into B, is proportional to the pressure, and hence to the depth. It is indicated by graduations on the tube, B, which are thus a measure of the depth. As the gauge is drawn to the surface, the air in it expels all the water remaining in the wider tube, A, but that in B remains there until it is let off by taking out the plug. To protect so fragile a contrivance from damage, it is enclosed in a suitable iron case perforated with holes to admit the sea.

While upon the subject we may also mention the new "nipper-lead" of Mr. Lucas, for bringing up



specimens of the sea-bottom. It is simply an ordinary lead, fitted with two hollow nipper-blades or spoons, kept apart against a strong spring by a locking bar. The shock of the open spoons striking the bottom unlocks the bar, and the spoons close together, clipping up at the same time a portion of the bottom, which they retain in their clutch until hauled to the surface for inspection. So effective is the nipper-lead, that it will snatch up a sheet of paper from a flat table.

The Telephone in Mines.

An interesting and highly useful application of the telephone has recently been successfully carried out in connection with the ironstone mines of Messrs. Stevenson, Jaques, and Co. at Boosbeck, in the North of England. The mines have been placed in telephonic communication with the smelting furnaces at Acklam, fifteen miles distant. This, however, is but "half of the story." The wires having to pass through the company's offices at Middlesborough, a set of telephones has been put up there, and so the three places have been brought within speaking distance of each other. Orders and the like conveyed from the central office can be most distinctly heard at either or both branches, the speaking being transmitted by a patent micro-telephone, which entirely overcomes the effects of induction from contiguous telegraph-wires. Besides establishing communication between Acklam, Middlesborough, and Boosbeck, the enterprising manager has carried a wire into the mine itself, so that it is possible for people in the furnaces or in the offices to speak direct to the men at work in the mine. This is certainly a notable achievement.

Cooking Burners.

Mr. Thomas Fletcher, F.C.S., is well known as the inventor of a great variety of ingenious heating appliances, such as gas furnaces, cooking stoves, and burners for chemical and domestic use. His "Solid-flame Gas Cooking Burner" is illustrated in Fig. 1. It consists of a tap for conveying the gas to the burner, a perforated copper dome for the flame, and three supports for the pot or pan to rest upon. It is stout and not readily injured, being designed to stand the roughest work. The flame is quite solid, and free from smell, so that it does not taint the viands in process of cooking. As regards its capabilities, it will boil an egg, cook a chop, bake a round of beef in a sheet-iron oven, or even (if desired) melt half a hundredweight of lead in an iron pot. Only six minutes is required by it to boil a

quart of water in a flat copper kettle. Mr. Fletcher also arranges two or more of these burners on a "boiling bench," so as to heat or cook upon a larger scale. Fig. 2 represents his "Instantaneous Water Heater," for use in sculleries, lavatories, and bath-rooms. The cold water flows into the heater by the upper pipe, as shown, and issues by the lower pipe as hot water. The ordinary pattern is made to hang against the wall, but it can also be mounted on a tripod. There are several sizes made—from one

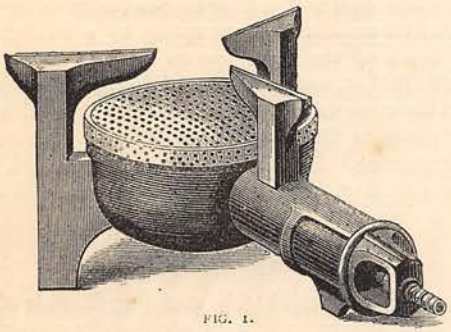


FIG. 1.

giving a pint of hot water per minute to one giving a gallon and a half every minute. All of these supply pure water fit for cooking, either boiling or at lower temperatures, almost immediately after lighting the gas. Mr. Fletcher is also the originator of a simple and convenient "Triple Gas Oven," which can be fully heated in less than a minute. One 12 by 14 inches in the bottom is sufficient for the service of an ordinary family, and costs on an average one penny for two and a half to three hours' work. The lower compartment of the oven is used for roasting joints, &c.; the upper compartment for puddings and pastry, &c.; while the space underneath the oven can be utilised for roasting potatoes or apples, or toasting bread; and the space on the top for heating plates, &c.

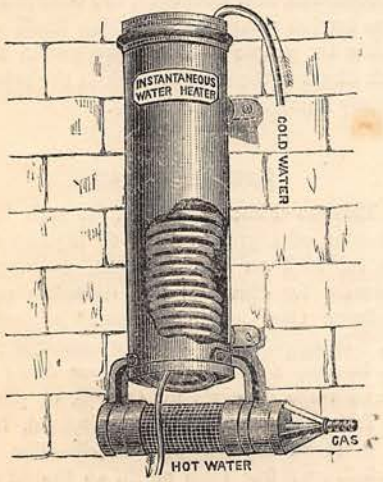


FIG. 2.

The gas is burnt below, and the heated fumes are carried round the food in an iron flue, so that they do not in any way contaminate the latter.

Prize Double Acrostics.

(Being the set of Six Double Acrostics for which the Prize of Five Pounds has been awarded.)

I.

SWEETEST flower of purity,
Whiter than the driven snow;
The drink the gods might joy to see
In their feastings here below;
Rolling river, calm and wide,
Icy waters pouring forth
In a full unceasing tide
To the ocean of the north.
Norman fear-inspiring king;
Tenant of the forest wild;
He whose death could Scotland bring,
Though he was Italia's child;
Island of refreshment, where
Sandy billows beat the coast;
And the flower the spring doth bear
Where the first sun shineth most.
Give their names and you shall see
What the two sweet flowers may be;
This the foremost letters give,
That will in the finals live.

II.

Within a shaded avenue
Close by a babbling brook,
I saw a youthful maiden sweet
Sit reading from a book.
It was a time of springtide joy,
I heard her name its name,
And then a word that meant that she
Would ever be the same.
(Inscribed it was on locket fair
In characters of gold,
Fit emblem of a faithful heart
Of such angelic mould!)
Far off the tall cathedral towers
Of a northern town were seen,
And my fancy strayed to a river sweet
Where my wandering feet had been;
But, as I mused, an Indian prince
With loving speech drew near,
And the maid at length became his bride
At a town in Lincolnshire.

The names of two old English towns
In these seven words we see;
The initial letters give the first,
The next in the last will be.

W. M. ADAMS.

(To be continued.)

DOUBLE ACROSTIC COMPETITION.

We are at length able to announce that the prize of Five Pounds offered for the best set of Six original Double Acrostics in Verse has been awarded to Mr. WILLIAM MAURICE ADAMS, *33, Lupus Street, London, S.W. Special Commendation is accorded to* LINDA GARDINER, *Winchester, for the variety and excellence of her Acrostics. It also affords us great pleasure to be able to state that many out of the very large number of Acrostics submitted to us possessed more than average merit.*

SPECIAL NOTICE.

The Six Prize Acrostics will appear monthly in due course; and as soon as the sixth shall have appeared (and not till then) the Editor will be happy to receive sets of Answers to the whole six; and for the best set (i.e. *the most correct and ingenious*) *the Proprietors of this Magazine offer a Prize of Two Guineas. Mere "keys" to the Acrostics, however correct, cannot be received, the answers or "lights" should be embodied in verse.*