ing to his phonograph rehearsing the beautiful strains of some *prima donna* who has herself ceased to exist, but has left her song behind her like an echo to keep her memory sweet; or he can hear the phonograph recite to him, with all the arts of elocution, some masterpieces of poetry and the drama. If he goes to a public lecture on some illustrious person of the past—some great statesman or orator of our own time, perhaps—he will be presented with a likeness of him which may be literally a speaking one, for the phonograph will at the same time deliver accurate imitations of his eloquence. How interesting would it be, for instance, to have a museum wherein were treasured up some of the memorable sayings of our national history—the last speech of the Great Commoner, or the famous command of Wellington to the Guards at Waterloo! It has long been a regret of the artist that he cannot paint sound, but in the theatre of the future the scenery will be enlivened by the fitting sounds of nature or art, and the realistic illusion rendered all the more complete. The nightingale will warble his liquid notes in the village lane, and the brook will murmur musically as it sparkles over its bed. The whistling of the wind through the tempest-tost wood, the furious rattle of the rain on the wet leaves, will all be imitated from nature by the phonograph; and the rumbling of barrel-thunder will be heard no more. The familiar noises of streets, the puffing of a railway train, and even the multitudinous din and tumult of a battle, may be imported into certain scenes to endow the effect with all the vivid power of reality. Even the orchestra may take the form of a phonographic organ revolved by mechanism. We have photographic albums now; there will be phonographic ones in the future. "It will be possible a generation hence," says Mr. Prescott, a distinguished American electrician, "to take a file of phonograph letters spoken at different ages by the same person, and hear the early prattle, the changing voice, the manly tones, and also the varying manner and moods of the speaker, so expressive of character, from childhood up."

J. MUNRO, C.E.

THE GATHERER.

The Block in the City Streets.

Some important observations on the causes of the frequent stoppage of the street traffic in the City of London—more especially in the immediate neighbourhood of London Bridge—have been made by the Commissioner of City Police, which seem to deserve attention. In a report to the Police Committee, Colonel Fraser—who speaks with authority on the subject—states that in his opinion the obstruction and delay which so often arise, more particularly with heavy vehicles proceeding towards the East End, are not, as many suppose, attributable to the narrowness of London Bridge, but rather to the insufficient width of some of the streets at the northern end of the bridge, into which the main portion of the traffic is compelled to pass. The three streets to which he alludes are Great Tower Street, from Little Tower Street to Mark Lane; Lower Thames Street, from Fish Street Hill to St. Mary-at-Hill; and especially the western end of Fenchurch Street as far as Lime Street; and the inconvenience which is liable to be occasioned in these thoroughfares, and the necessity for increasing their width, which Colonel Fraser urges upon the Committee, are apparent when we learn that in neither of them does the breadth between the footways exceed fifteen feet. This space is large enough only to permit the passage of two lines of traffic, the consequence being that the temporary stoppage of a single vehicle for any purpose brings the whole stream of one line to a standstill, while in the case of Fenchurch Street—which is more important than either of the others—there is not only this disadvantage to contend with, but there are also further difficulties, caused first by the additional traffic received from Lombard Street, and next by the numerous accidents to horses occasioned by the asphalte roadway. London Bridge, on the other hand, is, says Colonel Fraser, the only important thoroughfare in which serious stoppages of the traffic seldom occur, and he gives as reasons for this that the bridge is of uniform breadth throughout, that it provides ample room for two lines of vehicles in each direction, and that, it being devoid of buildings of any kind, drivers of carriages and vans have no necessity or inducement to linger on the way.

A Sailing Car.

Nearly 250 years ago great astonishment was excited by the performances of some Dutch sailing carriages which actually travelled a distance of forty-two miles in two hours—an unheard-of speed in those times. Of course the mode of locomotion entirely depended upon the state of the wind, and it could therefore only be made available under certain favouring circumstances. With the invention of railways, the wind carriage fell into disuse for many years—though, indeed, there is no reason to believe that it was ever anywhere very common—but it now appears not unlikely that it may be revived in some districts, because of these very railways which had temporarily put a stop to it. At all events, for a considerable time past a sailing car has been advantageously employed on the Kansas Pacific Railroad for the purpose of conveying repairing parties to pumps, telegraph-wires, &c., along the route. The vehicle has an average speed of thirty miles an hour, but with a strong breeze right abeam it is capable of traversing forty miles in the same period. The car has four wheels, each thirty inches in diameter, is six feet long, and weighs 600 lbs. The sail has two booms, respectively fourteen and fifteen feet in length, with an area of about eighty-one square feet. The mast is eleven feet high. When it is necessary to bring the car to a standstill, all that is requisite is the lowering of the sail, when the vehicle will speedily lose its impetus and pull itself up. The sailing car, being exceedingly cheap to construct and maintain, saves the labour involved in running a hand-car; though, on the other hand, it should not be forgotten that the latter is always available in any and all weathers, wind or no wind.

Imitation Tortoise-shell and Mother-of-Pearl.

Tortoise-shell, the product of the shield of a species of sea-turtle, has long been in favour for the manufacture of ladies' hair-combs and the like. The richness of its colour and the beauty of its markings amply account for this. But it is valuable, therefore high-priced, and therefore beyond the reach of many a purse. It is long since imitation combs, made of horn and stained, and presenting a tolerably fair resemblance to the original, were provided to meet the requirements of the fair sex. We have now to direct attention to another simple method of getting up a "shell." On a piece of glass there is placed a layer of clear gelatine, on which the distinctive markings of the tortoise-shell are obtained by dotting it with a concentrated solution of an aniline colour named "vesuvin," to which a beautiful reddish tint may be given with "foxin," another aniline colour. The solution may also be scattered over the surface, and the drops allowed to run together. The whole when dry receives a coat of glue.

Mother-of-pearl, which is procured from the shells of large molluscs found in tropical seas, can also be imitated somewhat readily, though the process is more difficult. On a piece of glass place a gelatine layer containing a concentrated solution of some salt, such as white vitriol, Epsom salts, &c. When this salt solution has dried and become crystallised, a solution of so-called pearls is spread over the whole. This latter material is derived from the very fine and silver-like "sounds" or air-bladders of fish, which possess considerable iridescence. When the gelatine layer thus treated has dried, a coat of glue is applied, and the article is finished.

Double Acrostic.

Who could imagine, gazing on my first,
As motionless and stiff it dormant lies,
That when the summer comes its bonds will burst,
And as my second flutter to the skies?

I am a sea-fish, and by many bought,
Yet hardly relished when by oarsmen caught.

Though a "sandwich" isle I be, before you're fed
You'll have to work hard for your ham and bread.

There meet the gay—but, ah! does not the grave
Find many a warrior, many a hero brave?

Lightly skimming o'er the waters,
Swift before the freshening gale,
Quickly fly the happy moments,
While we speed upon our sail.

A thousand nights her tale went on,
Her spouse was conquered when 'twas done.

If to the Paris Exhibition you should go,
'Twill be as well this useful verb to know.

It comes with the spring, in beauty most rare;
And fades in the autumn, when winter draws near.

"The stately flower of female fortitude,
Of perfect wifehood and pure lowlihead."

In days long ago they burned and tormented
Poor creatures for *this* who were only demented.

Answer to Double Acrostic on p. 383.

ASTARTE—MANFRED.

A ntiu M.	An ancient town of Italy where the statues of Fortune were believed to nod.
S o fi A.	Capital of Bulgaria—Sophia: "Ah! how Sophia."*
T heo N.	A philosopher who frequently walked in his sleep.
A ltdor F.	Where Tell shot the apple.
R umou R.	
T h o E.	One of the Nereides.
E pho D.	Part of the dress of the Jewish priests.

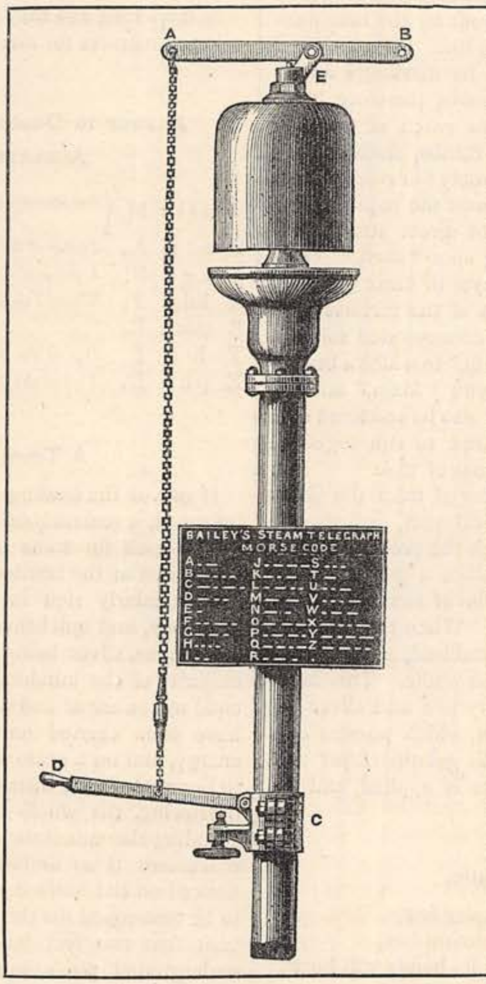
A Town on the Slide.

If one of the leading New York dailies be correctly informed, a remarkable phenomenon has been transacting itself for some time past at Virginia City, the chief town of the territory of Nevada. This territory is particularly rich in minerals; gold, silver, lead, antimony, and quicksilver being found in more or less abundance, silver being specially plentiful. The vast majority of the inhabitants are miners, and the principal mines are at and near Virginia City. Operations have been carried on for several years with great energy, and on a scale of such magnitude as actually to honeycomb the district. As a consequence of this burrowing, the whole town is said to be slowly descending the mountain on which it is situated. The movement is so uniform and gradual as to be unnoticed on the surface; but a water-main was found to be telescoped for the space of a foot, and to be so bent that two feet had to be repaired, while other underground pipes were discovered to be crowding towards each other. On the west side of the town, a long crack nearly eight inches wide has been traced, the ground on one side of it being three feet lower than on the other. The inhabitants are said to view this state of affairs with much *sang-froid*. Probably they feel that though their town may subside, its chances of being swallowed up are at least remote. We cannot, of course, vouch for the authenticity of the New York paper's information; and having regard to the extraordinary character of the occurrence, ample confirmation is imperatively required.

* "Ah! how Sophia"—the old catch, that sung quickly makes, *A house a-fire!*

Telegraphy by Sound.

It is remarkable that when one ship wishes to "speak" or signal another, it does so by means that are certainly of a somewhat crude description. While in other directions we have availed ourselves of the results of scientific research, our mode of "inter-vesselary" communication is almost of primitive simplicity. We have not yet got much beyond the fog whistle and the speaking-horn, both implements of a very restricted usefulness.



The ancient method of sending stereotyped sentences by flags is only of use in dire necessity, and then, of course, only in daylight. For these impracticable and limited means of communication, Mr. W. H. Bailey, of Salford, proposes to substitute a system of telegraphy by sound, which shall be serviceable within a distance of from three to fully six miles, under any given circumstances, for conveying any given instructions or message.

The instrument which he proposes to use is a large steam-whistle, so designed that a pianoforte touch will give an opening to the steam-way and cause the emission of a percussive sound, long or short, as required. At the lower part of the whistle is an equilibrium valve, so balanced as to be readily susceptible to the action of the lever A B, which rides upon the spindle E. This valve is depressed when the end A is moved downward by the chain and handle D. If D be kept down for, say, half a second, the rush of steam through the whistle would produce a long or "dash" sound, while a depression for a quarter of a second would produce a short or "dot" sound. If the distance from the whistle to the operating lever is great, requiring a considerable length of chain, a weight is suspended from B, which acts as a counterbalance. At C is an arrangement for the adjustment of the chain if it should happen to stretch. The whistle-bell is likewise adjustable so that high or low pressure may be used, and the best results derived from the steam of the boiler at work. The whistle is generally placed about ten or twelve feet above the operator. Attached to the stem is an enamelled iron plate containing the dot and dash letters of the Morse alphabet, so that by referring to it any person not familiar with the apparatus could yet work the whistle. The rate of transmission averages from ten to twenty and even thirty words a minute.

This instrument is valuable not only in foggy weather, or when boats are obscured by powder-smoke, but can also be used with great advantage for communication between outward and homeward-bound vessels, which can exchange messages of considerable length without the necessity of stoppage or the sending of small boats, a diminution in speed being all that is requisite. Vessels in distress or otherwise in need of assistance could communicate in definite terms with the shore or with other boats. Even when ships are docked or in harbour, the steam-whistle telegraph can still be called into requisition; and it will be found well adapted for a variety of purposes besides.

Mr. Bailey has tried hard to get his system adopted, but nothing short of an international "Congress" could make it really useful, although, if British ships were to introduce it, those of other nations would no doubt follow suit. As he pertinently observes, it would be useless for one vessel to make signals to another which the latter could not understand.

Hardened Glass.

It has fallen within the notice of most people, that hardened glass occasionally shatters itself into countless atoms without any apparent or, at least till recently, assignable cause. A German "scientist" has succeeded not only in ascertaining the reason of, but also in discovering a remedy for, the peculiar tendency alluded to. According to Herr Siemens, this unpleasant and at times decidedly awkward effect is due to overhardening. Where there is ground for believing that overhardening may exist, it can be detected by the prevalence of violet tints exhibited by the polarisator when the glass is examined. It is obvious that Herr Siemens' valuable discovery must be turned to practical account by manufacturers and not by private individuals, who of course could not utilise it, and would much prefer to rest assured that the glass had been carefully tested before it was fashioned into the thousand and one articles which are formed of the many-propertied substance.

Hardened glass, it is stated, can be more easily and cheaply manufactured than ordinary glass, while it has a resisting power equal to from eight to ten times that of the latter.

How the Phonograph came to be Invented.

An English patent of last year, taken out by Mr. Edison, clearly shows that his mind was being prepared for the conception of the phonograph. In that patent he describes a means of recording ordinary telegraph signals by a chisel-shaped stylus indenting a sheet of paper, enveloping a cylinder or plate, along the line of a groove cut in the surface of the latter. These indented marks were to be capable of re-transmitting the message automatically over another wire if required. Here then was the soil prepared, and the vibrating disk of the telephone was the seed needful to germinate the phonograph. That seed was dropped into it by accident.

"How did you discover the principle?" asked a newspaper reporter of Mr. Edison.

"By the merest accident," replied the Professor. "I was singing to the mouthpiece of a telephone, when the vibrations of the voice sent the fine steel point into my finger. That set me to thinking. If I could record the actions of the point, and send the point over the same surface afterward, I saw no reason why the thing would not talk. I tried the experiment first on a strip of telegraph paper, and found that the point made an alphabet. I shouted the words 'Halloo! halloo!' into the mouthpiece, ran the paper back over the steel point, and heard a faint 'Halloo! halloo!' in return. I determined to make a machine that would work accurately, and gave my assistants instructions, telling them what I had discovered. They laughed at me. That's the whole story. The machine came through the pricking of a finger."

Our Fuel Supply.

Although the substances which furnish artificial heat and light are many, and although recently there have been several attempts, and in part successful, for the utilisation of peat for these purposes, yet coal must be said to far surpass any or all of those as a fuel. Although in Britain it was used at least as early as the ninth century, yet it did not come much into household consumption in London till towards the end of the thirteenth century, and strong prejudice was felt against it; but when the supplies of wood for firing began to fail, the needs of London citizens overcame their objections to the "stench" of Newcastle coals; but the difficulty of carriage inland, and other circumstances of an allied nature, limited the demand, whilst the mode of working in the colliery districts limited the supply. As time passed on, and roads improved, the use of coal became greater; tram-roads were employed to more expeditiously transport it for shipment; and long lines of asses were employed to carry it to inland towns within a reasonable distance from the pit. When the railway system began to be formed, and lines increased, the facilities of supply became very materially enlarged; and the introduction of steam navigation and of gas-lighting had previously greatly swollen the demand, which was further enlarged afterwards by the enormous increase in metallurgical use. There are no official records of our production of coal before half of this century had gone; but it has been estimated that at its commencement the annual output of coal did not exceed 10,000,000 tons, whilst so late as 1845 the output is stated at under 32,000,000 tons. In 1855 the exact estimates of the keeper of mining records gave the quantity at 64,453,000 tons; in 1865 it was raised to 98,150,000 tons; in 1870 to 110,431,000 tons; in 1873 to 127,017,000 tons; and the increase was then checked by the coming into operation of the Mines Regulation Act. It has since re-commenced, and for 1876—the latest year for which official figures are procurable—the output is officially returned as 133,344,766 tons, or considerably more than double what it was a score of years ago. At the same time, whilst there has been that large increase in the production, it has not been wholly distributed in an equable manner throughout the various districts which contribute to the total coal production of the kingdom. About thirty years ago, it was estimated that the Northern coal-field supplied one-fifth of the coal consumed in and exported from the kingdom; and it now supplies rather more than a fifth of the increased production, but this is due to the development of the South Durham part of the district, then producing a very limited quantity, and now having the largest yield of any part of the Northern district. But there is far from a continuance of the proportionate output from all the coal-fields of the kingdom, there having been a large development of the great coal-field of South Wales, whilst some of the smaller have known a shrinkage in their yield. And in many districts this fact is also known, for the produce of those districts is from a smaller number of collieries than it was—the tendency evidently being to produce a given output from as few collieries as possible. The Mines Regulation Act added largely to the establishment charges of collieries, and where these are spread over a small output only they press more heavily upon it, and enlarge the cost of production more than when distributed over a greater area of produce; and this fact explains in large degree the present tendency. Moreover, in the older districts where some seams are working thin, there is usually a lessened produce in periods of low prices, for the additional cost of mining coal in such circumstances hampers the district in the competition with others more favourably situated.

The large output of coal to which we have attained now is over 133,000,000 tons yearly, or nearly one-half the production of coal of the entire globe. When it is remembered that the coal-yielding area of the United Kingdom is only about 11,900 square miles, and that of the world is stated roughly at 270,200 square miles, it will be at once evident how very largely the coal-fields of the kingdom are drawn upon. We have in Great Britain six exposed coal-fields, and six partly or wholly concealed, stretching over about a twenty-second part of the area of the kingdom. The rich basin of South Wales holds above a third of the whole of the available coal in the kingdom ; the Midland field—extending over the southern part of Yorkshire, and the adjoining counties—contains about a fifth of the whole ; the old and famous field of the North —that in Northumberland and Durham—contains a ninth part ; then follow those of Lancashire and Cheshire, of Staffordshire, that of Bristol and Somerset, the Scottish coal-fields, and others of subsidiary rank. In the various coal-fields, at depths not exceeding 4,000 feet, and in seams not less than one foot in thickness, there was, according to the Royal Commissioners' estimate of 1871, not less than 90,207,285,398 tons of coal; or, adding coal probably lying under the Permian, New Red Sandstone, and other strata, about 146,480,000,000 tons. As we have seen, we are increasing our demands upon our coal-fields in a rapid ratio when the growth for a number of years is considered ; and it becomes interesting to trace the production of the various districts, more especially as the yield is not in proportion to the extent of the coal deposits. The Northern coal-field, according to the estimate just referred to, had coal at the depth and in the thickness named, to the amount of 10,036,660,236 tons, and its output in the most recent year was 31,991,623 tons. South Wales, with 32,456,208,913 tons of coal, has a production of 11,973,336 tons ; the Midland coal-field was estimated as containing 18,172,071,433 tons, and its output may be set down roundly as about 25,500,000 tons ; Lancashire and Cheshire, with 5,546,000,000 tons, have a production of over 17,900,000 tons. The Bristol field is credited as enclosing 4,218,970,762 tons ; and its yield may be stated as about 1,000,000 tons ; the North Staffordshire area encloses 3,825,488,105 tons, and yields 4,077,548 tons annually ; the South Staffordshire, 1,906,119,768 tons, with an output of 10,081,067 tons ; and North Wales, 2,005,000,000 tons, and a production of 2,207,250 tons. There are small English coal-fields in addition, the estimated contents of which are 2,041,620,251, tons ; there are the Scottish coal-fields, with 9,843,465,930 tons, and an output of over 18,400,000 tons ; and the Irish coal-fields, with 155,680,000 tons, and the small output of about 125,000 tons. It may be thus seen that there is great variation in the proportion of production to the quantity of available coal, and that the duration of the coal-fields would be very different if the respective rates of output were continued as at present. And, indeed, the estimates that have been formed of the duration of given coal-fields vary most widely : thus as regards the great coal-field of the North it has been supposed that it would be exhausted in 200 years, whilst other estimates have lengthened out the duration of the same coal-field to over 1,700 years !

On the question of the duration of our coal supplies as a whole much may be said, and the estimates of the period of time that will be needed to exhaust this supply of fuel have varied from 110 years to seven or eight times that period. But it is evident that neither of the two numbers needed to give the quotient is exactly definable. On the one hand, the quantity of coal might be increased by the discovery of additional beds ; by the use of other modes of utilising the known beds, so as to extract them from deeper depths, or by subaqueous borings. And on the other hand, the production of coal varies, and is likely to vary more largely. There is an increasing use for gas-making and other purposes, as well as for steam power ; our exports of coal are also considerably enlarged ; but there is now a very great economy in the use of coal in several of the chief modes of consumption. For instance, it is believed that more than a third of the whole of the coal brought to bank in the United Kingdom is used for the manufacture of iron, and there is a very great economy already effected in the use of coal for this purpose, whilst a farther saving is in progress. Less than a century ago, it is believed that it took 9½ tons of coal to make a ton of pig-iron ; now this is accomplished with the expenditure of about 1½ tons of coal, whilst the utilisation of the waste gases is effecting a further saving. It is true that, as such economies are known, there is a greater use of coal ; for cheaper goods mean usually a greater use ; and it is to this fact we have to trace the increased consumption of coal in the iron manufacture as a whole, whilst it is known that the consumption is really less in proportion. Our coal is simply so much power—the "accumulated solar energy of past ages" —and it could not but be regrettable to see that so large a portion was used in a mode which has been demonstrated to have been a wasteful one. To the extent to which we obtain the full value of the force coal represents, to that extent we may fairly congratulate ourselves on the use. We are far from having attained that full value yet ; but so far as we have increased the proportionate value extracted, our enlarged coal consumption is matter for congratulation rather than regret. In the iron trade, we are unquestionably using greater economy in the consumption of fuel ; and the very great waste which has been permitted so long in the use of coal for steam purposes is being lessened. In the consumption for this purpose, it is notorious that there has been very great waste—to such an extent that it is said that only one-tenth part of the theoretic power in coal has been used. In the manufacture of coke, as well as in the consumption of coal for domestic purposes, and in other of the uses to which this fuel is put, there is ample room for further economy, and for the reduction of the consumption of coal in proportion to the theoretic power obtained from that used. It is evident, therefore, that with changes, accomplished and expectant, in the nature and degree of the use of coal, and with a varying production, as well as with the possibility of further coal discoveries, or their equivalent, the duration of our coal-fields becomes indefinite.