4. The preceding experiments, as well as many others, are rendered far more marvellous when accomplished *without contact*. In fact, after a little practice a good Reader can succeed equally well when the Thinker is at a distance of some yards.

We must here particularly impress upon our readers one thing. *Thought-reading* is a misnomer. *Mental picture-reading* is the real name for this power. When, for instance, the Thinker has fixed upon a word or a number he must not keep the mere *idea* of it in his head, or repeat it perpetually to himself, he must *see* it in his mind's eye, as if written up in chalk letters, for it is only by the faculty of *inner sight*—if there is such a thing—that the Reader reads. Thought-reading is very fatiguing to both parties concerned, but especially to the Reader, who should beware of too long-continued exercise of his powers. We have spoken of both in the masculine gender for convenience, but according to our own experience, men make the best Thinkers and women the best Readers. This may not be an universal rule however.

There remains but one thing more to say. Every one who sees these phenomena will ask—does ask—"What explanation do you—does science—offer for these marvels?" The answer is very simple, and may be given in one word—None.

THE GATHERER.

A Railway Velocipede.

The accompanying woodcut illustrates a velocipede designed to transport the *employés* of a railway company along the lines. It is now used on most of the railways round Lake Michigan. The machine is propelled by the rider working the hand-lever, as shown; but the feet can also be called into play in order to insure great speed. As the friction on the rails is very slight, the driver can readily attain a speed of twelve miles an hour; and if a train should be seen approaching, he can dismount very quickly and cant it off the rails.

Cable Tramways.

In Chicago tramcars are now drawn by cables instead of horses, and with an advantage in cheapness and speed in going uphill. The cable which draws the carriages passes in a tube under the roadway to drums at both ends of the course, driven by stationary engines, and the winding and unwinding of the cable draws the carriage along. It is intended to introduce the plan at Highgate Hill, London, and if successful there we may expect to see it adopted at other places in this country. Experiments of a similar kind have recently been made on the canal from Liège to Antwerp, in which the boats were hauled by an endless cable of Bessemer steel, supported on pulleys along the banks, and kept in continuous motion by stationary engines. The length of the cable was five miles, and the whole canal can be divided into five-mile lengths worked on this plan. The engines act on the cable through a clip-pulley, and the boats are connected to it by cheek-nippers which slip past the supporting pulleys without releasing their hold of the cable.

Steel from the Ore.

By the new process of Mr. Bull, iron and steel can be produced in the blast furnace direct from the ore. No solid carbon is employed to reduce the ore, and nothing but iron ore and flux is put into the blast furnace. The fuel is gas delivered in a hot state, and hot air is blown in to burn about ten per cent. of the gas and keep the slag fluid. The gases rise through the ore and flux in the form of carbonic oxide, hydrogen, and nitrogen, while the ore is being fused, reduced, and carbonised into steel. By the "Bull process," the mildest sorts of ingot iron and steel, suitable for rails, tools, and cutlery, can be produced from inferior ores direct and tapped from the blast furnace, like the ordinary pig-iron in the old process.

A New Power Meter.

Mr. C. V. Boys has invented a very ingenious device for automatically recording the work done on the piston of an engine in any given time. In the ordinary meters of this kind the work is recorded on an "indicator diagram," whose area measures the amount of work done, but to obtain these it is necessary to multiply the motion of the piston, and this introduces error. In the new apparatus there is no such multiplication of motion. It consists of a piston controlled by a spring,

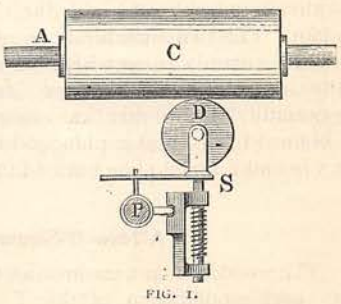


FIG. 1.

whose displacement is a measure of the steam-pressure of the cylinder at every moment, and this is caused to turn a light and delicate disc, D, Fig. 1, on a swivel axis, more or less, according to the movement of the piston. The disc or wheel runs along the surface of a barrel or cylinder, C, and when it moves parallel to the axis this cylinder does not move; but when the disc is turned however slightly by the spring piston, the barrel moves round the axle, A, on which it is mounted. The more the disc is turned the more the barrel rotates, and as the displacement of the disc is a measure of the steam pressure, the number of turns made by the barrel is a measure of the work done. A dial is added to indicate these turns of the barrel, and they may also be recorded on paper. The action on the disc is effected by the piston-rod, P, carrying two pins, one of which enters a slot as a guide, and the other gives inclination to the swivel frame, S, and thus to the disc, D. This disc is kept by means of the spring, S, in contact with the integrating cylinder, C. Fig. 2 is an engraving of the meter as actually made.

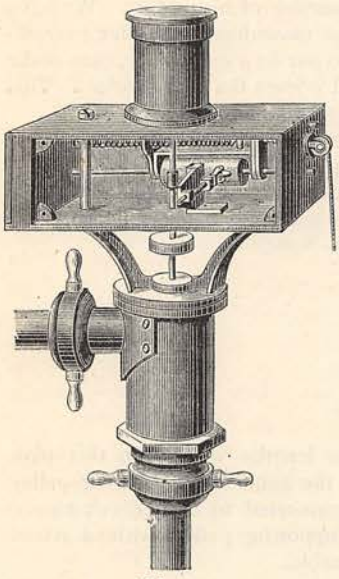


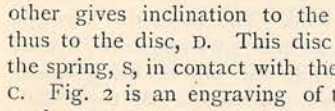
FIG. 2.

A Fire Battery.

Dr. Brard, whose electro-generative fuel we have already noticed in the GATHERER, has devised another heat battery which is worthy of attention. He takes a metal dish and puts some fused nitrate of potash into it. He then covers the bottom of the dish with asbestos cloth, which he afterwards coats with lampblack, and under the cloth places a metal plate. The two metals act as poles of the cell, and yield a steady current when the whole is placed over the smoky part of a Bunsen flame. It may not be generally known that an electric current can be obtained from a poker plunged into the upper part of a fire and a metal plate buried in the lower part.

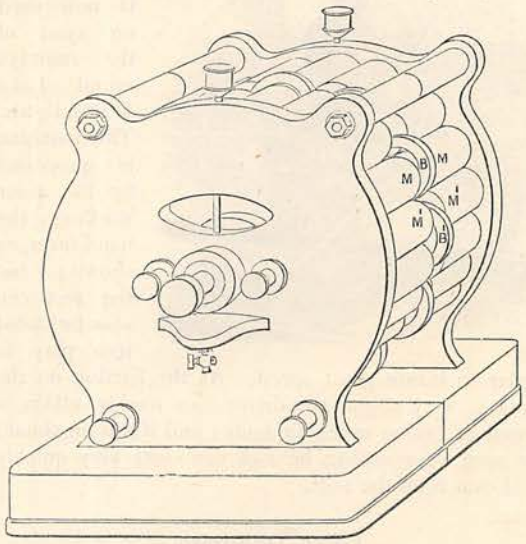
A New T-Square.

The woodcut that accompanies this note represents a novel modification of the T-square, whereby its usefulness is largely extended. The shaft, as will be seen, is triangular, the sides being equal and each impressed with a different scale of measurement. The head of the square is pierced with an equilateral opening, to admit of the entrance or withdrawal of the shaft, which is held in position by means of the binding screw fitted at the back of the stock. The under portion of the head is cut away in order to allow of the square being accurately adjusted to the surface upon which it is to be applied, thus keeping it both level and upright. The scales on the different sides may be brought into use by withdrawing the shaft from the stock, and then screwing it up again with the particular scale required. In this way the draughtsman may set his points directly from the square without employing his dividers.



The Ferranti Dynamo.

A new dynamo-electric machine of more than usual power, considering its size, has been brought out under the above name. It consists of two sets of electro-magnets, M M, M′ M′, arranged in rings, and presenting opposite poles to each other. Alternate magnets of each set are, however, of opposite polarity: thus, if M M are north and south poles, then

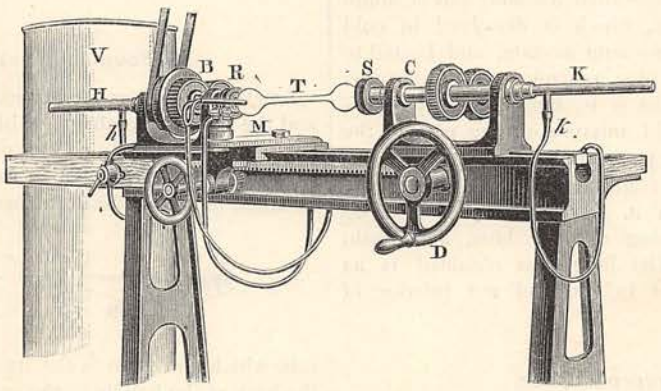


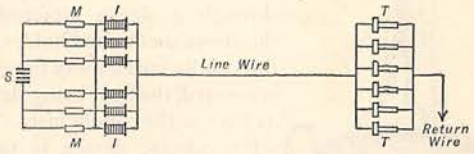
M′ M′ are south and north poles respectively. The poles are brought very close together, and, in the magnetic space between them, a ring or circle of copper coils, B B′, is passed at a high velocity. These copper coils are the special feature of the Ferranti machine: each is composed of a ribbon of copper about three-quarters of an inch wide, varnished to insulate it, and simply rolled up on itself in a coil, as ribbon is usually wound. They are mounted on an axle passing through the heart of the machine, and so connected together that the currents excited in them all unite into one. By reason of the alternating poles of the magnets, the current changes rapidly from positive to negative, negative to positive, and so on; hence it cannot be used to charge an "accumulator," or to excite the magnets of the machine. These

require to be excited by a separate small machine giving a continuous current in the same direction. A small Siemens machine, weighing 2 cwt., is at present used by Mr. Ferranti for this purpose. The Ferranti dynamo stands 25 inches high, and measures 24 × 22 inches. Yet this small machine, which only weighs 11¾ cwt., will feed 300 Swan incandescent lamps at the nominal brightness of 20 candles each. Nominal luminosity is, however, usually higher than actual luminosity in displays of this kind, and the lighting power of incandescent lamps is generally taken on trust at present. The Ferranti machine, however, is an advance on foregoing dynamos for incandescence lighting on a medium scale. Whether it will prove as economical when made on a larger scale remains to be seen. The power absorbed for the 300 lamps was stated to be 27 horse-power, and this would give about 11 lamps to the horse-power. The usual allowance is only 10 lamps per horse-power utilised.

Glass-Blowing by Machinery.

The growing demand for glass bulbs, such as are used in making electric incandescence lamps, and the mercurial pumps employed to exhaust these lamps of air, has called into existence a very ingenious apparatus for shaping heated glass much more quickly and effectively than can be done by the hand and mouth of the ordinary skilled glass-blower. The new machine is the joint invention of Mr. F. Wright and Mr. M. W. W. Mackie, Electrical Engineers, and is likely to greatly reduce the price of incandescent lamps. It is so simple in its action, and does its work so well, that we are forced to wonder why a similar machine has not been invented before. The action will be understood from the illustration, where B and C are two headstocks, one of which, B, is fixed while the other is capable of being slid to and fro by a rack and pinion worked by a handle, D. Each headstock is fitted with tubular mandrils, which are revolved at the same speed by a belt from a motor. At the end of each headstock is fixed a tube, H and K, closed at their outer ends, but communicating freely with the tubular mandrils; and to each of the tubes, H and K, there is a communication by flexible tubes, *h* and *k*, to a reservoir of compressed air, each pipe being fitted with a valve and stopcock to control the supply of air. Between the two headstocks is mounted a blow-pipe on a slide, M, and this pipe is supplied with gas and air by flexible pipes, as shown. The blow-pipe is so mounted that the flame can be turned on the glass at any angle, and its temperature can be regulated by stopcocks controlling the supply of air and gas. Each of the mandrils is fitted with a chuck, R S, at its inner end, to grasp the glass tubes to be drawn. To work the machine a glass tube, T, is inserted into these clutches, and caused to revolve by starting the mandrils. The flame is then directed on it, and the heated part drawn out by moving the headstock, C, away from B. By admitting air under pressure into either or both of the pipes, H K, the tube can be blown out into a bulb of the desired size and shape. The air is supplied by a bellows feeding a reservoir, V, which keeps the pressure equable. Glass tubes or rods can in the same way be jointed together, ,and candlesticks or other simple objects turned out of glass as in a lathe. Small machines are, we believe, to be made for the use of chemists, and sold at a low price.





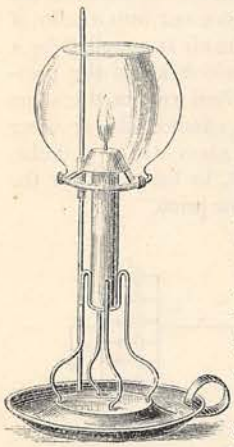
Telephoning Music.

A new method of transmitting the music of a band or opera to a large number of listeners by means of a single telegraph wire has been devised by Dr. James Moser, of the Compagnie Internationale des Téléphones, Paris, and was recently tried with great success between the Hippodrome and the Place Vendôme, Paris. The figure is a sketch of the electrical arrangement. Here, M M are a series of microphone transmitters, which are fitted up on the stage where the music is produced, and the current from a charged secondary battery or accumulator is sent through them, and also through the primary circuits of a series of induction coils, I I. The musical undulations in this current set up by the microphones induce corresponding undulations of a sharper kind in the secondary circuits of the coils, and these being connected to the line wire, the undulatory current traverses the line to the distant station, where a number of telephones are connected in the line circuit in the way shown. As many as a hundred persons, each having a separate telephone, can be listening to the same music transmitted over a single wire in this manner. Dr. Moser also claims that the "induction noises,"

so often heard in telephones to the confusion of the speech, are subdivided by this plan among the different telephones, and thus reduced in loudness.

A Globe-holding Candlestick.

The accompanying woodcut represents a simple and ingenious contrivance whereby a candle-flame may be protected by a globe. The candle is supported by four stout wires rising out of the stand, and the shade, or globe, rests upon a metal holder placed on the head of the candle, the wick projecting through a hole in the ring. Ring and globe are steadied by a rod (fastened to the stand) that passes upwards through a sleeve attached to the above-mentioned holder. As the candle burns away the globe is lowered, the light being shaded as long as the candle lasts. This self-regulating device is rather a novel and decidedly a useful feature. By using a candle the flame of which is protected in this way, the risk of accident from fire is greatly lessened.



Soluble Alizarin.

The beautiful alizarin blue has at last been obtained in a soluble condition. Until now it had to be employed in the form of a paste or an alcoholic solution; but Herren Brunck and Graebe, two German chemists, have reduced it to a soluble state, and it is now manufactured by the Badische Alizarin and Soda Fabrik. The new blue is made by mixing common anilin blue with 25 per cent. of a strong solution of sodium bisulphite of 1·25 specific gravity. From this is obtained by evaporation a double salt of anilin and sodium bisulphite, which is dissolved in cold water, mixed with chromium acetate, and heated to 140° Fahr., when a blue precipitate of alizarin is formed. To dye cloths it is, therefore, only necessary to prepare a cold mixture of one part of the anilin double salt, two parts of chromium acetate, and six to eight parts of a starch paste of 10 per cent., and dip the cloth in it, then steam it for ten or twenty minutes to bring out the blue, and wash, soap, and dry it. The blue thus obtained is as beautiful as the finest indigo, and not inferior in durability.

A Fireproof Door.

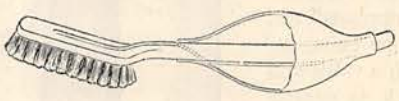
According to numerous experiments that have been made in America on the best kind of door to stop fires, the best yet tested is one of wood covered with tinned sheet-iron. The planks of the door should cross it at an angle of 45°, or at right angles, and there should be at the least two thicknesses of wood. The tinned iron is then put on, all the joints being soldered as in making tin roofs. Thus formed, the door should be supported by hangers moving on an inclined rail over the doorway, so that when free to move it will close by its own weight. On the jamb opposite the door when it is open should be a wooden casing covered on every side with tin, and into which the door will fit tightly when it closes by moving on its track, the inside of the casing being wedge-shaped. The casing on the opposite side should fit the door closely, so as to leave no cracks at the sides of the door. The door is kept open by a bolt on the inside of the door-jamb, the pressure of the door keeping the bolt in position. On the under side of the arch should be a wire having a joint or link in its centre, soldered with a metal fusible at 160° Fahr.; and above the bolt of the door should be a weight supported by a wire connected with the wire holding the fusible link. This weight moves in guides, and is wedge-shaped below. The threshold should be of brick or stone to resist fire, and high enough to keep out water in case the room is flooded. Doors and window-shutters of this pattern are reported to stand the test of fires which warp and destroy iron doors, while the automatic closing device shuts it even when the fire is in a house opposite. The device is recommended by the leading American insurance companies.

Preserving Honey.

Honey contains on an average about 1 per cent. of formic acid; and a German chemist, Herr Mylins, observing that crude honey keeps better than that which has been clarified, inferred this to be due to the presence of this acid in the crude sort. His conclusion was just, for on adding some formic acid to clarified honey he found the acid prevent fermentation without impairing the flavour.

A Fountain Tooth-Brush.

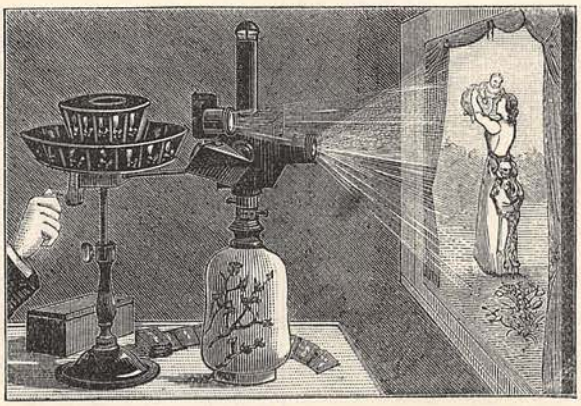
American novelties are almost proverbially ingenious and the fountain tooth-brush, of which we append an engraving, is certainly no exception to the rule. The chief feature of this invention consists of a rubber bulb attached to the handle of the brush, and a metal "feed"



tube which passes from the interior of the bulb along the back of the handle to the centre of the brush-head, where it enters an aperture for leading the water from the bulb to the bristles of the brush while in use. It need hardly be said that the bulb may be supplied with other liquids besides water.

A Projecting Praxinoscope.

The new praxinoscope, invented by M. Reynaud, for showing images to a large assembly, is illustrated in the engraving. In the praxinoscope a series of pictures, representing different attitudes of the figure, are painted on glass and set round in a circular frame, so that when the frame is rapidly rotated the images of the different pictures coalesce, and produce a semblance of animation in the figure. In the new praxinoscope, as shown, the postures or phases forming a subject are painted on glass plates connected in a continuous flexible ring. One of these flexible rings is placed in the open crown of the instrument. The background forms a separate picture, and the projection of the subject and background is effected by two separate object-glasses, the latter by the glass seen in front of the lantern, and the former by the glass seen at the side. The light of the lantern, after passing through a condensing lens, is reflected from a plane mirror through the painted glasses of the ring, and falls on a conical prism of mirrors within the ring, as shown. From this the rays are reflected through the object-glass and thrown upon the screen as a magnified image, as shown. The figure thus produced appears endowed with life, and is seen in the middle of the background. The beauty of M. Reynaud's apparatus is that it can be used with an ordinary moderator or other household lamp, and is thus adapted for drawing-room use.



Transmitting Power by Air.

A plan for distributing energy from a central station by means of air is about to be tried in Paris. There is a central station where the air is kept exhausted in a system of pipes radiating from the station to the houses of the district around. The main pipes are of iron, and the service pipes entering the houses are of lead. In the premises connected to the system are stationed Tatin "rarefied air-motors," which operate by means of exhausted air, and these drive the machinery as required. The experiment in Paris will extend over a circle of 600 mètres' radius from the central station. The Parisians have already enjoyed the unification of their time, a pneumatic system somewhat similar to this. We may add that a proposal to work the signals and point-levers of railways by means of compressed air has been put forward by Mr. Stroudley, an English engineer. His object is to relieve the overworked signalmen of the heavier part of their duties.

Self-acting Railway Signals.

The French railway company, the Chemin de Fer de Lyons, is at present testing the merits of a water-power apparatus for working the fixed and detonating signals of their line. It consists of two pedals placed beside the rails, and supported by solid springs on the top of two piston-rods, which work in cylinders containing glycerine and communicate with each other by halves. When a train passes it produces on these pedals at the side of the rails a swaying movement like that of a balance. When the last wheel of the train presses on the second pedal it drives the liquid into the other cylinder, and the piston in that is connected by a jointed rod with a disc or detonating signal which it operates. The detonating signals are supplied by a wheel, which carries sixty of them, and brings a fresh one forward after each discharge.

A New Spectrum Giver.

Professor Rowland, of Baltimore, a very promising American physicist, has devised an apparatus for giving more distinct and detailed spectra of the sun and other lights. His "concave diffraction gratings" are slabs of speculum metal, slightly concave, polished on the surface, and ruled in parallel lines very close together by a diamond graving point actuated by a special machine. These lines are so fine that as many as 42,000 of them have been engraved by Professor Rowland in the space of an inch; but many more could be ruled in this space if desired. When a beam of solar or electric light is reflected from the ruled surface on a screen, a beautiful series of spectra are obtained, succeeding one another along the screen. The advantages of the new instrument are that it gives finer spectra than have hitherto been attainable, and greatly shortens the time of photographing these. Professor Rowland and Captain Abney are preparing a map of the whole solar spectrum by their aid.

Dugong Oil.

However unpleasant cod-liver oil may be to "take," it may be safely asserted that it will always hold its own against any proposed substitute in respect of its wholesome and invigorating properties. That it is nauseous is undoubted, and this fact probably explains the reason for pressing from time to time the claims of new rivals upon the notice of the profession. The oil derived from the dugong is said to be viewed with

some degree of favour, inasmuch as it is free from the disagreeable odour and taste of cod-liver oil, while possessing the valuable qualities of the latter, and being also much less liable to change in keeping. When slightly warmed it becomes clear and colourless, but at ordinary temperatures, owing to the separation of its more crystalline constituents, it is opaque. The dose is the same as of cod-liver oil. The dugong, it should be added, is an animal belonging to the class *Sirenia*, and was long thought to be an herb-eating cetacean. It certainly feeds upon seaweed, but is not a whale. It is found off the western coast of Australia, in the Eastern Archipelago, and even off the East African coast. There is no likelihood of its beating the cod-liver oil out of the market, for whereas the fish is as plentiful as ever, the numbers of the dugong are considered to be diminishing, and the promotion of the oil industry would probably lead to the extinction of the animal.

A Tuning-Fork Piano.

Musical instruments in which the notes are produced by the strokes of the hammer on metal bars instead of wires are called tuning-fork pianos, but they have never come into use because of the difficulties of construction. Mr. W. Fischer, of Dresden, has, however, recently brought out one which gives purity of tone and considerable power of modulating the note after it has been struck. This good result is simply due to details of construction, which we need not particularise. We may mention, however, that he takes care to eliminate the beat of the hammer itself, and damps the harmonics of the forks by special means.

Cutting Glass by Electricity.

Electricity has been called in to aid in cutting glass. The ordinary way of severing large cylindrical vessels of glass is to surround them with a thin thread drawn from the molten glass, and cool them suddenly by contact with a cold body. A surer method is that of Herr Fahdt, of Dresden, who surrounds the vessel with a copper wire, through which he sends an electric current sufficient to heat it to whiteness, and thus the glass is broken along the line of the wire. The rough edges are then rounded off by turning the object in a blow-pipe flame.

An Iron Man.

Mr. Hornburg, a clever mechanical engineer of Launceston, Tasmania, has invented an iron man who can walk about automatically. The figure, which is dressed like a footman, is 5 ft. 10 ins. in height, and weighs 160 lbs. Its action arises from the power of a coiled spring concealed inside, and it can not only walk, but grip and drive a perambulator with great ease. While upon this subject we may also mention that a very exquisite watch, constructed entirely of iron, was recently exhibited by Messrs. Crowther of Kidderminster.

Why all this Smoke?

LETTERS TO THE EDITOR.

SIR,

I read with great pleasure the letter from "Ex Fumo Dare Lucem" which appeared recently in your pages, as it undoubtedly raises a question of the utmost importance to dwellers in towns and cities. I myself am not a sanitary engineer, neither am I a member of the Smoke Abatement Committee, so that I do not at present see my way to propose an infallible specific for the nuisance from which so many of us suffer; nevertheless, there is one aspect of the subject which I should like to bring before your readers.

All large towns—and especially our great metropolis—are intersected by several lines of railway, over each of which from 100 to 1,000 trains may pass daily; and from the engine of every train, as it passes along its route, proceeds a nauseous column of smoke, poisoning the air and adding greatly to the discomfort caused by the combustion of coal for cooking, heating, and other purposes. Now, why should not legislation be brought to bear on these locomotive smoke-carriers? Why should not the railway companies be forced either to burn smokeless coal, or to provide engines that will consume their own smoke?

This is but a suggestion; still, if it should chance to provoke others of more value, I shall feel that I have not written in vain.

I am, &c.,

A DWELLER NEAR A RAILWAY.

SIR,

It seems to me that the reason why there is all this smoke is not far to seek. The general public are not sufficiently interested in the subject, and have not enough of the self-sacrificing spirit to try and improve matters. Patents and schemes without number are brought before us, and many of them would achieve to a large extent the desired result, if only they were universally adopted. But they are not given a fair trial even.

Just look at my own case. I have had my kitchens fitted with the new smokeless stoves; my drawing-room and dining-room, my library and study are heated with gas or asbestos—I don't know what it is to see the good roaring blaze of a coal fire; and all my upper rooms are warmed by hot-water pipes. And what is the result? While smoke is never seen to leave *my* chimneys, all my neighbours go on as before, as though no smoke appliances had ever been invented; my garden—if such a miserable place can claim the name even—is black with soot; I am thanked by nobody, and am daily expecting the fire insurance companies to pounce upon me for increased premiums for "extra risk" appertaining to my "improvements." Is it surprising that I am disheartened, and am seriously thinking of returning to the old ways?

I am, Sir,

A SCIENTIFIC HOUSEHOLDER.