THE EARTHQUAKE IN ESSEX.

THE various reports which have been published in metropolitan and local journals give nothing like an accurate account of the earthquake which shook a large portion of the eastern counties of England last Tuesday week. Nor is this matter for wonder. Those on the spot, brought face to face with the possibilities of a tremendous catastrophe are not those most likely to write coolly on such a subject. It is impossible indeed for those who have not endured such an experience to form anything like an adequate conception of the terror which an earthquake can inspire. It is not so much what has occurred, as the uncertainty concerning what will happen next that produces this feeling of dread. The utmost difficulty is experienced in getting an accurate account of what really takes place. We might as well expect a sufferer in a railway collision to give a precise description of the events which resulted in maiming him, in their proper sequence. The tendency all round is to exaggerate, and we have felt that it would be desirable to place in our pages for future reference the result of our own personal observations. We were not on the spot at the time when the earthquake occurred, and our visit of inspection was paid last Saturday and Sunday, when the excitement had disappeared and the scattered thoughts of the inhabitants had been recalled.

The facts which we can place at the disposal of the seismologist are, as usual in earthquake literature, very few—at least, those which are in any way likely to strengthen one theory or weaken another are very few. It may, however, be taken as certain that the nature of the motion is known. Very careful answers from intelligent eye-witnesses all lead to the same conclusion, and an examination, equally careful, of the ruins made by the earthquake strengthen that conclusion. There was a direct upheaval of the ground, which fell again immediately, the fall being accompanied by a violent vibration or shaking. If there was any lateral motion it must have been very small. The mere rising and falling of the ground did little harm; the subsequent shaking did a great deal. To make this matter quite clear we may cite the experience of Mr. Clegg, C.E., municipal engineer, Colchester, to whom we are indebted for valuable information and assistance in pursuing our inquiry. Mr. Clegg was at breakfast when the shock took place. Workmen were employed in the upper part of the house. Mr. Clegg's first impression was that one of the men had fallen off a ladder, and he ran to the door of his room and called to the man. Immediately afterwards all the bells in the house began to ring. This ringing was apparently due to the shaking or vibration which followed the primary upheaval. Again, a great deal of damage has been done to tiled roofs, which abound in the district. When we have seen one house, we have seen all. The chimney was thrown down, and smashed through the roof. Apparently this happened first. Then all the tiles were shaken out of their places, some falling to the ground, but by far the greater number being packed on the roofs at a lower level. The accompanying sketch, Fig. 1, will give an idea of what we mean. The result is not only precisely what can be produced by a violent shaking, but it does not seem that it could have been produced in any other way. The position of the roofs has in no way affected the facts; whether the buildings which they covered faced north, west, east, or south, the result is the same. The position of the tiles on the roofs, however, materially affected the results. Thus the tiles near the walls have seldom been moved, while the ridges and upper portions have been stripped. In one instance, on a slightly raised portion of a house, the roof has been shattered, while on the rest of the house it has scarcely suffered at all. Fig. 2 will serve to illustrate what we mean. This shaking is a well recognised concomitant of earthquakes. Thus Mallet, the greatest authority on the subject, says in the *Nautical Almanac* under the title, "Seismology or Earthquake Phenomena":—"Before, during, or immediately after the passage of the great earth-wave or main undulation, a continuous violent tremor or short quick undulation—like a short chopping sea—is often felt. This may arise from secondary elastic waves accompanying the great earth-wave—like the small curling or capillary waves on the surface of the ocean swell—produced probably by comparatively minute or secondary impulses, due to the discontinuous and heterogeneous nature of the formations through which the normal wave has been propagated. Sometimes, however, a number of shocks occur so rapidly as to convey the impression of a continuous jar or tremor, and may be succeeded by one or more *great* shocks; this is probably the source of 'tremor observed before the shock,' as the subsequent arrival of the transversal waves is of the tremors after it. (For other complications of the phenomena see Mallet's 1st, 2nd, and 4th Reports, Brit. Ass.) It is very desirable that the interval in time between these minor oscillations should be observed by a seconds watch, and also the total duration at each epoch of motion and of rest between consecutive movements. Narrators often confound the whole of each epoch of such rapidly recurrent shocks, with one shock supposed to last a considerable time."

FIG. 1

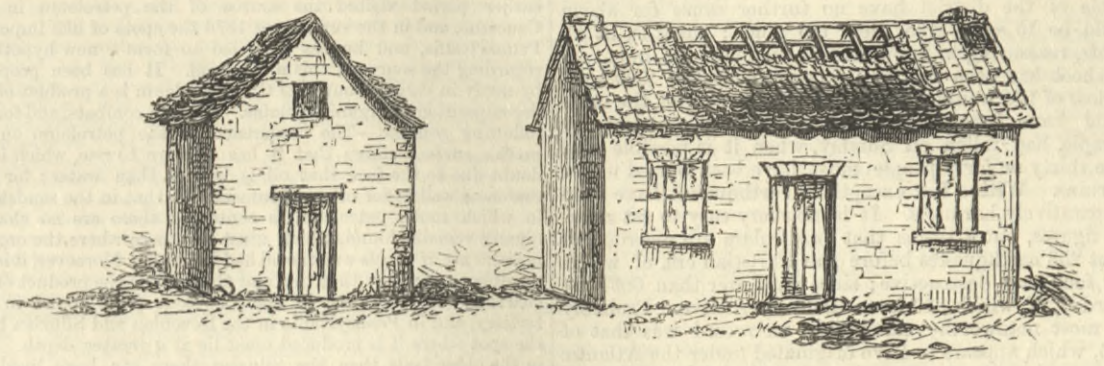
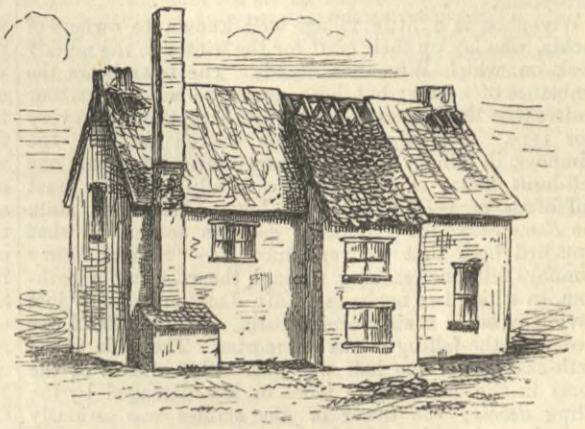


FIG. 2



EFFECT OF THE EARTHQUAKE ON HOUSES IN ABBERTON AND PELDON.

MAP OF PART OF ESSEX, AFFECTED BY THE EARTHQUAKE OF 22nd APRIL.

The accompanying map shows that portion of the district most severely affected. The nearer the sea level the worse the shock. Possibly some deductions of importance may be drawn from this. It is proper to state here, that only in a very few instances have really substantial buildings suffered at all. We read in the local press that Langenhoe Church has been completely destroyed. Those not living on the spot will naturally conclude that a church is a large and substantial edifice, and the circumstance that a church has been ruined will appear very alarming. As a matter of fact, however, Langenhoe Church was a small building crumbling to ruin, and we should say unfit for use. It possesses a large Norman tower, built, so far as can be gathered, at least 800 years ago. At some very remote period this tower leaned to the south-east, and was buttressed up by a huge rough mass of masonry. The tower has been cracked from top to bottom time out of mind; and it can be seen now that the mortar used in its construction was not very good. It is not remarkable, therefore, that the battlements on this tower were shaken off, and falling through the roof, of which the timbers were rotten, has involved the whole in destruction. The wonder is that Langenhoe Church did not fall down bodily of itself long since. The only specially interesting point about its destruction is that the ground at the south side of the church seems to have sunk. The stones in the floor of the little chancel have at one side perceptibly gone down. When it is borne in mind that the church tower had evidently needed propping up centuries ago, to keep it from sinking in the same direction, it is possible that the earthquake only developed and strengthened some original tendency to subsidence. Most of the strata here are brick earth on chalk; rather a treacherous foundation. Peldon Church is a much larger structure and in better preservation than Langenhoe Church. It, too, has a tower dating from the reign of the Conquerer. This also has a crack in it, but the crack has not been opened. The battlements have been shaken down on the roof of the church, and the lead flushing still stands up all round

where the battlements have left it. The tiled roof has been shaken off in great part, as in Fig. 1. Going into the church, it is seen that scarcely a portion has escaped. The whole structure shows the result of a violent shaking. The plaster has disappeared off the walls in all directions, and small cracks have been opened, which follow no particular direction. The chancel has been recently restored with flint facing and sandstone dressings. All this new work has been shaken ; that is the only word for it. The ancient buttresses of the church are cracked and split. An oak timber chancel arch, apparently new, has had all its joints opened. No disturbance of the floor is perceptible.

Wivenhoe is a little village well known to owners of yachts, who lay up their craft for the winter in the muddy creek on which Wivenhoe stands. The town bears the semblance of a ruin; but here, again, we must warn our readers that the houses are, with few exceptions, of a very poor type. The tiles have been shaken off, and the chimneys, in falling, have done much mischief. Only one well-built house in the place has really suffered a great deal of damage—Mr. Jackson's house, Wivenhoe Hall. The *Essex Standard* contains so good an account of what happened here that we reproduce it:—"Several heavy chimneys fell, one crashing through the roof into a bath-room, in which two nephews of Mr. Jackson had only just previously taken their morning bath. The bath itself was filled with the falling bricks and mortar. The gable at the north-east end of the hall was dismantled. Most of the rooms in the house were more or less damaged by the falling *débris*; the tower of the stables was seriously cracked, and will probably have to come down; two chimneys in rear were so injured that, for safety sake, they were at once pulled down; the north-east part of the entrance lodge, where the keeper resides, was greatly damaged, the top end being carried away, as well as some of the chimneys."

There is no evidence whatever available to show that the shock was not felt simultaneously over the whole district affected. This is quite consistent with what is known of earthquakes, the velocity of wave transit being very high even in chalk. The centre of maximum disturbance lay not far from West Mersea. On the roadside, near Strood Mill, stands the house of Dr. Green. This was a substantial, two-storied, double villa, and it gives evidence of having undergone much more than a shaking. The upper part of the house seems to have moved bodily on the lower portion; and further evidence of this lateral action is shown by the fact that a heavy flat cut-stone cap on one of the piers at the entrance gate, which pier is about 5ft. high, has been shifted bodily a couple of inches on the brick beneath it. This is the only house in which the glass in the windows has been directly broken by the shock, and the fracture is just of the kind produced when a sash is suffered to drop violently. There is no exaggeration in the following statement in the *Essex Standard*:—"Mr. Green's house is literally split from end to end—there is not a sound wall either inside or outside standing, all the windows in the house are smashed, the cap stone to the porch at the entrance is down, as also are the chimneys, one stack of which, falling upon Mr. Green's consulting-room, completely demolished the latter. Mr. Green, who fortunately had left the consulting-room only a few minutes before, was in the surgery adjoining at the time, and here he was startled by the bottles from the shelves falling upon and around him, perfectly smothering him with their contents. A massive pier glass over the mantelpiece in the drawing-room was wrenched from the wall, and fell into the middle of the room; lustres and other ornaments were strewed about, and the general furniture of the room disarranged. The upstair rooms suffered as much or more than the downstair ones, and are now altogether uninhabitable—in fact, almost the only room in the house that can be used is the kitchen." It is not easy to say in this case whether there was or was not any vibration, such as that which unroofed houses elsewhere. As we have said, the house looks as though the bottom of it had been violently pushed from under the top of it.

In Colchester there was little damage done worthy of note. We suppose that it would not be easy to find anywhere a town of such importance in which there were so many ricketty old chimneys. The ruin which has fallen on them is widespread, but no injury worth naming has been done to any well-built structure, if we except one steeple, off the top of which about 16ft. has been shaken. The water tower, which had about 930 tons of water in it at the time, remains entirely uninjured. We may sum up what remains to be said by stating that the great bulk of the injury has fallen on weak and ill-built structures; and while we have no intention of understating the appalling danger from which so many have escaped, we are bound to add that the shock had little in common with such catastrophes as those of Ischia or Java.

There is little to be learned which can interest the geologist. The most noteworthy fact is the rise of the water in the wells which supply the city with water. Mr. Clegg found that within a very short space of time the level rose in them to a height of 5ft. above the highest point at which it had ever stood before. This does not seem to be due to any increase in the quantity of water, but to an augmentation of head. The water has continued to rise slowly, and on Sunday stood 8ft. higher than yet recorded. This is probably due to a shaking of the chalk, which has opened up fissures communicating with water holes in the rock standing at a higher level than any previously tapped.

The freaks played by the shock are, in a few cases, noteworthy. At the "Rose" Inn, Pelden, the roof has, as usual, been shaken off, and the house is a good deal racked At the back is a brick chimney, some 15ft. high and 2ft. square; about half-way up it was supported by a band of iron put round, and a horizontal stay fixed to the roof behind it. The chimney has parted at the iron band, and the upper portion has been twisted round a couple of inches on the bottom. Another somewhat similar chimney has had all the bricks below the band loosened and ready to fall apart, as shown in Fig. 2. The upper portion is quite sound and unharmed. The circular stone tower, of Strood windmill, has been shaken and split all over, evidently by the vibration of the vertical wooden post carrying the mill above. Steam is supplied in aid of wind, by a small horizontal boiler in a house close by. The chimney, a square shaft, nearly new, some 35ft. high, and very well built, has parted at about two-thirds of its height from the ground, and the upper portion has twisted slightly on the lower. There is no evidence that any decided vortex motion was manifested by the earthquake, though the results are supposed to indicate this.

When additional scientific evidence has been collected we shall, perhaps, return to this subject. To say that the people of the district have no further cause for alarm would be to say a great deal too much; but it is, at all events, reassuring to know that no one has been hurt. If the shock had been felt at 9.20 p.m. instead of 9.20 a.m., the loss of life would have been very great: and the same would have been the case if Langenhoe Church, for example, had fallen on Sunday, when it is possible that some thirty or forty people must have been buried under the ruins. With a few exceptions earthquakes have been comparatively harmless. It is not very easy to get accurate figures, but it seems that particulars are recorded of about 258 earthquakes before the Christian era, of which only four were destructive; since not fewer than 6831 are recorded, of which 230 have been destructive. Probably the most noteworthy earthquake on record was that of 1755, which appears to have originated under the Atlantic Ocean, and to have affected no less than four millions of square miles. Lisbon was destroyed by a succession of shocks, the first being felt about half-past nine a.m. At Madrid, Gibraltar, Algiers, Funchal, in Germany and Sweden, successions of fearful shocks were felt. Throughout almost the whole of Great Britain and Ireland they were felt with more or less severity. England is by no means outside the earthquake zone; but the shocks recorded are comparatively trifling. Possibly this with which we are now dealing was one of the worst.

The shock of the 21st instant was preceded by another much slighter on the morning of the 18th of February, which was felt about 1.30 a.m., in West Mersea and Pelten. History records, moreover, a severe shock. In the parish register of St. Peter's Church, Colchester, is the following entry:—"On Thursday, Sept. 8, 1692, there happened about 2 of the clock in the afternoon, for the space of a minute or more, an universal earthquake all over England, France, Holland, and some parts of Germany. And particularly it was attested to me by the masons that were there a-plastering the steple of St. Peter's, in this town, and upon the uppermost scaffold, that the steple parted so wide in the midst that they could have put their hand into the crack or cleft, and immediately shut up close again, without any damage to the workmen (who expected all would have fallen down), or to the steple itself. Most of the houses here and elsewhere shook, and part of a chimney fell down on North Hill; and very many who were sensible of it were taken at the same time with a giddiness in their head for some short time. In witness of what is here related, I have hereto set my hand. Robert Dickman, Minister of St. Peter, Colchester." The following extract from "Bufton's Diary," quoted by the Rev. Bryan Dale, in his "Annals of Coggeshall," bears on the same point:—"1692 Sept. 8th being Thursday and the same day that Jacob Cox dyed about 2 o'clock there was an Earthquake at Coxall and many towns beside hereabouts and at London and several other Countries we heard and ye news-letter said it was at ye same time in Holland and ye rest of ye provinces in ye Netherlands—I was in our garret at that time and heard ye house crack and perceived it shake and was afraid it would fall and therefore ran downstairs."

On the map on the preceding page will be found the principal places we have named, such as Peldon, Langenhoe, and Wivenhoe. With the aid of this map it becomes possible to identify the locality of maximum disturbance, but it must not be forgotten that the shock was felt over a very wide area, extending on the south to London, and north and west to nearly as great distances. We may add that Colchester is precisely the same distance from London that Brighton is, namely, 50¼ miles.

PETROLEUM: ITS PROBABLE ORIGIN.

In a highly interesting article by the Right Hon. Sir Lyon Playfair, K.C.B., F.R.S., on petroleum, the light of the poor, he deals to a slight extent with the question of its origin. It is held by geologists that it is due to the charring action of heat on the pre-existing organic *débris*, on the bodies of trilobites, and such like remains are usually supposed to be the sources of it. But he writes, is then petroleum cosmic? Perhaps the question is not so absurd as it appears, he replies. Recent observations on the tail of the great comet which adorned the heavens not long since showed that it contained hydrocarbons very similar to petroleum. "I do not mean to indicate," he adds, "that the comet was a huge petroleum lamp rushing through space; still the detection of hydrocarbon in it is a significant fact. It lends considerable support to the idea that petroleum is being continually formed anew in the deeper parts of the earth. In all petroleum wells water is also found. In the depths of the earth there is probably a large abundance of compounds of the metals with carbon, for we find them in basaltic and other rocks. When the crust of the earth becomes fissured, water would reach them at a high temperature and be decomposed, its oxygen passing over to the metals, while the carbon and hydrogen would unite to produce hydrocarbon, the most common form of which is petroleum. The gaseous hydrocarbons, formed by the same action, are pent up in these cavities, and, when a boring is made for a well, force up the petroleum frequently as high fountains. Wells of this substance are generally found at the base of mountain ranges, as of the Alleghanies in America or of the Caucasus in Russia. These elevations indicate cavities, fissures, or crevices below, and into these, as into a receiver, the hydrocarbons may have been distilled and become condensed. This is only a theory, but it is the one which is the most satisfactory to my mind, and, if it be true, it is a comforting one; for while we find forests disappearing from the earth, and coal being exhausted without being formed afresh, petroleum—which as fuel has about twice the value of coal—is being constantly formed and deposited in nature's reservoirs. I have admitted, he says, that this is nothing more than a theory, and as such the practical mind is accustomed to look upon it with contempt. But theories are the leaves of the tree of knowledge, nourishing it while they survive, and even when they fall they give new nutriment to the parent stem. We probably may soon have a better theory, and when it comes we will embrace it."

Thus writes Sir Lyon Playfair in 1884. Now let us see what a Russian chemist said on the same subject now several years ago. M. Dimitri Ivanovitch Mendelejeff, on whom in 1882 was conferred the Davy medal by our Royal Society, is principally known for the calculations by which he certainly has in one case foretold the atomic weight of a new element—the metal gallium which he made out to be ekaaluminium. He had at an earlier period visited the source of the petroleum in the Caucasus, and in the summer of 1876 the spots of like import in Pennsylvania, and he has been led to form a new hypothesis regarding the source of this mineral oil. It has been proposed by many in various countries that petroleum is a product of the decomposition of organic remains. This he combats, and for the following reasons:—The occurrence of the petroleum on the earth's surface shows that it has a desire to rise, which is no doubt due to the fact that oil is lighter than water; for this reason as well as for other circumstances, that in the sandstones in which much petroleum is contained there are no charred organic remains found, which must be there where the organic remains are, if in this way the oil had its origin. Moreover, it is impossible to conclude that this and this only is the product of the charring. As, however, in the Caucasus it is found in the tertiary, and in Pennsylvania in the Devonian and Silurian beds, the spot where it is produced must lie at a greater depth. But in the older beds than the Silurian there can have lived but very few organisms, and therefore the theory that it is produced by the charring of organic remains is a very improbable one. When we consider the hypothesis of Laplace regarding the development of the earth at the outset, the law of Dalton respecting the original condition of vapour, of the constituents of the globe, and the density of the globe, taking into consideration the density of the vapour of the elements, it appeared to Mendelejeff necessary to assume the existence of a collection of metals in the interior of our globe. If now we suppose that among the metals iron prevails—this view was propounded long since, chiefly from the increased density of the interior—which does not appear to be improbable, since it is found in considerable quantity in meteorites, and in the constitution of the sun, and the existence, moreover, of carbon compounds of these metals be allowed—it will serve not only to explain the mode of formation of the petroleum, but to make conceivable all those peculiarities under which it is found in certain localities where the earth-beds, in consequence of the upheaval of the mountain ranges, must have suffered a break on the interior face. Through a fracture produced in such a manner, the water passed down to the carbon compounds of the metals, and acting upon them at high temperatures and pressures, metallic oxides and saturated hydrocarbons are the result. The latter rise in the form of vapour to those layers of the earth's surface where they can condense, and the porous sandstones, where many oil products can be taken up, are saturated with them. With such an explanation of the genesis of petroleum, many other natural phenomena can be explained—the prevalence of elements of low atomic weight on the earth's surface; the distribution of petroleum in straight lines or in large circles; the connection which has been traced with vulcanism, which has been noticed by several scientific men, and especially by Abich; the magnetic phenomena of the globe, and many other natural phenomena. The further metamorphosis of petroleum, the formation of mine-gas and unsaturated hydrocarbons out of it, the chemical composition of petroleum from various regions, and of the salt water which invariably accompanies it—all these points only require a continuous study, which, in connection with future geological investigation of facts, will tell for or against this hypothesis.

Curiously enough, up to the year 1870 there had not been found anything in the earth's crust which by its composition favoured this view, either in the earth's crust or among the meteorites which have fallen on the earth's surface, and have reached our hands. But in that year Baron Nordenskjöld, who was at the time in Greenland, found some remarkable masses of what was at the time supposed to be meteoric iron. Some weighed eighteen to twenty tons, and a Swedish gun-boat was sent the following year to bring them home. Unlike meteoric iron, it was found that they were insoluble in acid ; they consist largely of carbide of iron and oxide of iron ; when heated it evolves 100 times its volume of gas, which chiefly consists of carbonic oxide and a little carbonic acid ; the iron now becomes brighter in appearance, and soluble in acid. The composition to the supposed "iron" was found by Wöhler to be:—

Iron	80·64
Nickel	1·19
Cobalt	0·49
Phosphorus	0·15
Sulphur	2·82
Carbon	3·69
Oxygen	11·09
	100·07

Iron carbide is not found in meteoric iron. These blocks had been enclosed in the basaltic cliffs of Ovifak, which by weathering had set them free ; and they fell down the face of the cliff to between high and low water mark, where they were found. These more or less metallic blocks must have been erupted from the interior with the basalt, in which they were inclosed, and after the investigations carried on by chemists, who are especially experts at meteorites at most centres of cultivation, have been pronounced to be terrestrial rather than meteoric. In them, then, we have the material which the theory propounded by these chemists has sought for.

International Exhibition of Engines, Machinery, Tools, &c., for Artisans.—An International Exhibition for Artisans—Internationale Ausstellung von Motoren und Werkzeugmaschinen fur das Kleingewerbe—under the protectorate of the Archduke Carl Ludwig, will be opened in Vienna on the 24th July and closed on the 12th October, 1884. It is instituted by the Austrian Society of Arts—Niederoesterreichischer Gewerbe Verein—in Vienna, and will comprise all articles of interest for artisans, such as motive power engines, machinery, tools, physical and chemical apparatus, and materials for industrial schools. The Exhibition will be held in the buildings of the Horticultural Society on the Park Ring, therefore in the centre of the town. Numerous applications for space have been made by manufacturers of small motive power engines, and of machinery and tools for carpenters, shoemakers, tailors, and other artisans. The intending exhibitors have been mostly Austrian and German firms, but it is expected that English and American firms will participate largely as soon as the Exhibition becomes more widely known. Applications for space are to be addressed to the Gewerbe Verein, Vienna, before the 15th May.

F.R.S., a civil engineer, to whom science is indebted for the magnificent collection of 6831 instances of earthquake phenomena, contained in his reports to the British Association during the years 1850-54, alludes to the intimate correspondence that exists between these shocks, "earth currents," magnetic disturbances, and electrical action generally. But he merely dallies with the question, and he does not attempt to follow it up. His efforts in respect to seismology, great as they were, resolved themselves principally into a discussion on the application of ingenious instruments and arrangements for measuring the direction, intensity, and rate of transit of earthquake shocks. In July, 1881, a closely-reasoned paper appeared in the *Quarterly Review*, with special reference to the extensive researches made by Dr. Schmidt in respect of the earthquakes that for so many years had harassed the Greek peninsula, and the author earnestly contended for the electrical theory as the one which alone could stand the test of facts; but this essay seems to have attracted little or no comment from natural philosophers. The geologists and scientists, who were looked upon as authorities in earthquake matters, still appear to uphold one or other of the following theories as to the origin of earthquakes, viz.:—(1) The expansion of water into steam on coming into contact with subterranean lava. (2) Chemical changes within the earth. (3) The shrinking and cooling of the earth's crust. (4) Rupture of the surface by tension. (5) Collision between solids and a liquid. (6) The passage of a wave of elastic compression causing each particle to perform a vibratory movement. (7) An incomplete effort to establish a volcano. Now, so far as my own investigations in geo-dynamics have proceeded, all these causes appear to me to be pure, unmitigated speculations; and none of them seem to me to have anything like the foundation in fact which cannot be denied to the electrical theory. But I think that the one great advantage of all others which attaches to the acceptance of this theory is this: Whereas, should any of those ideas I have mentioned above as being held by geologists prove to be true, we are just as far advanced in our immunity from injury and disaster as we were before, if the electrical theory should prove to be true, we are in a position, by reason of our practical grasp of the nature and action of electrical discharge, to deal with these terrible convulsions in a manner that will at all events tend to minimise their frequency as well as their violent effects. Our knowledge of electrical engineering comes into play, and in regions habitually devastated by earthquakes, such as Ischia, Java, or the Northern and Western parts of South America, we can reasonably take such simple inexpensive measures as are dictated by the assimilation between lightning strokes and earthquakes which would then be recognised by the scientific world. In a small work on the "Action of Lightning," completed by me in April, 1881—whilst in ignorance of the theory having ever been mentioned before—and reviewed in your columns shortly after its publication in April, 1882, I ventured to suggest that, allowing Peltier's idea of the earth constituting a vast reservoir of electricity to be correct—and I think no one will in these days dispute this dictum—it was only reasonable to conclude that terrestrial operations known—as are earthquakes and lightning strokes—to be intimately associated with the earth's electrical action, were actually the effects of that action. But it was not within the scope of that work to submit any practical measures for adoption in respect of the prevention of earthquakes.

In conclusion, Sir, I would ask these two questions:—(1) Is not the electrical theory of earthquakes at all events worthy of close investigation by eminent physicists? (2) Is not any theory, that professes in its results to mitigate a dreadful plague to which mankind is liable, worthy of attention from all persons?

ARTHUR PARNELL,
Colonel (late Royal Engineers).
13, Windsor-terrace, Newcastle-on-Tyne,
April 29th.

[We give space to Colonel Parnell's letter not because we endorse his enthusiastic support of electrical theories of earthquakes, but because it contains references to writings on the subject which may interest some of our readers. His views on seismic questions seem to be based on imperfect knowledge of the writings of some of the more competent modern physicists, if we may judge of the very limited acquaintance which his remarks suggest with Mallet's works. Electrical phenomena and magnetic disturbances no doubt accompany earthquake shocks; but there is very little evidence that these have any other relation than that of effect, though they may be related more nearly to seismic origin than to that phase of seismic disturbance of which we see the results.—ED. E.]

PURIFICATION OF WATER.

SIR,—In reply to the request appended to my letter which appeared in THE ENGINEER last week, asking me to state how I know that the process to which I referred frees water from disease germs, I beg to say that although I know very little of science, one may be able to judge of results.

The process itself may be shortly described. Charcoal is not used, for its action is only temporary. In 1858, Mr. Spencer laid before the British Association his discovery that the magnetic oxide of iron which exists in some stratifications only, is the purifying agent. Also that wherever spring water was the purest, *i.e.*, the most free from organic matter, there the largest quantity of this oxide existed, but in strata where it was absent, the water, although free from turbidity, retained all the gaseous and organic impurity it had acquired on the surface. Hence the impurity of spring water in new red sandstone districts and in others, where iron although plentiful is non-magnetic. The result was the discovery of a process by which a new compound chemical is made, akin to loadstone, and as little acted upon by air or moisture as platinum or gold, and called in chemical nomenclature magnetic proto-carbide of iron. The worst water has never been known to affect its power nor to diminish its bulk. The purifying power of this peculiar oxide consists in its converting oxygen into that body known to electricians as ozone, which is two atoms of this gas combined in a state of magnetic polarity, and when thus polarised has the power of consuming organic matter and forming carbonic acid gas. Hence the origin of carbonic acid found in pure spring waters which gives them their pleasant freshness and salubrity. This mode of purification is believed to be the first practical application of the inductive principle known as Catalysis, which was discovered by Berzelius, and little recognised before being used by Mr. Spencer for water purification, although now acknowledged as the greatest sanitary agent in nature.

"The magnetic oxide of iron"—protoxide—as naturally found, has no more effect on impurities in water than so much broken glass. The purifying body must be so treated as to become highly porous. This in many cases—for instance, at Malvern—nature has done; hence the purity of its waters. Putrescent matter, *i.e.*, organic matter in a state of rottenness, forms the ready-made food for the fructification of the living germs of choleraic or endemic disease when absorbed by water in seasons when they are prevalent. It is surely not saying too much to state that this is now acknowledged by the scientific world. The whole of this putrescent organic matter is removable at a small cost from every water supply in the kingdom. Wherefore, then, seek at a distance for a nominally pure water, which really does not exist, and which, if brought to us would have to undergo the very process of purification which can be applied above?

For facts I again refer to Wakefield, and although some are years old, yet the conditions remain the same. Cases of dysenteric disease had become frequent in the large County Lunatic Asylum situated near this town. Part of the water used in the asylum came from wells in its extensive grounds, and the rest from the water company of the town, and it was but natural to suppose that the evil was due to the "filtered sewage," as the company's water was termed, than to water from wells in a comparatively country district. The apparently purer water of the wells was ordered for the use of the inmates. Still the disease increased, so that a chemical analysis both of water from the wells and that of the company was ordered by the commissioners. In sending the samples it was stipulated on behalf of the company that the labels should afford no clue to the sources from which they were derived. The report of these analyses showed, however, that the filtered water was greatly purer than the lauded water of the wells; and strange to say, it came from a chemist who had advised the metropolitan water companies that purification by the process now referred to was impossible. The Lunacy Commissioners ordered the wells to be closed, and the filtered water only used. In reporting on the results of their order, they say, "The mortality has been below the ordinary average of the asylum; and in connection with it we have to remark that a portion of the water in use last year, when diarrhœa prevailed to so considerable an extent, has been disused, and the rest—namely, the supply from the town works—has been purified and improved by the company. There is now nothing epidemic in any of the sick cases. One man only is in the hospital suffering from dysentery."

The late Professor George Wilson, of Edinburgh, said, "Previously to Mr. Spencer's mode, there was practically no such thing as purifying impure water. The most perfect filtration was mere straining, whilst the organic matter was left untouched. The rapidity of its action on brown peat water is marvellous." Professor Alfred Swaine Taylor, of Guy's Hospital, said, "A good and wholesome water, fit and proper for the supply of a town population." This was said with respect to the Wakefield purified water. At an inquiry held some years ago by a Royal Commission, several medical men who were examined freely admitted that during the visitation of cholera, which had spread itself over several towns in that year, no cases had occurred in Wakefield, though in its former visitatien that town had not escaped disease.

In giving evidence before a Parliamentary Committee on a Southport Water Bill, Mr. Hawksley, the eminent water engineer, speaking of the action of magnetic carbide on iron, stated, "It is the most remarkable thing I have witnessed, and I did not believe it would produce this extraordinary effect. It immediately separates the oxide of iron which is held in solution in the water, and enables the water to be emitted free of that objectionable matter, so that the water coming out of the present wells in a styptic state leaves the filters perfectly free from any traces of iron whatever. In other places where it is used to take out organic matter it is equally successful."

Evidence could be multiplied to a large extent. Surely enough has been said to call attention to the subject. If one remembers the present cry for pure water, which with many persons means soft water, one remark may be made. Take the mass of large towns supplied with soft water and compare them with those using hard water; it is said that the death-rate of the former exceeds that of the latter about 10 per cent. CHAS. FRANCIS.

London, April 28th.

[It will be seen that our correspondent leaves the question we asked about disease germs untouched. May we remind him that organic impurity is one thing, disease germs quite another. For further information we may refer him to Koch's investigations. It is the opinion of able authorities that nothing that is done with water save boiling it can destroy a disease germ, and consequently the magnetic oxide of iron is entirely incapable of removing them. It would appear that Mr. Francis has, like many other people, confounded the disease germ with inorganic impurity.—ED. E.]

RAILWAY SIGNALLING.

SIR,—I am rather surprised at some of the statements with regard to railway signals made by Mr. Stretton, especially as coming from such a well-known correspondent on railway matters. I must say that I think some of his statements require challenging.

In the first place, I do not think that railway signalling, as carried out on English lines during the past, say, ten or fifteen years, can be called defective. There are exceptions to every rule, but, compared with what it was thirty or forty years ago, railway signalling in its recent improvements is as nearly perfect as possible. I quite admit that some branch lines, made and opened before the Board of Trade was invested with its present autocratic power, are very defective in signal arrangements, there being no such things as facing point locks or bars, and no concentration of handles or interlooking, the points being principally "spring" worked by a "cesspool" box. This state of things is now, however, getting rare, and on the lines where it remains there is, as a rule, very little traffic.

Secondly, there is a standard system in vogue with regard to placing signals, viz., that all signals are placed on the left-hand side of the road to which they refer, the board or arm being on the left side of the post, and therefore away from the line. If from local circumstances it is imperative that the post be placed on the other side, the arm still remains on the left; thus, if the signal be a down-road one, it is thus easily distinguishable from an up-road one. In every instance, however, notice would be given to all concerned.

Home signals are always placed clear of any points or cross-over, not too far away, or there would be time for the signalman to put the signal on after the engine had passed, and shift his points before the train was on the bar. I also think that Mr. Stretton will find that on every well-managed line alterations in the signals are communicated by the superintendent to all the departments whom they may concern; and when any branch or new lines are opened printed lists of all signals, their positions and distances, and the regulations concerning them are issued. I quite agree that calling a train past a danger signal by hand is a dangerous practice, and has led to many accidents. I have also known drivers refuse to move until the signal had been lowered. Distant signals when at danger are, as a rule, indicative to the driver to stop at the home signal, but on some lines they work the distant independently of the home, and make it a stop signal; but the usual practice is to pass the distant when at danger, whistle, and pull up at the home. With regard to the selection of position, a good inspector takes infinite pains to obtain a "fair view," "sighting" with flags placed at different heights—corresponding to the arms—on poles 20ft. or 30ft. high.

In conclusion, I do not think there is so much fault to be found with railway signalling as Mr. Stretton seems to think, but perhaps he looks at it from a different point of view.

April 30th. WILLIAM MARRIOTT.

THE EFFICIENCY OF FANS.

SIR,—Your correspondent, Mr. Aland, complains I did him an injury by reference to his fan as a "castle in the air." If he refers to my letter he will find I said, "11in. water gauge, with 3400 blade tip speed, seems . . . a veritable pneumatic castle in the air." These words only referred to certain figures relating to a volume of 35,000 cubic feet of air per minute passing through a tube 2ft. diameter, driven by a blade tip speed of 3400ft. This was the "castle in the air." And Mr. Aland's letter now proves such to have been the case, for he says in his last of the 3ft. fan which he brings into comparison with my 3ft. single inlet fan, "I open my suction to the diameter, or nearly the diameter of the revolving disc." This explains the whole mystery of the figures. Mr. Aland's open fan has two inlets, and in the side discs at the lee side of the blades he forms openings leading from the case into what would otherwise be the vacuum chamber of the fan. He says these, with inlets proper, nearly equal the diameter of the fan in area. Thus, taking the suction area of the two sides at 12ft., then his fan, passing 38,400 cubic feet at 699 revolutions, would draw air in at a speed of 3187ft. per minute, which by Hutton's tables, equals 1in. w.g. due to air speed. For comparison, take the 3ft. fan which he compares with this. At 699 it drew 13,377 cubic feet per minute through a 20in. tube at 3½in. water gauge taken in the air current, while the anemometer gave 6154ft. speed per minute. Work out the results of the two fans by formula $\frac{W v^2}{2g}$ and you will find the single inlet fan put over 33,000 foot-pounds per minute more work into the air than Mr. Aland's low-pressure ventilator. His fan is really a broad Waddle fan, with side openings above the inlet. If he put that fan on a 20in. tube, indicates his engine and measures his volume, he will find it drop down to the volume due to 1·90in. of water gauge, as the suction of the fan with vacuum chambers impaired cannot be better than a perfect fan of Waddle type, and 1·90in. is the water-gauge for that type at the blade tip speed before us. If I want very large volume, I resort to one of three courses: I can enlarge my inlets to three-quarters the diameter of my fan without destroying the water-gauge. Thanks to my cylinder, I can thus at 6000 blade tip get quite 5000 air speed in two inlets of 27in. diameter; or (2) which is simpler and cheaper, I use the central collector of my ordinary fan consisting of two inlets, inner wings, and port-holes. This, as far as I know, is the most perfect air displacer for low-pressure, and where low-pressure is required and large volume, will move more air by far than Mr. Aland's fan with much lower power. But for general use I prefer the combination of central collector, and a wing disc with port-holes in the disc—in fact the open fans, blades, and port-holes arranged round a disc. I must here remark that the term "constricting cylinder" is a misnomer. The cylinder collects air and discharges it through port holes a little more than the area of the hold. The cylinder simply prevents re-entry from periphery to inlet, and gets over the worst feature in an open fan, enabling the air to be discharged at low velocity, which, as, Guibal maintained, and Peclet's experiments prove, is a great point in central feed fans.

Mr. Aland undertakes to give the public a few hints as to the traps concealed under the report on the 30in. blast fan. I will give a few more. In every blast fan there are three water gauges. (1) When the discharge is full open, where the water-gauge is due to velocity pressure, and in this case the best fan is that which gives the highest velocity in the outlet, which is largest in relation to diameter of fan at a given tip speed. In the case of the 30in. blast fan, the outlet was 17in. diameter, the blade tip speed 7571, the air speed 6050 per minute, the open water-gauge would be 3½in., according to Hutton. (2) The second and most important water-gauge is that of the fan blowing into a closed chamber. This represents what I call the final water-gauge of the fan, or the maximum power of a fan to blow against resistance. For a fan's power to blow through tuyeres is regulated by this water-gauge, also to blow through long lengths of pipes. (3) There is what I call the intermediate water-gauge, which is the water-gauge a fan produces when blowing its air on given work. This also is regulated by the final or closed water gauge + the volume. To compare two 30in. fans, one of my make and another of well-known type. At 1350 the 30in. fan of my type gave 11in. water gauge, when all tuyeres were shut off. At 1950 the other fan gave 12in. water gauge. On putting on the tuyeres to two cupolas, my fan's water gauge went down to 10in. With the other fan, with one cupola put on, the water sank to 4in. In the latter case the water gauge reached the level of the volume, for on open test my fan gives at 1300 about three times the air given by the other fan at 1950. To test two blast fans, have a square box with a tuyere inserted in one side. Blow into it, and mark the water gauge. The best fan is the one which can give the highest water gauge with lowest blade tip speed, for the volume of air discharged depends on the pressure maintained in the box. If you will permit me, I will deal with the question of the water gauges in open ventilators in another letter, and apologise for the undue length at which I have written now.

I can assure Mr. Aland I have had no wish to attack the reputation of any fans, or their makers. I have simply taken "fan" as an abstract proposition, and tried to work it out with neither makers nor inventors in my mind. G. M. CAPELL.

Passenham Rectory, April 29th.

SIR,—Probably it would help to settle this Capell fan controversy if Mr. Capell could show conclusively that the cylinder in his machine does really increase the efficiency of his fan. The model of his fan, when divested of this cylinder, may be far from perfection, yet it is almost a certainty that without this cylinder the fan will be more efficient than with it. How does this cylinder operate? It is impossible even for Mr. Capell to explain this. Certainly it cannot add to the angular velocity, nor can it be shown to strike or steer the air in such a way as to help it outwards. It is at every point almost at right angles to the proper path and in the way of the air, and the inevitable inference is—in the absence of other than many questionable assertions—that this cylinder is simply an obstruction, and the reverse of an improvement.

If, on trial of an open fan with, and then without, the cylinder, the results are not in favour of the fan without the cylindrical obstruction, the Rev. Mr. Capell will doubtless make many converts to his views, including R. SNOWDON.

Widnes Foundry, Widnes, April 28th.

SIR,—Mr. Clark has missed the point of my letter. I am not disputing Peclet's statements, nor those of any other authority. What I want is an explanation of the facts connected with Mr. Capell's fan on, let us say, Peclet's theory. "These augmentations of velocity were in both cases effected without any increase of absolute head pressure for propulsion; and such results have a direct bearing on the case in question." Thus writes Mr. Clark in your impression for the 11th of April. Now I want to know what bearing—and I want Mr. Clark, if he has no objection, to tell me how, at any point of its career, a current of air can represent more work than has been done on it by the engine.

So far as I can gather from Mr. Clark's report and letter, we have two amounts of work done on the air, one over, the other under the horse-power of the engine. If we take the average it will be either greater, or less, or equal to the power of the engine. I suppose it is less. Can Mr. Clark say how much less, or what the ratio is? Can he, in a word, supply any information not contained in his report? C. T. W.

Bilston, April 29th.

CONTRACTS OPEN.

THE Indian State Railways require tenders for underframes and body ironwork, roofing, iron and brass fittings, and trimmings for third-class carriages with side doors, and with wheels 2ft. 0⅜in. diameter. The work required under this specification comprises the construction, supply, and delivery in England, at one or more of the ports named in the conditions and tender, of iron underframes, underframe and body ironwork, roofing, iron and brass fittings and trimmings, with all requisite bolts and nuts, rivets, washers, coach and wood screws, both iron and brass, and brass work, for putting the work together in India and fixing the bodies to the underframes, for twenty third-class carriages, with side doors. All fastenings, screws, &c., are to be supplied in quantities sufficient for securing the ironwork and fittings to the bodies and underframes, and for putting the bodies and underframes together, together with an allowance of 20 per cent. extra for waste. The contract does not include wheels and axles, bearing and draw and buffer springs, india-rubber window cushions, Attcock's blocks, lamps, and axle boxes. All these parts will form the subjects of separate contracts. No woodwork is required to be sent to India. The carriages are shown on page 326. The forms of the contract are those usually employed by the Indian Government. It is worth notice that the roofs are to be covered with waterproof Willesden canvas. Tenders addressed to the Secretary of State for India in Council, with the words "tender for ironwork for third-class carriages," on the envelope, must be delivered at the India Office, Westminster, S.W., before 2 p.m. on Tuesday, the 6th May, 1884. If delivered by hand, they are to be placed in a box provided for that purpose in the Store Department.

CONTRACTS OPEN—THIRD-CLASS CARRIAGES, INDIAN STATE RAILWAYS.

(For description see page 325.)

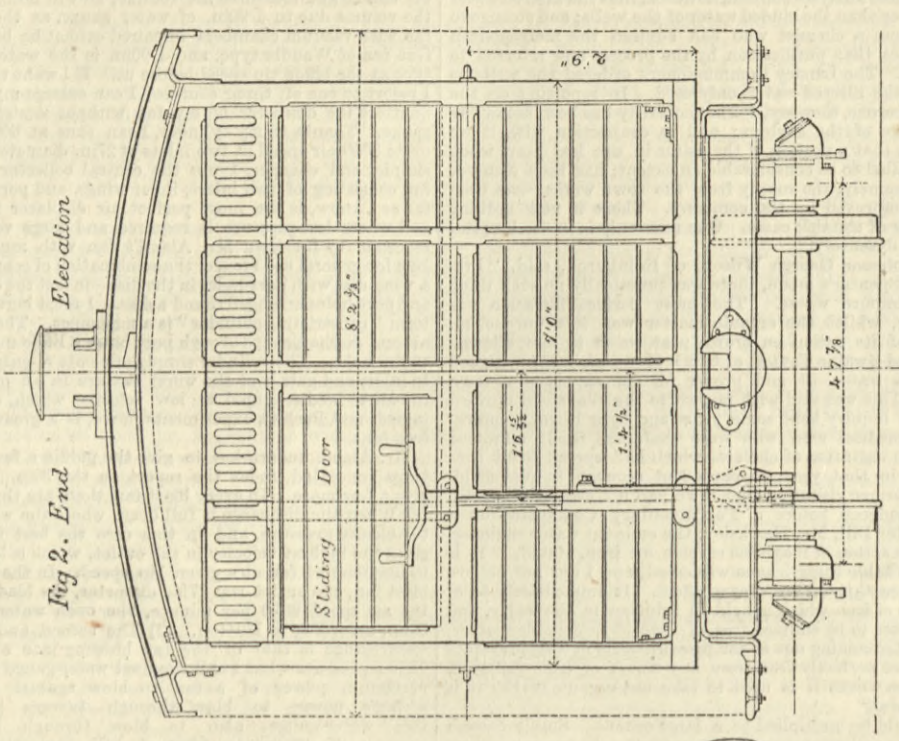
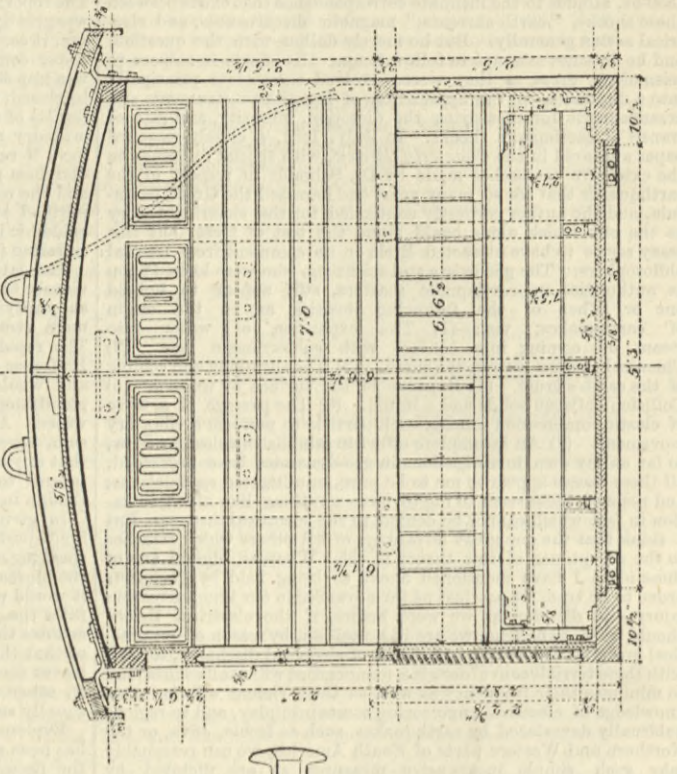


Fig 2. End Elevation



Half cross section at C.C. Half cross section at D.D.

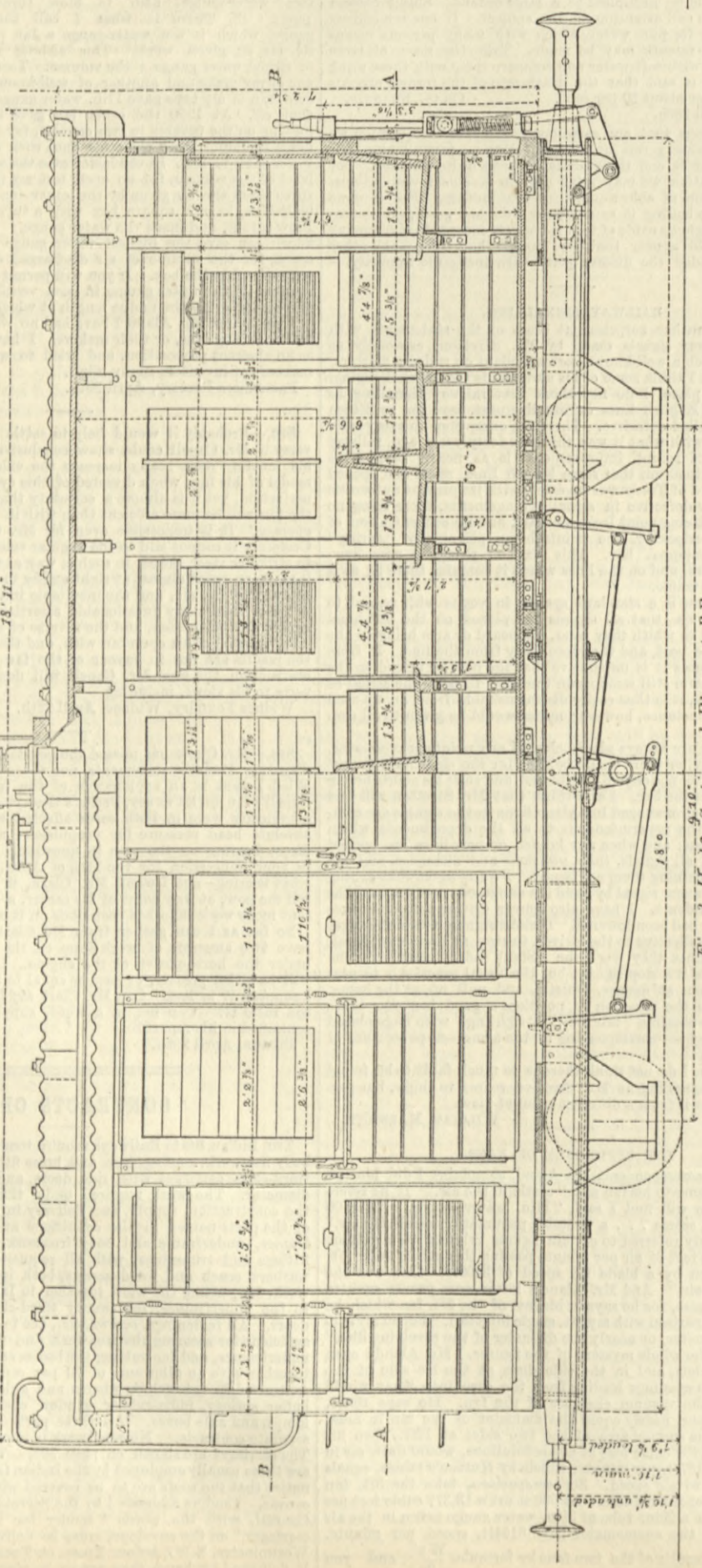


Fig 1. Half Side Elevation Half Longitudinal Section.

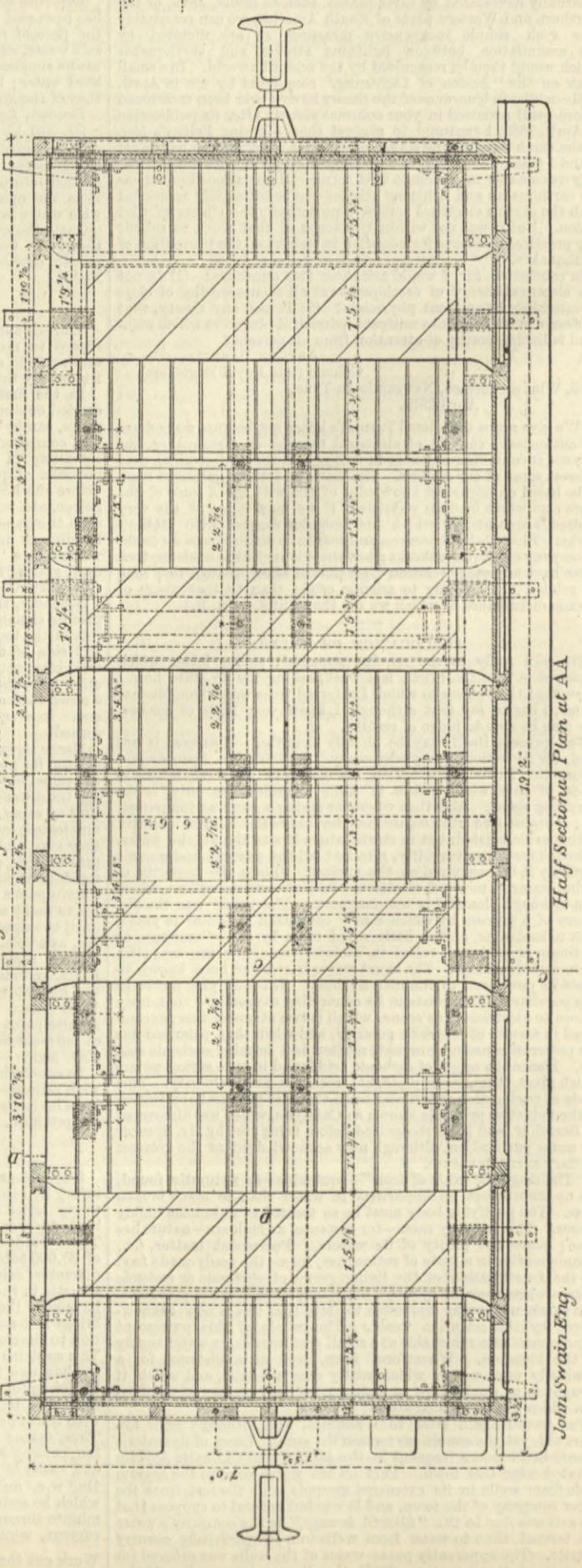


Fig 3 Half Sectional Plan at BB. Half Sectional Plan at AA

John Swain Eng.

PRIVATE BILLS IN PARLIAMENT.

ON Tuesday, one of the most important and interesting schemes of the session came before a Committee of the House of Commons. The Metropolitan Railway (Parks Railway and Parliament-street Improvement) Bill provides for the construction of a railway from the Edgware-road, where there are two spurs running with the existing Metropolitan line towards High-street, Kensington, and towards Praed-street respectively, under the Edgware and Uxbridge roads, to Hyde Park, which, with the Green and St. James's Park, it traverses, passing *viâ* the Marble Arch and Albert Gate. In coming out of St. James's Park, the line is carried along Gardener's-lane, and terminates in a new street to be constructed between Charles-street and Great George-street. The line will be constructed partly in open cutting, partly in tunnel. The line in its course through the Park is, by special arrangement with the First Commissioners of Works, to be carried out by cut and cover, *i.e.*, the company having removed the surface, will cover, by timber bridges, over which the sods of grass are to be relaid. By this system, which has been found to operate successfully in the City, the public use of the parks will not be interfered with. In St. James's Park, the line happens to pass under the ornamental water, and provision is made in the Bill that the work of carrying the tunnel beneath this lake shall only be carried out at that time when, in the ordinary course, the water is run off for the purpose of cleansing. There is a further provision in the Bill that all the works in the parks are to be executed between the 1st of September and 1st of March, the time of year when the parks are least used. The total length of railway to be constructed is 2 miles 74 chains, and Sir John Hawkshaw's estimate of the cost is £1,131,389. The improvement works to be undertaken at Westminster raise the total expenditure under the Bill to £1,275,040. The case for the promoters was opened by Mr. Littler, Q.C., who expatiated on the importance of the facilities of communication to be offered by the scheme at a cost which was small compared to what had been expended on other metropolitan enterprises. With a laudable view of interfering in the least possible degree with traffic along the roadways affected by the line, it is proposed by the promoters that timber baulks should be laid, and the works carried on at night, so that carriage traffic may be worked in the ordinary way. The ventilation is to be by shafts carried along the inside of the line, these shafts conducting the air which will be propelled by the motion of the trains. At Albert-gate there will be an air shaft carried up behind the Company's station, and it will be so placed as not to cause inconvenience to the public. In reference to the special instruction of the House to the Committee respecting junction with the District Railway at Westminster, Mr. Littler said that his company, although not favouring such a proposal, would not oppose the principle of a scheme empowering the District Company to construct, at their own cost, a physical junction, provided that the line between Westminster and the Mansion House was widened. They would, however, prefer a passenger subway joining the subway already existing between the District Railway and the Houses of Parliament. After hearing this statement, Mr. Pope, for the District Company, the principal opponents of the Bill, took a preliminary objection of a novel character. He said that the House having expressed its opinion that a junction was desirable, and the promoters taking no powers to give effect to that view, was it not a question whether the Bill should proceed further this session? The Committee, however, overruled this objection. Had they sustained Mr. Pope's contention, the result outside this particular case might have been very serious, for the decision would have been regarded as a precedent, and doubtless objections of a similar character would become frequent. We shall be able to go into the engineering details of the scheme at greater length after having heard Sir John Hawkshaw's evidence.

Group 1.—The London Central Electric Railway Bill was before a Select Committee presided over by Sir Joseph Bailey. The object of the Bill is to authorise the making of an underground line starting from Charing-cross—at the junction of the electric railway, authorised in 1880, going across the river to Waterloo Station—and thence to Regent-circus, and in a straight line down Holborn to the General Post-office. Mr. Bidder, Q.C., with whom was Mr. Moulton, appeared for the promoters, and stated that there was no doubt that electricity might be advantageously applied for the purpose of locomotion, and various experiments had been successfully tried at different places, notably at Berlin, Paris, Frankfort, and there were six miles working at Portrush in Ireland, and giving great satisfaction. This was a proposal to construct a railway consisting of four lines and a branch to be worked by electricity. The estimated cost would be somewhere about £360,000. Its locomotive power would depend on electricity, and the question of ventilation did not arise. There would be no noxious vapours arising from steam and smoke. It was said that they were going to have no openings in the Parks Railway, but how they were going to do it he did not know, but this could be done with an electric railway. By electricity they would not carry heavy trains, but it was specially applicable to carrying vast crowds of people and giving a very prompt and frequent service, because the electric system was to be worked by stationary engines. There would be no locomotive engines of any kind whatever. It would be worked by a standing arrangement, and the current was conveyed to the carriages. An ordinary locomotive engine and tender would weigh some thirty or forty tons in itself, and by dispensing with these they were enabled to have a light stock altogether, and they would run at speeds varying from ten to twelve miles an hour. They would have a light train of only two or three carriages, and, by working at a low speed, they could arrest the train within practically its own length, and instead of working by complicated signals, as was absolutely essential to safety with a heavy rolling stock, they could work it as a sort of omnibus traffic. There would be a constant succession of trains with two or three cars, and they would follow each other closely and would be worked at sight, without signals, like omnibus traffic. In that way they would be able to carry on a traffic with an enormous power of accommodating the public. They were told by Mr. Forbes that the maximum number of trains per hour was fifteen; but by electricity there would be no difficulty in getting thirty trains in each direction. There would be no difficulty in stopping the cars as often as they liked. and there would be no bumping or any inconvenience of any kind to passengers. It would be worked chiefly so that they would be able to carry the public at excessively low rates. By the Act of 1882 there was an electric railway going across the river, which, starting from the Waterloo Station of the Richmond line of the South-Western Railway, passed underground, and, by a tunnel under the Thames and under the District Railway to a station in Northumberland Avenue; and this proposed line would form a junction which would be very convenient for getting people from north of the Thames to Waterloo. This electric railway across the Thames would have then started, as part of the money had been subscribed and a contract entered into, but for the recent death of Sir William Siemens, who was the principal promoter. The Bill did not propose to interfere with the streets or the public in any way; and therefore he could not account for the opposition of the Board of Works, who complained that as the road authority, their easement would be interfered with. Mr. Law, C.E., was called, and stated that he was engineer to the scheme, and that the works would not interfere with streets, 'buses, or sewers. The dimensions of the tunnel would be 15ft. by 8ft 9in.; the gauge would be 4ft. 8½in., and the height of the cars 7ft. 6in. They would be like light omnibuses, and could be run close after one another, as Mr. Bidder had described. There would be a driver to each car, and in fact it would be an underground tramway. Mr. Siemens also gave evidence. The Metropolitan Board of Works having been heard against the scheme, the Committee declared the preamble not proved.

Group 4.—The Committee on this group held their first meeting on Tuesday, Sir John Ramsden in the chair. The London, Brighton, and South Coast Railway Bill having by the successive withdrawal of petitions become unopposed, the Committee commenced their proceedings by inquiring into the London and South-Western and Metropolitan District Railway Bill. This is merely a Bill for authorising an extension of time for completion of the Fulham and Surbiton line authorised in common with the rest of the Kingston and London Railway in 1881, and transferred to the South-Western and Metropolitan District Companies in the following year. It may be remembered that the works in connection with the line are of an unusually heavy character, involving a tunnel of about a mile in length through Wimbledon Common, and a bridge over the river Thames.

Group 6.—This group came before Sir H. Selwin Ibbetson's Committee on Tuesday. The first of the six Lancashire Bills, composing the group, was the Blackpool Railway Bill. This is the scheme of an independent company for extending the West Lancashire Railway from Preston to Lytham and Blackpool. It will be necessary to construct about twenty miles of railway, and it is estimated that the cost of the works will be £504,748. Blackpool is an exceedingly popular watering place for Lancashire people, and this scheme for giving better railway communication has the hearty support of the local authorities. The principal opposition comes from the London and North-Western and Lancashire and Yorkshire Companies, the owners of the existing route.

Group 8.—The first Bill in this group was the Wisbech Dock and Railways Bills. This is a scheme under which the Corporation of Wisbech take upon themselves power to construct a dock, and in connection therewith railways communicating with the Great Eastern and Peterborough, Wisbech and Sutton Railways. Being a public body, the promoters propose to raise the necessary funds by a loan.

Group 9.—The Committee on this group re-assembled on Tuesday to consider two Bills yet remaining on their list. The first of these—the Leominster and Bromyard Railway Bill—enables the promoting company to make an extension or branch railway to the Worcester, Bromyard, and Leominster Railway at Bromyard, and to enter into working and traffic arrangements with the Great Western Company. The Bill is opposed by the London and North-Western Company.

THE IRON AND STEEL INSTITUTE.

THE annual meeting of the Institute was commenced on Wednesday at the Civil Engineers' Institution, under the presidency of Mr. B. Samuelson, M.P. Among those present were Sir James Ramsden, Sir John Alleyn, Sir Henry Bessemer, and Messrs. I. L. Bell, Kitson, jun., Fisher Smith, Markham, Evans—Bowling—Dale, Head, Snelus, Jenkins, E. Williams, Martin, Windsor Richards, Putnam, Carbutt, M.P., and R. Heath.

Mr. J. S. Jeans, the general secretary, having read the minutes of the past meeting, the financial statement was submitted, and it showed an increase of £254 of income, and a decrease of £234 of expenditure as compared with last year.

The Secretary then read the report of the Council, which showed that "the total number of new members elected in 1883 was 131. Sixty-eight were removed during the year in consequence of death and other causes, leaving a net increase of sixty-three. The number of candidates on the list for the present meeting was sixty-three, which, if all were elected, would increase the number of members to 1332. Of the 131 new names, thirty-one reside out of the United Kingdom, a circumstance which showed the estimation in which the Institute was held by the metallurgists in other countries. The Council had been deprived of a colleague, whose fame shed lustre on the Institute, by the death of their past president, Sir C. W. Siemens. He assisted in its establishment, and never ceased to promote its welfare. Mr. W. Evans, of Bowling, had been elected to fulfil the vacancy in the list of vice-presidents created by the election of Mr. Samuelson as the President of the Institute. A sum of £1450 had been collected and invested for the family of Mr. Davidson, who was killed at Middlesbrough during the last autumn meeting."

"Mr. Hewlitt had been accepted by the Council—subject to ratification by the meeting—to fill the vacancy in the Council caused by the death of Mr. Bagnall. The President said the members would have noticed that Chester had been chosen as the meeting-place for the autumn. It was true that at Chester they would not find themselves in immediate contact with large metallurgical works; still, it was a convenient centre for excursions to objects of general interest to iron and steel manufacturers."

The report of the Council was adopted, and Bessemer medals presented to Mr. E. Windsor Richards and to Mr. E. P. Martin in recognition of their services in the development of the metallurgy of iron and steel, and particularly for the great efforts they had made with so much success in the application of the basic process of making steel from phosphoric pig. The receipt of the medals was appropriately acknowledged by Mr. Richards and Mr. Martin, and a paper was then read by Mr. I. Lowthian Bell,

"ON THE USE OF RAW COAL IN THE BLAST FURNACE."

Mr. Bell said that in papers read at the Institute upon the consumption of fuel in the blast furnace, coke alone had been considered as the source of heat. This had partly arisen from the fact that the papers dealing with the question had generally emanated from quarters where raw coal is seldom or never used, and partly because the subject is greatly simplified when the behaviour of the vast amount of volatile substances which accompanied the use of uncoked coal was not considered. He referred to the large use of very hard anthracite in America, and gave, as amongst the most economical consumptions, 23 cwt. to each ton of Bessemer iron, with blast at 1375 deg., and furnace 70ft. high. In the United States in the year 1882 no less than 2,042,138 tons—or 39 per cent. of the entire make—was produced by means of anthracite. The chief object of Mr. Bell's paper was to consider the differences between bituminous coal and coke in the smelting of iron and to compare their respective action. In doing this he mentioned that in the value of these two substances as measured in a calorimeter, there is but little difference between them, the value being ascertained by the power possessed to raise the temperature of a given quantity of water. But this did not in all cases give the value of a fuel used under different circumstances. Mr. M'Donnell, the locomotive superintendent on the North-Eastern Railway, recently made some experiments for Mr. Bell, and furnished him with the pounds of coal burnt per train mile on nine of the great railways of the United Kingdom during the half year ending 30th June, 1883. These vary considerably according to the character of the traffic, nature of the ruling gradients, and probably, to some extent, according to the quality of the fuel employed. The lowest is 32·45 lb. per mile, and the highest 47·02 lb., the average of the whole being 42·21 lb. per train mile. Two lengths of road were selected on the North-Eastern system for the experiments. The same engines were used at both localities in the two sets of experiments; the trains consisted of the same number of wagons in the trials of coal and coke, and the loads were practically the same also. The trials were continued for one week with each kind of fuel, full loads being taken to the place of shipment and the wagons returned empty to the collieries :—

	Coal.		Coke.
One week's trial of each fuel; pounds consumed per train mile	40·5	...	41·6
One week's trial of each kind of fuel; pounds consumed per train mile* ...	37·0	...	42·2

"The parity of results observed in burning coal and coke on a grate where the combustion is, generally speaking, perfect, is not to be found in blast furnace experience, for the simple reason that the volatile constituents are scarcely at all oxidised in the furnace, and consequently little or no useful effect is obtained from their presence. This statement presupposes that the smelting operation is conducted in a close-topped furnace; but in cases where the escaping gases are not utilised, the combustion on the mere upper surface of the materials is attended with little or no benefit. There is, however, another way in which the volatile hydrocarbons might be useful in the blast furnace, viz., as a means of reducing the oxide of iron to the metallic state. Reverting for a moment to the action of a blast furnace using coke, this first stage in the operation of smelting iron may be performed by one of two processes. Carbonic oxide generated by the combustion of carbon at the tuyeres may be the reducing agent, in which case carbonic acid is the product; or else the operation may be effected by solid carbon, in which case carbonic oxide is generated. In the latter case, not only does the carbon which has served for the purpose of reduction never reach the tuyeres, and in consequence acts no part in fusing the iron slag, but since the heat generated by a unit of carbon leaving the furnace as carbonic oxide and as carbonic acid is respectively as 2400 to 8000, there is a great loss in the heating power of the fuel employed. This, of course, is an argument for seeking to obtain as large a proportion as possible of carbonic acid in the escaping gases. Experiment and practice, however, have demonstrated that the power of carbonic oxide to reduce an oxide of iron to the metallic state has its limits; and that when something like one-third of this gas is saturated with oxygen, *i.e.*, has become carbonic acid, further change is suspended. We have then the carbon gases in their ultimate form composed of one volume of carbonic acid and two volumes of carbonic oxide. It might, however, be possible to dispense with a portion of the carbonic oxide, and still maintain the reducing power of the mixture by substituting for it a gas also capable of deoxidising the ore. The hydrocarbons, like the oxide of carbon, are energetic reducing agents; but it will be seen by a study of the composition of the escaping gases, as well as by a consideration of the quantity of fixed carbon present when raw coal is used in the blast furnace, that they do not render any marked service in the process itself."

The latter part of Mr. Bell's paper dealt with the value of bye-products from the use of coal. He said we have seen that whether coked or raw, in a heat-giving point of view, there is not much to choose between the two; that while about 4 cwt. of coal per ton of iron are wasted by inferior oxidation in the furnace, the same quantity is lost in the coke oven. In the former case, however, we have, in addition to the inflammable carbonic oxide of the escaping gases, about 7 cwt. of combustible gases which are useful for other purposes; whereas in the coke ovens but a very small percentage of these remains over, after satisfying the requirements of the process of coking itself. In such coke ovens as are employed for the purpose in question there is practically no waste of fixed carbon, the distillation being performed in a closed retort of fire-brick. If we assume that 22½ cwt. of coke are consumed per ton of iron, we have, according to the analysis of South Durham coal formerly given, a trifle under 30 cwt. of raw coal required to furnish the coke for each such ton of metal. Estimated from the figures in the analysis just referred to, for each ton of iron made the coke ovens will have to provide means for separating the tar and ammonia from about 7½ cwt. of gaseous matter. In the Scotch furnaces using raw coal the weight of the gases is of course very much larger, because, besides that they contain the volatile constituents of the coal, all the fixed carbon of the coal is burnt, which means a very large admixture of atmospheric

* The coal in this trial contained only 1·2 per cent. of ash, against 7·4 per cent. in the coke. In both trials the coal and coke were from the same colliery, viz., Eldon and West Wylam.

nitrogen. Instead, therefore, of having 7½ cwt. of gases to deal with in the coke oven, for each ton of iron made with the coke produce, we have almost exactly 170 cwt. In other words, and speaking roughly, instead of having 20,390 cubic feet of gas to contend with, the furnace gases emitted by a furnace using raw coal will occupy about 260,167 cubic feet, or something like thirteen times the space occupied by the volatile constituents of the coal in the process of coking.* Under such a condition of things, it is almost needless to say that the condensable products accompanying the distillation of 30 cwt. of coal in a coke oven must be more easy of collection than the same products from 42 cwt. of raw coal burnt in a blast furnace.

So far, however, as his inquiries lead him to form an opinion on the subject, there is no more ammonia and tar obtained from a ton of coal distilled by Sir J. W. Pease and Co. in the Simon-Carvé's oven than is obtained by the Messrs. Baird from the coal used in the blast furnace. This would, if true, indicate that the yield of ammonia is not affected either by the increased difficulty attending its condensation as it leaves the iron furnace, or by the known action of ammonia on oxide of iron. The sulphate of ammonia obtained in each case was about 20 lb. per ton of coal distilled; the alkali of this was considered worth 2s. 3·84d., reckoning the sulphate as being worth £15 per ton. The tar was worth 1s. 10d., making together 4s. 1·84d. The labour and depreciation represents about 1s., leaving 3s. 1·84d., or say 3s. per ton of coal used as such. In the analysis of escaping gases from the Scotch furnace using splint coal, the amount of ammonia was such as to represent 12·32 lb. of this alkali per ton of iron, or 5·81 lb. per ton of coal. This corresponds very closely with the ammonia in 20 lb. of the sulphate, which weighs 5·15 lb. On the other hand, the quantity of nitrogen in the fuel employed is sufficient to generate about 27 lb. of ammonia per ton of coal; so that 20 lb. of sulphate of ammonia represents only about 19 per cent. of that capable of being yielded from the coal were all the nitrogen expelled. Mr. William Foster, in a paper recently read before the Institution of Civil Engineers, pointed out that the nitrogen in coal, when distilled in a close vessel, was thus disposed of:—

11 to 18 per cent. takes the form of ammonia gas or its compounds.
·2 to 1·5 per cent. ,, cyanogen.
48 to 66 per cent. remains behind in the coke.
21 to 36 per cent. is not accounted for.

These results point, therefore, to the possibility that the present quantity of ammonia—20 lb. of sulphate—obtained from each ton of coal may be susceptible of a considerable increase. The demand that exists for nitrogenous compounds for agricultural purposes invests the subject with an importance entirely national in its character. This will attract an increased amount of attention; but stopping short of what is possible, and having regard to what has actually been achieved, we have more than 12 million tons of coal used by our blast furnaces alone, and probably capable of yielding substances worth at present value nearly two million pounds sterling per annum.

At the conclusion of the reading of the paper, Mr. Bell said that he had learnt within the last few days that Messrs. Baird and Co. had produced, instead of 20 lb. of sulphate of ammonia, from 20 lb. to 30 lb., and instead of 200 lb. of tar they were getting 225 lb. of tar to the ton of coal in each case; so that the net value of the produce must be worth nearly double what he assumed in the production of two millions per annum.

Mr. Markham opened the discussion. When at Staveley they had increased the blast from 2·5 to 3 lb. to nearly 6 lb.; the result had been a very large waste of fuel. There was no doubt that the production of iron had increased, but with it they were using 5 cwt. more out of 40 cwt. of coal now than before, and he attributed that in a great measure to a cause which appeared to be rather singular at first. When they first began to use the gas from the gas tar, they were very nearly on the point of collecting tar, and it obstructed the tubes to such an extent as to make it almost impossible to work. When they increased the pressure to 6 lb., the gas tar almost immediately disappeared. The ironstone they used was the oolitic deposit, and frequently they had from 15 to 20 per cent. of water. He doubted very much whether at any time the water was less than 15 per cent., even in summer time. It always appeared to him that by throwing this ironstone in at the top of the furnace, the water was evaporated by the operation of throwing it in—it passed away, and kept the water from passing through the stoves. But where the bell-top is used, this 20 per cent. of water had to be forced through the stoves, and that had caused a good deal of difficulty, and had led to their never being worked with success. He hoped Mr. Cochrane would give some account of operations in his own experience where both coke and coal were used, and he hoped they would have more information with reference to the coal.

Sir James Ramsden said that on lines with which he was connected they were working the locomotive engines at the same rate of coal as with coke.

Mr. Stores Smith corroborated what Mr. Markham had stated as to the remarkable disappearance of tar from the gas tubes by the increase of the blast. When first they began taking in their gas by suction they were frequently stopped by the enormous amount of tar. He believed it was Mr. Markham who suggested the increase of blast. They largely increased the blast and the tar had vanished entirely. It had entirely gone, and they had not seen the tar. But another experience of theirs was directly opposite to that of Mr. Markham. The increase of the pressure of their blast had not been attended with an increase in the use of coal. Mr. Markham asked if his attention had been directed to it. He knew as a matter of fact that the grand result was that they were making iron cheaper than before—that is, as to the total cost. Since then he had got the figures out, and he found in 1880, when their blast was low, it seldom reached 3 lb. In 1881 they kept it to 3 lb.; but in 1882 it would average 4 lb. They made pig iron in 1880. In the first half-year the consumption was 2 tons 4 cwt. 3 qr. to the ton of metallic iron; in the December half-year 2 tons 5 cwt. 3 qr. In 1881—June—it was 2 tons 3 cwt. 3 qr. and—December—2 tons 5 cwt. 3 qr. In 1882—June—when their blast got up to 4 lb., the consumption was 1 ton 19 cwt. 3 qr.; for the six months ending December, it was a mere fraction over 2 tons. They had almost identical results in 1883. They were making iron at a consumption of 2 tons of coal. Now, simultaneously with increasing their blast, they had increased their heats. They were working at an average heat of 600 deg. two years ago; but now it was about 900 deg., so that there was a very great increase. They had increased the pressure of their blast, and they had increased their heat very largely indeed, and the result had been a saving of 5 cwt. per ton of metallic iron. Mr. Markham's experience alone had been an increase in the quantity of coal. He might say that they used coke at their furnaces, and Mr. Markham does not. They used ⅛ lb. of coke to ⅞ lb. of raw coal, and these figures had been deduced by a calculation by long experience, and they were found to be the equivalent of the coke and the coal. That was on the experience of twelve years, and it showed that 5½ cwt. of coke did the duty of 8 cwt. of coal. This paper was no doubt an exceedingly valuable one, but every district can only work according to the conditions of the district. Before they could say whether it was cheaper to use coke and coal, they must know the relative cost of coke and coal in the district in which they lived. Now in Derbyshire they had the coal cheap, and at the present moment it was worth 6s. at the oven—a good top hard coal of 21 cwt. They had the bituminous coal, which when washed made the purest coke in England. It was exceedingly valuable for steel making. It went to Birmingham and to Sheffield, and it was singularly free from sulphur, and had a very small proportion of ash. Their coal was worth 6s. per 21 cwt., and their last month's average for coke was nearly 12s. for 20 cwt. They would be simply lunatics to put that coke into their furnaces in place of the hard coal. The pressure of the blast was never less than 4 lb. The discussion was continued by Mr. Cochrane and others, and replied to at length by Mr. Bell. To this and to the papers afterwards read by Mr. R. Smith-Casson and by Mr. W. Sutherland "On Gas Puddling and Heating Furnaces," and "On the Utilisation of Gaseous Fuel," we shall return in another impression. The meeting was resumed on Thursday and this morning.

* The volumes of the two sets of gases are calculated for a temperature of 0 deg. C—32 deg. Fah. If the temperature were about 480, which is more nearly correct, the volumes just given would be nearly doubled.

The Institution of Mechanical Engineers.—At a special meeting of the Institution of Mechanical Engineers, held on Thursday afternoon at the Westminster Palace Hotel, Mr. W. Bache, many years assistant secretary, was elected secretary, in the place of Mr. Walter R. Brown, M.I.C.E., resigned.

Launch at Southampton.—On the 24th ult. Messrs. Oswald, Mordaunt, and Co. launched at Southampton an iron sailing ship of 2400 tons register, and a carrying capacity of about 3600 tons. Miss Ella Oswald named the ship the Ellisland. The dimensions are—Length, extreme, 314ft. 6in.; breadth, extreme, 41ft. 3in.; depth of hold, 24ft. 9in. The vessel is full rigged, has four masts, and is built to class 100A at Lloyd's, and twenty years in red at Liverpool.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—Henry B. Clatworthy, engineer, to the Indus, for the Tamar; George Ramsay, assistant engineer, to the Valorous, vice Clatworthy; Richard R. Rundle, engineer, to the Indus, as supernumerary; Elijah Thomas, engineer, to the Firebrand; Ernest F. Ellis, engineer, to the Asia, for service in the Dreadnought; Edwin K. Odam, assistant engineer, to the Indus, for the Agamemnon.

South Kensington Museum.—Visitors during the week ending April 26th, 1884:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 13,607; mercantile marine, Indian section, and other collections, 4598. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 6 p.m., Museum, 2209; mercantile marine, Indian section, and other collections, 368. Total, 20,782. Average of corresponding week in former years, 16,478. Total from the opening of the Museum, 20,982,772.

The United States Cruisers.—"Our London contemporary, The Engineer," says *The Army and Navy Register*, U.S., "is in error in stating that it has been instrumental in securing the abandonment of the beam engines devised for the Chicago. The statement that a change had been determined upon originated, we believe, in the columns of the New York *Evening Post*, and was promptly corrected there. The engines of the Chicago, as originally planned, are now being constructed at the Morgan Ironworks at New York." For the sake of the United States we are sorry to hear this. However, an instructive, if costly, experiment will be tried.

City and Guilds of London Institute.—At the meeting of the executive committee of this institute, held on Monday, the following appointments were made at the central institution, Exhibition-road:—To the Professorship of Chemistry, Henry Armstrong, Ph.D., F.R.S., of the Technical College, Finsbury; to the Professorship of Engineering, W. C. Unwin, B.Sc., of the Royal Engineering College, Cooper's Hill; to the Professorship of Mechanics and Mathematics, Olaus Henrici, Ph.D., F.R.S., of University College, London; to the Professorship of Physics, Oliver Lodge, D.Sc., of University College, Liverpool.

Society of Arts.—The following meetings of the Society of Arts have been arranged:—Ordinary meetings, May 7th, "Bicycles and Tricycles," by C. V. Boys. May 14th, "Telpherage," by Professor Fleeming Jenkin, F.R.S. May 21st, "Telegraph Tariffs," by Lieut.-Col. Webber, R.E. May 28th, "Primary Batteries for Electric Lighting," by I. Probert. A paper will be read on May 8th on "Cupro-Ammonium Solution and its Use in Waterproofing Paper and Vegetable Tissues," by C. R. Alder Wright, F.R.S., D.Sc. In the Indian Section the following papers will be read:—May 9th, "Indigenous Education in India," by Dr. Leitner. May 30th, "Street Architecture in India," by C. Purdon Clarke, C.I.E. This paper will be illustrated by means of the oxy-hydrogen light.

Graving Dock for New South Wales.—The tender of Mr. Lewis Samuel has been accepted for the construction of the new graving dock at Biloda, the amount of the tender, which has been worked out to a schedule of prices, being £135,078. The quoins at the entrance of the dock are to be of granite, and the copings, broad altars, dock floor, steps, &c., are to be of blue stone bedded in concrete. The length of the dock will be 600ft.; the width at entrance 84ft.; and the width inside of coping will be 108ft.; the depth of water at ordinary spring tides will be 32ft.; and at ordinary neap tides 30ft. The contract for levelling the rock on that portion of the island where the dock is to be constructed has just been completed, and the new contract will be commenced almost immediately. The time fixed for the completion of the work under the tender just accepted is three years, but it is thought that the work can be done in two and a-half years. When the dock is ready for use it will be capable of accommodating any vessel in the British Navy, or even the Great Eastern.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(*From our own Correspondent.*)

On 'Change in Birmingham to-day—Thursday—and in Wolverhampton yesterday, ironmasters reported that the works were again very irregularly employed, consequent upon a continued lack of remunerative orders. At numbers of establishments only half time is being made. The demand for shipment is still below the average, and prices are kept down by the numerous sellers who flood the offices of London, Liverpool, and other export merchants directly they know that these buyers have anything like an order to place. Competition from other iron and steel-making centres also tends to deprive our works of orders which would otherwise be received.

Makers are determinedly doing their best to prevent prices from further falling. Many of them are still turning a deaf ear to buyers' offers, and they are being rewarded. Although £8 10s. is considered the current price for galvanising sheets of 27 b.g., well authenticated instances were mentioned on 'Change this week in which sales of 1000 ton lots for galvanising purposes have just been made at between £8 15s. and £9 per ton. Sheets of 24 b.g. are £7 10s. as a minimum, and £7 10s. is also asked for superior qualities of 20 b.g. Some descriptions are, however, still to be had at the level £7 at works.

Plates keep very quiet. In truth there is less doing in this branch than in any other, and the competition of distant districts is keener in plates than in almost anything else. Tank-plates are to be had at £7 7s. 6d. to £7 10s. easy. For boiler-plates £8 10s. to £9 is quoted, and on to £9 10s.

Marked bar makers reported to-day—Thursday—that sales of best branded sorts were very limited. Export buyers are the chief consumers. Most business continues to be seen in second and third-class bars, which are offered at prices more suited to buyers' present requirements. £7 10s. is quoted for marked bars, but only one or two firms are believed to be realising the figure. £7 is the more general price. Second-class bars are £6 10s., and common £6 to £5 15s.

Hoops were to-day to be had at, in some cases, £6 5s. at works, which means £7 delivered London, or £6 15s. delivered f.o.b. Liverpool. These prices relate to common merchant sorts. For superior qualities more money was obtained. Gas strip ranged from £6 down to £5 15s. easy.

The steel question continues to occupy much attention. I hear this week that a small syndicate is inquiring for a vacant blast furnace plant in this district, at which to commence steel-making under a system which was patented by a French inventor. By this method the steel is made direct from the blast furnace, and experiments which have been made with it elsewhere are said to have proved quite successful. The inventor claims for his process improvements even over the basic patent. Several vacant furnace plants have been inspected, but at present no spot has been definitely selected.

New steel ventures will have to reckon with low prices for their products. As I have previously indicated, some local steelmasters are already finding this out. An additional indication in the same direction is the circumstance that Messrs. Tangyes have recently reduced the outturn at their steel works owing to the existing low prices for blooms and billets, and that they do not see any early likelihood of their putting the works on full again.

Pig iron keeps tame, whether native or foreign sorts. Yet a little more is doing in hematites, and instances are within my knowledge in which sales of 2000 tons in a line have this week taken place. Tredegar hematites are quoted 57s. 6d., but the quotation is not absolute. Native cold blast all-mines are 80s., and hot blast 60s. Cinder pigs are 40s. to 35s. as a minimum.

When on Monday Alderman Avery, the arbitrator to the Mill and Forge Wages Board, heard the claim of the employers for a reduction in puddlers' wages of 6d. per ton, and in millmen's wages of 5 per cent., there could be no difference of opinion as to the evidence for the claim being unusually strong. They argued that the South Staffordshire iron trade was experiencing a period of great depression. South Staffordshire was being invaded by iron from other districts. Northern plates were being sold at £5 a ton, and angles at £4 15s.—prices at which it was inevitable that orders should be going away from them. The operatives in the North, too, had recently received a 2½ per cent. reduction, which brought their wages to 6s. 9d. a ton, whereas in South Staffordshire the men were receiving 7s. 6d. Attention was also drawn to the fact that if the puddlers were receiving small wages there was a large class of men who received high wages. Mr. Heathfield said that at least 73 per cent. of the skilled men were paid high wages. The operatives' case was only weak. They had submitted to no fewer than twelve reductions since January, 1874, and the results had proved that the lower the price the less the volume of trade. They were surprised that as Dr. Watson had only awarded 2½ per cent. in the North of England, that the employers here had not withdrawn their notice. Besides, the iron made in Staffordshire realised at least £1 per ton more than that made in the northern districts. As to the wages paid to puddlers, they replied that there were twelve or fourteen puddlers to one mill roller. Moreover they believed that the cause of the evil was over-production. There is not much speculation in the district as to what the award which is to be issued in a few days will be, for it is held that relief to the masters on some scale or other is certain. Business can scarcely go on without it.

Some of the colliers in the West Bromwich district are dissatisfied with the pledge given by the operative section of the board that when the masters' claim for a 5 per cent. reduction is arbitrated they will abide by any judgment that does not involve a new sliding scale. The disaffected portion are for agreeing to nothing which lowers the minimum wages below the present 3s. 8d. per day of eight hours. The district generally, however, consider the engagement reasonable, and will abide by it.

The railway carriage and wagon works continue very busy.

Very gratifying testimony to the unique position which English makers of steam engines and some other machinery occupy in the favourable estimation of Antipodean buyers, especially as exhibited in the position which Messrs. Tangyes have secured, appears in some remarks just made known by an Australian correspondent of one of the chief trade papers of Berlin. This correspondent advises German machinists, in catering for the Australian colonies, to avoid the special lines and patterns affected by the English firm of Messrs. Tangyes, whose engines and machinery are at once so good, so cheap, and so well adapted to colonial wants, as to set competition at defiance.

Shipping orders for hardwares are not increasing in other than exceptional instances. Some branches that had anticipated increased spring business from South America have thus far been disappointed. Still, those markets are taking cheap cultivating tools, and certain other requisites, with fair vigour. India still proclaims herself more than an average purchaser, and while certain firms are tolerably satisfied with the business which has resulted from the Calcutta Exhibition, others are no less dissatisfied. Amongst these are the steam and hand pump makers. Yet the same people have found the Amsterdam Exhibition productive of valuable orders.

It is the expressed opinion of Mr. Bowling, who, until recently, had charge of the factory inspection in the Birmingham district, that "the introduction of gas engines has had a marked effect in increasing the number of factories, and must have greatly enlarged the productive power of the town." My own enquiries satisfy me that gas engines are being used more and more for the supplying of motive power in workshops in the town and district, and are supplementing steam engines. When manufacturers learn from gas engine makers that their use results in an economy of one-third in the consumption of fuel compared with some forms of steam engine, there is at once a strong inducement to make the change.

The manufacture of ice, which has proved so successful in Manchester and Liverpool, is to be begun in Birmingham. The makers will be the Patent Transparent Ice Company, Limited, who have secured a lease of the old Fazeley-street Gasworks from the Corporation. The process to be used is the well-known Pictet, and it is estimated that about 24 tons of ice will be made every day. The refrigerating house, which is 140ft. long by 40ft. wide, contains a tank 107ft. long by 17ft. wide, and is fitted up with a powerful travelling crane running the whole length of the building. The refrigerating machinery is worked from a horizontal engine of nearly 40-horse power, with a fly-wheel 15ft. in diameter and a cylinder of 22in., having a 3ft. 6in. stroke. The refrigerator is a copper vessel, and is fitted with 420 tubes. Inside the tank there are 420 moulds made of tinned sheet iron, each 4ft. long and 3ft. 10in. deep, with an average width of 7in. Each of these moulds is capable of producing two blocks of transparent ice of 1¼ cwt. each, or a single block of opaque ice weighing 3½ cwt. The tank is filled with brine, and after the acid has done its work in lowering the temperature of the brine, it passes in a state of vapour into the compression pump, from which it is forced into the condenser—a vessel similar to the refrigerator. Forty hours is necessary to complete and make the transparent ice into blocks of more than usual hardness. The company hopes to do a large business, and has provided storage accommodation for 300 tons.

The South Staffordshire Stipendiary on Tuesday mulcted Mr. Thomas Davis, general manager of the collieries and magazines belonging to the Patent Shaft and Axletree Company, of Wednesbury, in penalties and costs amounting to £8 6s. for breaches of the Explosives Act. The offences consisted in having a workshop where cartridges were made undetached and within 2ft. of the door of a boiler in which pitch was being boiled, and in not keeping the shop as far as practicable clean. The Stipendiary, however, promised to consider a plea raised by the company that it, and not its manager, should have been summoned.

Local manufacturers are expecting to benefit from the third annual Building Trades Exhibition at Bingley Hall, Birmingham. A new department has been inaugurated this year; it relates to gas apparatus in which gas can be made to serve as a fuel or as motive-power. There are therefore to be seen in this department numbers of gas engines, cooking stoves, and cooking engines. From this the Corporation, more particularly, anticipates advantages in their gas department. In his opening address the Mayor pointedly remarked that instead of some fifty stoves only being called for, as was now the case, thousands of stoves ought to be issued during the next two or three years. His own opinion, too, was that there was a great future for gas and for compressed air, especially for use in small manufactories. There can be no doubt but that manufacturers of gas appliances coincide with the Mayor, and hope that his premises may be early fulfilled.

The new pumping engines which the Birmingham Corporation have just bought for their waterworks department were set to work at Whitacre on Monday. They are of the double type, and are twice as large as those employed by the Wolverhampton Corporation at their works at Cosford.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—A generally depressed feeling continues throughout the iron trade of this district. There is a moderate hand-to-mouth business doing, but there is no animation in the market, and consumers, as a rule, do not care to buy beyond present requirements. Any possibility of an upward movement in values, so far as the immediate future is concerned, seems to be generally regarded as out of the question, and the efforts of makers appear to be solely directed against any further material giving way. The large number of furnaces at present out of blast no doubt has a tendency to keep prices from coming down as low as they might otherwise do; but on the other hand, the very fact that there is all this latent means of production, which could be brought into operation at the first favourable turn of the market, acts as a check upon any advance, as buyers, in view of the largely increased production which higher prices would bring into the market, are quite indifferent about the future.

There was a moderately well attended iron market at Manchester on Tuesday, but very little doing, and prices had a weakening tendency. Outside brands of pig iron, such as Scotch and Middlesbrough, were to be bought at under the prices ruling last week; and although local and district makers were not actually quoting lower rates, where there was a possibility of negotiating anything like large sales there was a disposition to give way to meet buyers. Lancashire makers of pig iron still quote 43s. 6d. to 44s., less 2½ per cent. for forge and foundry, delivered equal to Manchester, and at about these figures sales to a moderate extent have been made during the past week; but for anything like quantities buyers want concessions, and a fairly large weight of business is pending the acceptance by makers of lower offers. For district brands the average prices are about 43s. 4d. to 44s. 4d. for Lincolnshire, and 44s. 6d. to 45s. 6d. for Derbyshire forge and foundry, less 2½ per cent., delivered equal to Manchester; but not much business is doing except where makers are prepared to come below their quoted rates.

In hematites the business doing continues extremely small, with no material change in prices from the basis of about 56s., less 2½ per cent., for good foundry brands delivered into the Manchester district.

The finished iron trade continues very dull. For home requirements the demand shows no improvement, whilst, for the season of the year, the shipping trade is extremely quiet. For good Lancashire and North Staffordshire bars delivered into the Manchester district £5 15s. remains about the average price, but for inferior brands less is being taken, and North-country iron continues to be pushed here at very low figures, bars and ship-plates being quoted at £5 12s. 6d., and angles at £5 7s. 6d. per ton. For local made hoops delivered at Manchester or Liverpool, £6 5s. is now about the average figure, and sheets can be bought at about £7 5s. to £7 10s. per ton.

In girder work there has been a good deal of activity of late both on light and heavy sections. A large quantity of railway bridge work has been recently given out, and makers of heavy girders in this district are in some cases full of orders. For mill and other building construction a very large weight of orders has been placed, and this has brought about an upward movement in the price of the lighter sections both of Belgian and English made girders, 2s. 6d. per ton above the price at which orders would have been taken a short time back, being now asked, and for ordinary sections delivered into the Manchester district, £6 to £6 2s. 6d. per ton is now about the average price.

Although I still hear complaints from engineers that new work is coming forward very slowly, and only at extremely low prices, generally a very fair amount of activity is being maintained, and tolerably large orders of one kind or another continue to be got here and there, which keep works going. There is not that actual pressure of work which existed a few months back, but there is certainly no actual scarcity of work, and the leading tool makers and machinists generally are tolerably busy, some firms in the cotton machine making trade, which, as I have pointed out previously, has been getting more active of late, having orders in hand that will carry them on to the end of the year.

Messrs. De Bergue, of Manchester, have just completed, for a firm in Italy, a powerful rivetting machine for marine boiler work. In general construction the machine is of the well-known De Bergue type, with steel holding up pillar, and is similar to one illustrated in THE ENGINEER some time back, with the exception that in this case the pressure is regulated by dead weight in the place of hydraulic power, and it is the second machine that the firm have made on this principle. It is termed a compound lever dead-weight rivetting machine, and is worked by gearing driven by a belt, and the pressure, as already stated, can be regulated by weight upon a lever working through a system of compound levers, so that the predetermined weight upon the rivet is never exceeded, and in the present machine the maximum pressure which it is calculated to put on is 50 tons.

The question has been mooted among the various scientific, literary, and other societies associated more or less with engineering, mechanical, and mining pursuits established in Manchester, whether they might not all be brought together under some central organisation. It is suggested that a special building in which the various societies should all hold their meetings might be provided, and not only would this be the means of affording better facilities than are at present possessed for holding such meetings, but it would bring the societies into closer union, which would tend to promote the various objects they have in view. The suggestion has not yet taken any actually definite form, but a committee has been appointed to make preliminary inquiries, and ascertain whether such a scheme would be practicable.

In the coal trade business continues fairly steady for the time of year, and, with the exception of the common classes of round coal, all descriptions of fuel are moving off moderately well, the cold weather of the past month having given an extra activity to the demand for house fire consumption, which has helped up trade considerably. There is, however, by no means any real briskness in trade, and even with pits working only about four days a week stocks are being put down. Prices are without material change, except that there is a giving way upon the top quotations, which in a few cases were being adhered to, and that for quantities under current rates is being freely taken. The average prices at which coal can be bought at the pit mouth are about 9s. for the best qualities, 7s. for seconds, 5s. 6d. for common round coals, 4s. 6d. to 5s. for burgy, 3s. 9d. to 4s. 3d. for best slack, and 3s. to 3s. 6d. for ordinary qualities.

Fairly large railway contracts for locomotive fuel have been concluded during the past week, and I understand that the prices obtained have been slightly better than those which were got last year.

A tolerably active trade is being done for shipments, but the prices taken to secure orders continue very low, Lancashire steam coal delivered at the high level, Liverpool, or the Garston Docks not fetching more than 7s. to 7s. 6d. per ton, whilst seconds, house coal, can be bought at about 8s. 3d. to 8s. 6d. per ton.

The question of reduction in miners wages in the West Lancashire district, which has been under consideration for some time past, is, as I anticipated last week, now being allowed to drop, and, at least for the present, no further meetings will be called to consider the matter.

Barrow.—On the whole the iron trade of this district remains very dull, with few signs of an early improvement taking place. Consumers are very backward in placing out orders, and the little business doing is just sufficient to supply immediate wants. One would have thought that with the present low prices buyers would have been a little speculative, but this does not appear to be so. Makers, although anxious to do business, show a disposition to reject low priced orders. Prices are certainly low enough, and little, if any, profits are realised on present transactions. Few orders of any extent are coming to hand, and the shipments lately have fallen considerably. Quotations this week are practically unchanged, although they are a little firmer. Mixed samples of Bessemer are in demand at about 47s. 6d. per ton net at works. The quantity of metal stored at the warehouses is considerable, and with the present state of affairs some time must elapse before it will be cleared. The output so far has been fairly well maintained; but I have reason to believe that unless business becomes brisker makers will further reduce the output. The steel makers of the district are but indifferently employed, and the orders to hand from all quarters are inextensive. Little activity is noticeable in any departments, as the contracts on the books are of no great extent. Rails are quiet at from £4 10s. to £5 per ton net at works, prompt delivery. Shipbuilders are practically at a standstill, and no new orders have been booked for some time. Builders all over the district are deciding to partially close the works, and in some instances operations have ceased entirely. Iron ore is in improved demand, and some large sales have been made at advanced prices. Quotations generally ruling are from 8s. 6d. to 9s. 6d. per ton net at mines. Stocks are heavy. Coal and coke easier. Shipping dull, as freights are low.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

SOME time ago I mentioned that Messrs. Sanderson Brothers and Co., one of our oldest establishments, had secured the War-office contract for files for the unprecedentedly long period of three years, the deliveries to be about 12,000 dozen a year. The Admiralty contracts have now been given out, and three local firms have been successful enough to obtain the work. The quantity required is 11,000 dozens, of which Messrs. Charles Cammell and Co., Limited, and Messrs. Austin and Dodson have taken 4000 dozens each, and Messrs. Howell and Co.—Brook Steel Works—3000 dozen. Portions of these contracts provide that the files shall be "sand-blasted" according to the process of Tighlman's Patent Sand-blast Company, Bellefield Works, Fawcett-street.

The Staveley Coal and Iron Company has just made several important alterations in its Articles of Association. It has reduced the qualification of directors from £5000 to £2000, lessened the maximum number of directors from eleven to seven, made provision for the resignation of directors, and lowered the amount of call to be made at any time to £10. Formerly, the directors could make a call of £25 if they pleased. Mr. Beddow, the late secretary, has found it necessary for reasons of health to resign his office; and the reduction of the directors' qualification is to admit him to a seat on the Board, Mr. Beddow's experience and acquaintance with the company's affairs rendering this step desirable. These and other alterations were approved by the shareholders at a meeting held on Monday, and have to be confirmed by a special meeting to be subsequently called.

The strike of colliers at Unstone and Dronfield still continues. At Sheffield hand-picked Silkstone brands are quoted at 13s. 6d. per ton; best Silkstone brands, 12s. 1d.; best Silkstone screened, 11s. 3d.; second Silkstone screened, 10s.; nuts, 7s. 11d.

The dulness in the shipbuilding trade continues to have a depressing effect on the iron and steel trades, and there is no prospect of any improvement in the immediate future. The keen competition between the large steamship companies has had the inevitable effect of "no dividends," and in some instances heavy losses. Firms who make a specialty of cranks, propeller blades, and similar heavy goods, are well employed; but there is very little doing otherwise.

All kinds of railway material are but lightly ordered, the railway companies having of late years greatly increased their own powers of production in springs, buffers, and other rolling stock. Rails are scarcely worth mentioning, so very little is now done in that department here. The iron markets are dull. Consumers, in the hope that prices may still fall, withhold orders, and makers stubbornly decline further concessions. Bessemer steel is also dull, and the crucible steel trade has rarely been so languid.

Sheffield is about to take definite action with regard to the passage of traction engines through the town. The Highway Committee have recommended the enactment of a bye-law prohibiting, during eight hours a day, any traction engine traversing any of the roads of the borough. This was the first recommendation made by the committee two years ago, but it was so severely opposed in the Town Council that the bye-law was limited to only thirty streets. Some serious accidents have recently occurred in the town, which have led to this stringent rule being again brought up.

The seventh annual delegate meeting, in connection with the West Riding of Yorkshire Miners' Permanent Relief Society, was held at Barnsley on Tuesday. The Earl Fitzwilliam—who presided—and the Earl of Wharncliffe were present; 2242 members have been added during 1883 to the roll, which now numbers 16,138—1429 half members and 14,709 full members. The revenue from all sources was £11,203 10s. 7d., or £1405 8s. 9d. over the preceding year. After the payment of all current claims and charges during the year there remains £2905 10s. 7d. to place to the £17,752 17s. 10d. available capital previously reported, bringing the total to £20,660 8s. 5d. The Society has now been in existence seven years, during which it has relieved 10,704 members, no less than 2845 having been helped last year. In the explosion at Wharncliffe Carlton nineteen of the twenty who lost their lives were members, and the cost of the claims arising from this disaster was nearly £4000. The number of members killed during the year was 55, bringing the total in seven years to 151. A motion was proposed in regard to the Aged and Infirm Members' Department. The Earl of Wharncliffe told the members they would murder the Society if they agreed to it, and eventually the motion was defeated by 37 to 20. The motion was to the effect that the Aged and Infirm Fund should be worked together with the other fund of the Society. By the new rules of the Society, all coalowners who give 20 per cent. on the amount contributed by their workmen will be entitled to honorary membership, and two gentlemen representing the employers are to have seats on the board of management. Previously the coalowners, who contribute one-sixth of the income, have had no voice in the Society's affairs.

At the annual meeting of the Kelham Rolling Mill Company, held at the Cutlers' Hall on the 30th inst., the chairman—Mr. J. M. Habershon, J.P.—stated that the company had turned out a greater weight of material during 1883 than in any former year of the company's existence; but the keen competition had materially reduced prices. This was especially the case with regard to German competition in the wire trade. A dividend of 4s. per share was declared.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THERE was about an average attendance at the Cleveland iron market held at Middlesbrough on Tuesday last, but of actual business there was scarcely any. Home consumers are holding off, in the hope of being able to buy at lower rates, and inquiries from foreigners are not nearly so numerous as is usual at this time of year. Merchants' prices for No. 3 g.m.b. are 36s. 9d. to 37s. per ton. Sales of small quantities have been made at the lower figure, but most of the business done on Tuesday was at 36s. 10½d. Makers outside the combination accept the latter price, but the minimum price quoted by those inside is 37s. 3d. No. 4 forge iron can be bought at 35s. 6d. per ton from merchants, but makers ask 6d. per ton more.

Warrants are little inquired for. The price is nominally 36s. 9d. per ton.

The stock of pig iron in Messrs. Connal's Middlesbrough stores has not altered during the last four or five weeks. Their stock at Glasgow has decreased slightly.

Shipments from the Tees are but moderate this month. The quantity of pig iron sent away to Monday night was 72,107 tons, against 75,679 tons last month, and 81,470 in April, 1883.

There is no change for the better in the finished iron trade. Keen competition invariably takes place for the few orders appearing in the market, and the prices accepted are ruinously low. Shipplates may be had for £5 per ton for good specifications. Angles are being offered at £4 15s. and common bars at £5 5s. For small lots the price is about 2s. 6d. per ton higher. Bar makers are fairly well-off for work, and the price of bars is consequently higher than that for plates. The prices named are all free on trucks at makers' works, cash 10th less 2½ per cent. discount.

As the ships on the stocks at the various building yards on the east coast become completed the number of unemployed workmen increases. Scarcely any new vessels are being ordered, and distress and destitution among the less provident classes becomes daily more apparent. The following is an estimate of the unemployed in the north-eastern towns and surrounding districts compared with the respective populations. It has been compiled from returns made by correspondents of the *Newcastle Chronicle*, and is probably not far from correct.

	Unemployed.	Population.
Newcastle and Walker	2,000	165,000
Gateshead District	500	67,000
North Shields District	3,950	62,000
South Shields District	3,500	109,000
Sunderland District	8,750	145,000
Hartlepool	500	50,000
Stockton and South Stockton	2,600	53,000
Middlesbrough	3,500	75,000
Cleveland	1,000	20,000
Total	25,800	746,000

Considering that the first set of figures represents bread-winners only, and the second the entire populations, it becomes necessary to take only, say, one-fourth of the latter, in order to get a comparison between operatives out of work and those continuing at work. If this be done, and due allowance be made for the non-wage-receiving class, it will be seen that something like one operative is now out of employment to five still remaining employed.

Owing to depression in trade, Messrs. Pease and Co. have given a fortnight's notice to the men employed at their Windlestone Colliery.

The new steelworks, which are being erected by the Weardale Iron and Coal Company at Spennymoor, are fast approaching completion, and it is expected that a start will be made in about a month.

The boring operations are still proceeding at Port Clarence. Salt was reached at one bore-hole on Tuesday last at a depth of 1030ft. below the surface. The bore-hole from which Messrs. Bell, Bros., and Co. have been obtaining brine for a considerable length of time was bored to a depth of 1200ft. before salt was found. A third hole in progress has already reached a depth of 600ft. Mr. John Vivian, of Whitehaven, is carrying out the work.

The West Hartlepool Ironworks, which have been standing idle for some time owing to scarcity of orders for iron plates, commenced last week to roll steel plates for a vessel Messrs. Wm. Gray and Co. are about to build. The plates are to be made from steel blooms supplied by the Steel Company of Scotland. About 500 men are employed at their works.

The fixed and loose plant—including three blast furnaces—belonging to the South Durham Iron Company, Limited, and situated at Darlington, were sold by auction last week. The company liquidated in 1877, and since then several unsuccessful attempts have been made to sell the works. There was a good attendance at the sale, and good prices were given for the blowing and other engines and boilers. The materials composing the furnaces were sold for £180 per furnace.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE warrant market has been again quiet this week, and prices were flat, the fluctuations being confined within narrow limits. It was anticipated that the week's shipments would be unusually large, but they only turned out moderate, and as the production has been somewhat increased the market has a more spiritless feeling than it had a week ago. Three furnaces that were extinguished at the Clyde Ironworks, on account of a breakdown in the machinery, have again been lighted, and there are now ninety-five in operation, as compared with 113 at the same date in 1883.

The stock of pig iron in Messrs. Connal and Co.'s stores has been reduced fully 300 tons since last report.

Business was done in the warrant market on Friday at 42s. 6d. cash. On Monday forenoon transactions took place at 42s. 5½d. to 42s. 4½d. cash, and 42s. 6½d. one month; the afternoon quotations being 42s. 4½d. to 42s. 3½d. cash, and 42s. 6d. to 42s. 5½d. one month. Business took place on Tuesday morning at 42s. 3d. to 42s. 2½d. cash, and in the afternoon at the same figures, and 42s. 5d. to 42s. 4½d. one month.

The market quotations of makers' iron are somewhat easier, as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 52s. 3d.; No. 3, 50s. 6d.; Coltness, No. 1, 57s. 6d. and 50s.; Langloan, 53s. 6d. and 51s.; Summerlee, 51s. 6d. and 47s. 6d.; Calder, 53s. and 47s.; Carnbroe, 52s. and 48s.; Clyde, 47s. 6d. and 45s. 6d.; Monkland, 44s. and 41s.; Quarter, 43s. 6d. and 41s.; Govan, at Broomielaw, 43s. 9d. and 41s.; Shotts, at Leith, 52s. 6d. and 51s. 6d.; Carron, at Grangemouth, 48s. 6d. (specially selected, 54s.) and 47s. 6d.; Kinneil, at Bo'ness, 45s. and 44s. 6d.; Glengarnock, at Ardrossan, 52s. and 45s. 6d.; Eglinton, 45s. 9d. and 42s.; Dalmellington, 48s. 3d. and 44s.

There is no improvement in the malleable iron trade. The past week's shipments of iron manufactures from the Clyde embraced £17,253 worth of machinery, £3300 sewing machines, £4100 steel goods, and £21,100 iron manufactures.

In the coal trade there has been rather more activity in certain departments, but, as a whole, the volume of business is considerably behind what it was at this time last year. The past week's shipments from Glasgow embraced 4220 tons for Quebec and Montreal, 2200 for Copenhagen, 1490 for Genoa, 1346 for Leghorn, 1250 for Portland—Oregon—1380 for Pillau, 1060 for Valparaiso, 1670 for Norway, 692 for Buenos Ayres, 1100 for the West Indies, 480 for Mexico, and 397 for Oporto. There is a fair shipping business this week.

The Wishaw coal-field is at present threatened with disaster in the shape of flooding. Since December last there has been an extensive inflow of water from an adjoining colliery into the Netherton Colliery on the Wishaw estate, the lessees of which are the Glasgow Iron Company. In the Netherton pits the best appliances for pumping are in operation, and the water has accumulated so rapidly as to completely inundate the splint coal workings, and also the main coal workings, which are 13 fathoms above the splint coal seam. The water has been rising at the rate of 18in. a day, and still continues to rise. One of the pits has had to be altogether abandoned in consequence. Application has been made to the Sheriff Court at Lanarkshire on the subject, and engineers have been appointed to examine the pits.

The West Calder, Broxburn, Oakbank, and Uphall Mineral Oil Companies have agreed to restrict the reduction of their shale miners' wages to 5 instead of 10 per cent., and the men are again at work.

The movement for restricting the output of coals is now very generally adopted throughout Lanarkshire.

At a meeting of the executive board of the Fife and Clackmannan Miners' Association on Saturday, Mr. Jas. Innes in the chair, it was resolved that before commencing the restriction policy, with a view to enforcing an advance of wages, indicated by the unanimous votes of the men, a series of mass meetings be held throughout the two counties, so that a definite policy may be inaugurated and carried out with thorough unanimity and effect.

At the annual meeting of the Mining Institute of Scotland, held a few days ago, Mr. James M'Creath, M.E., was reappointed president. It was reported that the members on the roll numbered 447, an increase of thirty-six in the course of the past year. Papers were read by Mr. J. H. Ronaldson on "Coal Mining in Belgium," and by Mr. G. W. Smith on "The Diamond Fields of South Africa."

Considerable interest has been shown in the trial which took place this week at Whinninghall Colliery, Fifeshire, of the Harrison improved mining machine, which has been brought to this country by Mr. George Whitcomb, of Chicago. It is wrought by air pressure, works both long wall and stoop and room, measures about 7ft. in length weighs 500 lb., requires a maximum of 10 cubic feet of air per minute at 65 lb. pressure, strikes 200 blows per minute, and is credited with performing the work of eight miners at a cost of 4s. 6d. per day.

On Monday evening notices were posted at the Clyde shipbuilding yards intimating another general reduction in wages, to take effect on the 12th May. In the past month twenty-five new vessels, with an aggregate tonnage of 23,482, were launched, as against twenty-nine, of 31,883 tons, in April, 1883. For the four months the production is sixty-seven vessels, of 86,242 tons, compared with eighty-one, of 114,218, in the corresponding period of last year.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

Wales is being shipped away wholesale! I think last week was one of the heaviest coal shipments on record. From the three principal ports to foreign and coastwise destinations went no less than 278,378 tons! Out of this great total Cardiff sent foreign 164,398 tons, and 18,720 coastwise. Newport followed with a total all round of 54,418 tons, and Swansea, which is steadily improving, with 40,842 tons. This is good work, and though one could wish to see another shilling per ton for best coals, still the result is fairly satisfactory to coalowners and colliers. I hear of one company whose returns show a margin to the good of £125 daily. This is, of course, very exceptional.

The tone of the house coal trade is improving, and the shipping and other interests of Newport are in consequence improved. Another good feature is also visible at most of the collieries. The stocks of small steam are lessening, but as yet coke ovens are not more active, and the great iron and steel industries still remain in a semi-dormant condition. I may fairly state that not one of the works is turning out half of what it is capable of doing. These are not good signs for Cyfarthfa, which is now in a forward state of completeness. This week they have been busy loading the blast furnaces, and the make of pig may be expected to begin the second week of May. I have not heard of any demonstration. The Crawshays are a practical business race, and the way that close upon half a million of money has been spent shows it. Everything is solidly done; no half measures. The best productions of Tannett, Walker, and Co., Leeds; Stephenson and Co., Preston; Galloway and Co., Manchester; and Davy Brothers, of Sheffield, have been obtained, and if steel rails are wanted, and can be made with any profit, it is at Cyfarthfa that this will be done.

Advices from America are slightly better, and railway speculations in various countries are hopeful of steel business improving. A good railway scheme is now being floated that promises well—the Northern of Europe Railway putting the iron works of the world in contact with iron ore containing 97 per cent. of iron. Whenever this ore is brought to English works, Bilbao would suffer. As for Welsh ore, with its poor percentage of 25 per cent., its day is gone, though, singularly enough, the stocks turned out at collieries where iron is worked with the coal are not suffered to remain long on the bank unsold.

The Ocean collieries' sliding scale will admit of an advance to the colliers this term. This will surprise many, seeing that the Ferndale scale did not justify an advance; but the Ocean collieries are the cream of the cream.

The Newport Slipway Company has declared a dividend of 7½ per cent. This is an exceptionally good undertaking, and in capital hands.

The shipping industries of Cardiff are not buoyant. Steam shipping has been overdone, and I am afraid that the meeting called of steamship owners will not mend matters. The project is to lay up ships in ordinary for certain proportionate periods, allowing owners so much per ton for doing so. The fact is too many steamers have been built, and we must get either a largely increased industry to employ them, or a decrease in building must correct the overplus.

A capital concern has been started at Swansea—the Swansea Bay Graving Docks and Engineering Company; capital £150,000, in £50 shares. The object is to carry on, principally at Swansea and Briton Ferry, the ordinary business conducted at a graving docks. Sir J. Jenkins, M.P., and many of the leading capitalists of Swansea are largely interested in the scheme.

A steam tug company has been started at Cardiff, called the Pioneer; capital £650, in £10 shares.

Tin-plate business at Swansea and in Monmouthshire is very good of late, and a stiff demand has set in. Best tinned-steel plates are most sought for. Ordinary coke plates fetch 3d. to 6d. more than last week. Present prices, 15s. 3d. to 15s. 6d.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

*** *It has come to our notice that some applicants of the Patent-office Sales Department, for Patent Specifications, have caused much unnecessary trouble and annoyance, both to themselves and to the Patent-office Officials, by giving the number of the page of* The Engineer *at which the Specification they require is referred to, instead of giving the proper number of the Specification. The mistake has been made by looking at* The Engineer *Index, and giving the numbers there found, which only refer to the pages, in place of turning to those pages and finding the numbers of the Specification.*

Applications for Letters Patent.

*** When patents have been "communicated," the name and address of the communicating party are printed in italics.

22nd April, 1884.

6632. Dust Shoots, A. M. Wheeler and W. Warren, London.
6633. Vessels for Containing Liquids, J. R. Blair, Manchester.
6634. Regulating the Speed of Gas Motor Engines, C. H. Andrew, Stockport.
6635. Sight Feed Lubricator, R. Montgomery, Greenock.
6636. Knocking-off Boards for Cloth Milling Machines, &c., E. Wood, Leeds.
6637. Shapes for Bonnets, A. T. Harden, Manchester.
6638. Roughing Horseshoes, W. J. Nash, London.
6639. Knobs and Spindles, J. Mangnall, Manchester.
6640. Bacon Knives, J. Shepherd, Stockport.
6641. Preventing Bells going over in Change Ringing, J. Shaw, Bradford.
6642. Covers of Tea Canisters, W. Kloen, Birmingham.
6643. Compound for Sizing Yarns, J. Clarke, Nelson.
6644. Electric Cables, &c., S. F. Shelbourne, New York, U.S.
6645. Pencil Clasps and Pocket Holders, G. A. Schlechter, Reading, U.S.
6646. Secondary Voltaic Batteries, H. F. Joel, London.
6647. Insulating Materials, J. A. Fleming, Hampstead.
6648. Pipes for Smoking, F. S. Rothschild.—(*S. Notton, France.*)
6649. Mail Bag Catcher, W. W. Horn.—(*J. A. Kellogg and W. A. Reneau, Nashville, U.S.*)
6650. Heel Machines, P. M. Justice.—(*The Mansell Heel Machine Company, Massachusetts, U.S.*)
6651. Diamond-shaped Wire Net or Trellis Work, J. R. Collier and D. S. Musgrave, Manchester.
6652. Carburetting Air, J. H. Johnson.—(*E. Delamare-Debouttville and L. P. C. Malandin, France.*)—*26th February*, 1884.
6653. Transmission of Motive Power, J. H. Johnson.—(*E. Delamare-Debouttville and L. P. C. Malandin, France.*)—*26th February*, 1884.
6654. Steam Valves, &c., J. Etherington and J. Batey, London.
6655. Automatic Shaft Carrier with Solid Bearings, W. Walker and T. S. Shoulder, Leicester.
6656. Grates for Cooking Purposes, J. Wetter.—(*A. M. L. Mathioly, France.*)
6657. Billiard Markers, &c., J. Wetter.—(*J. Couteux, Bagnolet, France.*)
6658. Utilising the Flow of Fluids in Pipes, J. Wetter.—(*T. Glaneur, Havre, France.*)
6659. Self-igniting Signal Lights, G. S. Allright, Oldbury.
6660. Grinding Wheat, &c., C. Lampitt and E. J. Guest, Warwick.
6661. Cradles, &c., L. Micciullo, London.
6662. Gas Engines, S. L. Wiegand, Philadelphia, U.S.
6663. Car Couplings, S. L. Wiegand, Philadelphia, U.S.
6664. Preparation of Beverages, J. Walker, Leeds.
6665. Wigs, F. Horsnell, London.
6666. Kilns, A. W. L. Reddie.—(*F. Pelzer, Dortmund, Germany.*)
6667. Drying China Clay, &c., J. Lovering, St. Austell.
6668. Preparing Infusions of Coffee, &c., D. H. Shuttleworth-Brown, London.
6669. Preparing Infusions of Coffee, &c., D. H. Shuttleworth-Brown, London.
6670. Valves, W. R. Lake.—(*W. Scott, Malden, U.S.*)
6671. Driving Tacks, W. R. Lake.—(*E. Woodward, R. Ash, and E. F. Grandy, Massachusetts, U.S.*)
6672. Rolling Axles, &c., W. R. Lake.—(*R. H. Thompson and H. D. Norris, New York.*)
6673. Breech-loading Fire-arms, W. R. Lake.—(*J. Tonks, Malden, U.S.*)
6674. Looms, W. R. Lake.—(*L. Malhère, Paris.*)
6675. Obtaining Incised Designs on Metal Surfaces, J. Brown, London.
6676. Detaching Gear for Ships' Boats, J. S. Wilson, Southampton.—*28th March*, 1884.
6677. Ships' Davits and Gear Attached thereto, J. S. Wilson, Southampton.
6678. Gas Motors, P. Mugnier, Paris.
6679. Disinfecting Wearing Apparel, T. Jennings, London, and G. Case, Bristol.
6680. Counting, O. W. F. Hill, Norbiton.
6681. Substitute for Suspensory Bandages, C. Thornhill, Colchester.
6682. Supports or Holders for Books, J. C. Wilson, Oxford.
6683. Combined Umbrella and Walking-stick, J. Fenigstein, London.
6684. Pedo-motive Apparatus, A. M. Clark.—(*J. B. Hall and T. P. Hall, Ontario, Canada.*)
6685. Cigars, &c., A. G. Goodes, London.
6686. Saucepans, &c., J. W. Perkins and R. W. Perkins, London.
6687. Filters, J. H. Jacobs and H. Went, London.

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6688. Cameras, S. D. McKellen, Manchester.
6689. Metal Eyelet, H. Law, Northampton.
6690. Gully Trap, F. W. Hagen, Kingston-upon-Hull.
6691. Water-closet Basins, F. W. Hagen, Kingston-upon-Hull.
6692. Neutral-axis Braced Girder for Bridges, W. Campbell, Newcastle-upon-Tyne.
6693. Set of Nine Pins and Balls and Table, W. T. Black, Northampton.
6694. Type-writing, E. E. Peacock, Streatham Hill.
6695. Heating Furnaces, J. W. Summers and T. Sharp, Staleybridge.
6696. Corking Machines, J. F. Gowans, Glasgow.
6697. Attaching Buttons, &c., to Garments, &c., J. S. Whitten and E. Hemming, Birmingham.
6698. Clippers, J. Kimberley, Birmingham.
6699. Production of Hot Gases, P. Macintyre, Maryport.
6700. Extraction, &c., of Glycerine, E. Jackson, Handsworth.
6701. Raising and Lowering Music-stool Seats, &c., H. P. Trueman and J. G. New, Birmingham.
6702. Barring Machines, W. Hargreaves and W. Inglis, Bolton.
6703. Ovens, J. L. Baker, Hargrave.
6704. Rising and Sinking Platforms, J. L. Baker, Hargrave.
6705. Frames for Bicycles, A. Fiddes, Bristol.
6706. Exhausting or Forcing Apparatus, A. Fiddes, Bristol.
6707. Unfermented Drinks, E. Perrins, Sparkbrook.
6708. Rack Pulleys, F. E. Morris, Colchester.
6709. Toothed Wheelworks, E. Capitaine.—(*The Actiengesellschaft Duelmen (Eisenhütte Prinz Rudolph), Germany.*)
6710. Pianos, E. Capitaine.—(*T. Mann and Co., Germany.*)
6711. Connecting Ends of Driving Ropes.—E. Capitaine.—(*D. Mueller, jun., Germany.*)
6712. Notches for Umbrellas, &c., C. F. Nokes, Birmingham.
6713. Self-motive Power Engine, J. Wilson, London.
6714. Velocipedes, &c., C. K. Welch, London.
6715. Bicycles, &c., C. K. Welch, London.
6716. Fork and Knife Sharpener, W. Kaufman, New York.
6717. Pocket Receptacle for Billiard Chalk, W. R. E. Alexander, London.
6718. Pencil Sharpener, W. R. Alexander, London.
6719. Mechanical Toys, J. G. Tongue.—(*F. Staudt, Germany.*)
6720. Generating Carbonic, E. Capitaine.—(*Dr. M. Shroeder, Germany.*)
6721. Window Screen Ventilators, O. Barrett, Leeds.
6722. Obtaining Copper, A. P. Price, London.
6723. Parallel Ruler, D. Pope, London.
6724. Making Paper Stuff, G. and C. D. Singer.—(*J. H. Chaudet, France.*)
6725. Bending Staves for Casks, &c., W. R. Lake.—(*E. and B. Holmes, New York.*)
6726. Hydrocarbon Oil Burner, H. J. Allison.—(*D. A. Dangler, Ohio, U.S.*)
6727. Regulating Supply of Liquids, G. Clutterbuck, London.
6728. Malting Grain, E. P. Alexander.—(*J. N. Galland, Paris.*)
6729. Discharging Chemically-charged Liquids, J. Sinclair, London.
6730. Travelling Cranes, B. and F. W. Walker, Hunslet.
6731. Chromates and Bichromates, W. J. A. Donald, Glasgow.—*13th March*, 1884.
6732. Glazing Greenhouses, &c., S. Eliott, Exeter.
6733. Movable Dome or Cover, H. Aplin, Bishopston.
6734. Electric Generators, Hon. C. A. Parsons, Durham.
6735. Motors Actuated by Elastic Fluid Pressure, Hon. C. A. Parsons, Durham.
6736. Decomposing Metallic Haloid Salts, C. Hoepfner, Berlin.

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6737. Treating Sulphates, R. Trevet and N. MacPhie, near Johnstone, and J. Pettigrew, jun., Greenock.
6738. Communicating in Trains by means of Electric Bells, J. E. Drokin, Birmingham.
6739. Receiving Electric, &c., Signals, M. Gill, Huddersfield.
6740. Four-wheeled or Two-wheeled Vehicle, E. C. and J. W. Clift, Wellington.
6741. Rein-holders, R. F. Finlay, Liverpool.
6742. Packing Caustic Soda, J. Clare, Penketh, near Warrington.
6743. Production of Printing Surfaces, N. Macbeth, Bolton.
6744. Holding Tools to a Smith, R. Archer, Durham.
6745. Corliss Valves, R. Ogden and I. M. Livesey, Ashton-under-Lyne.
6746. Easy Chair, R. H., C., and H. J. Bishop, Stroud.
6747. Twist Lace Machine, E. Longmire, Derby.
6748. Connecting Leather Picking Arms to Picking Sticks, D. Crosland, Lindley.
6749. Stands, &c., for Holding Lawn Tennis Nets, F. Davis, Nottingham.
6750. Superphosphates of Lime, E. Packard, Bramford, near Ipswich.
6751. Obtaining Phosphoric Acid, E. Packard, Bramford, near Ipswich.
6752. Obtaining Products from Phosphate of Lime, E. Packard, jun., Bramford.
6753. Lamps, T. C. J. Thomas, London.
6754. Freezing Microtome, J. Swift, London.
6755. Blotter Desk, J. Livingstone, Glasgow.
6756. Leather, J. Paterson, Glasgow.
6757. Inkstands, J. A. Wagner, Peckham.
6758. Mitreing for Picture-frames, &c., T. L. Switzer, Isle of Wight.
6759. Trussing Straw, J. Marshall, Gainsborough.
6760. Feed Lubricator, R. J. Threlfall, Gateshead.
6761. Shanks of Boots and Shoes, A. V. Newton.—(*J. Keats, Frankfort-on-the-Main.*)
6762. Transmitting Motive-power, J. Hodgkinson, Salford.
6763. Wringing and Mangling Fabrics, J. P. Rothwell, Lytham.
6764. Gas Producers, &c., J. G. Wilson.—(*J. E. Bott, Delaware, U.S.*)
6765. Crucibles, J. G. Wilson.—(*J. E. Bott, U.S.*)
6766. Tricycles, R. S. Wheels, Coventry.
6767. Bicycles, T. Humber, Beeston.
6768. Making Fodder, J. Wetter.—(*H. Hencke and Co., Grüneck, Germany.*)
6769. Elastic Gaiters, G. Blumenthal, Berlin.
6770. Electricity Counter, H. Avon, Berlin.
6771. Sewing Machines, A. B. Smith and S. Pattee, San Francisco.
6772. Magnetic and Electrical Apparatus, L. Mason and C. R. Huxley, London.
6773. Embrocation, R. Cole, Wallingford.
6774. Downcast Ventilator, T. H. Herbertson and R. Pollock, London.
6775. Railway Couplings, J. T. Leighton, Edinburgh.
6776. Miniature Ammunition for Ordnance, R. Morris, Blackheath.
6777. Cutting and Printing Stepped Indexes, A. S. Coghill and J. A. C. Ruthven, Dublin.
6778. Portable Ovens, A. J. Boult.—(*E. V. Noorden, I. V. Baalen, J. Knight, and S. J. McDowell, U.S.*)
6779. Oxidised Linseed Oil, E. Fischer, London.
6780. Match-boxes, S. B. Stevens, Reading.

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6781. Ensilaging Forage, T. Pearson, Glasgow.
6782. Envelopes and Paper Wrappers, C. C. Bell, Greenwich.
6783. Reeling Machines, W. Scott, Antrim.
6784. Motors for Tramways, A. McNeill, Liverpool.
6785. Keys, &c., J. H. King, Liverpool.
6786. Bleaching Mineral Oils, &c., W. P. Thompson, Liverpool.
6787. Breech-loading Small-arms, W. Tranter, Aston.
6788. Temples for Looms, A. McNab, Glasgow.
6789. Washing Coal, &c., R. Robinson, near Bishop Auckland.
6790. Reservoir Penholders, D. H. Sparling, Oldham.
6791. Brackets for Supporting Window Curtain Rods, &c., C. Priestland and G. Fletcher, near Birmingham.
6792. Storing Forage or Vegetables, H. J. Rogers, Watford.
6793. Producing Designs upon Waterproof Fabrics, J. Hebblewaite and E. Holt, Manchester, and A. S. Young, Stubbins.
6794. Propelling Ships, &c., A. Berhard and M. Zagury, Paris.
6795. Drill Chucks, R. H. Brandon.—(*A. Söderström, Stockholm.*)
6796. Gun Carriages, B. B. Hotchkiss, Paris.
6797. Scotch Bonnets, A. Goold, Hawick, and W. Wylie, Stewarton.
6798. Fastenings for Window Sashes, J. B. O'Callagan, London.
6799. Head Stalls, J. Lytle, Belfast.
6800. Supporting Trousers, J. Williams, Sheffield.
6801. Valve Motion of Steam Hammers, G. Glossop, Sheffield.
6802. Low Water Alarm Apparatus for Steam Boilers, J. H. Dewhurst, Sheffield.
6803. Gearing for Lathes, J. Cunliffe, Sheffield.
6804. Weighing Machines, T. H. Ward, Tipton.
6805. Washing, &c., Fibrous Materials, W. Scheidt Prussia.
6806. Domestic Fire-grates, &c., J. Hall, Stockport.
6807. Exhibiting Railway Signs, W. R. Holyoake London.
6808. Filter Presses, J. H. and J. Porter, London.
6809. Combined Brush and Scraper, J. Walsh, London.—*28th January*, 1884.
6810. Lighting Broughams, J. Barrett, London.
6811. Liquid Meters, J. Wetter.—(*G. Lee, Spain.*)
6812. Adjustable Horse Collar, L. A. Groth.—(*P. Mersch, Luxembourg.*)
6813. Causing Bicycles to Stand Alone, H. S. Brown, London.
6814. Removable Brush Handles, W. A. Barlow.—(*F. L. Eckendoerffer, Paris.*)
6815. Steam Boilers and Furnaces, J. Rowan, Glasgow.
6816. Railway or Tramway Carriages, E. G. Brewer.—(*T. Grondona and Co., Milan.*)
6817. Domestic Open Fire-grates, H. Westman Birmingham.
6818. Picture-rod Hooks, E. Tonks, Birmingham.
6819. Lawn Tennis Poles, F. W. Squier, London.
6820. Preventing Waste of Water, T. Morgan, Hay.
6821. Tube Stopper, S. A. Johnson, London.
6822. Traction Engine Wheels, G. Grieg, Harvieston.
6823. Ploughs, G. Greig, Harvieston, and T. Benstead, Leeds.
6824. Safety Gear for Starting Fly-wheels, C. J. Galloway and J. H. Beckwith, Manchester.
6825. Multicolour Printing Apparatus, F. H. B. Phillips.—(*J. T. B. Gibbs, Sydney.*)
6826. Photograph Frames, P. J. Charles, London.
6827. Mounting, &c., Stump Bars, A. Harrison, Nottingham.
6828. Crushing Ores, &c., T. W. B. Mumford and R. Moodie, Victoria Docks.
6829. Raising Water, &c., H. H. Lake.—(*A. Rhende, San Francisco.*)
6830. Corn Separating Machines, F. J. Drechsler, London.
6831. Amalgamating Auriferous, &c., Ores, H. G. Williams, East Greenwich.
6832. Writing Slates, E. J. J. Dixon, Bangor.
6833. Ploughs, W. H. Sleep, St. Germans.
6834. Adjusting Door Handles to their Spindles, W. Harrison, Sheffield.
6835. Bottle Stoppers, J. S. Davison, Sunderland.
6836. Ratchet Drilling or Boring Machines, L. Short, Backworth.

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6837. Moving Straps on and off Driving Pulleys, B. A. Dobson, Bolton.
6838. Printing Textile Fabrics, W. Mather, Manchester.
6839. Driving Gear for Bicycles, J. E. Dixon, Nottingham.
6840. Belt Fastenings, J. W. Sutton, Liverpool.
6841. Burning Bricks, &c., W. Wade, Liverpool.
6842. Navigation, &c., Apparatus, V. Falkner, Southport.
6843. Boring Holes in Metal, R. Jones, Birkenhead.
6844. Flap or Check Valves, F. G. Stoney, London.
6845. Steering Perambulators, &c., J. G. Jones, Manchester.
6846. Tool for Facing the Flanges of Steam Pipes, J. Tyson, London.
6847. Thread Guide Ballooning Wire, &c., S. Tweedale, Accrington.
6848. Thread Guide Ballooning Wire, &c., S. Tweedale, Accrington.
6849. Projecting Rescue Lines, M. W. O'Reilly, Batley Carr.
6850. Roofs for Silo Pits, W. G. Cowlishaw, Stoke on-Trent.
6851. Socks for Boots, &c., H. Harrison, Birmingham.
6852. Opening and Closing Doors of Hoists, B. Shaw, Wakefield.
6853. Ploughs, A. Leslie.—(*A. S. Massey, Madras*
6854. Clamp Rollers, I. D. Pollard, London.
6855. Sound Signalling, J. W. Black, Glasgow.
6856. Music Sheets for Mechanical Musical Instruments, P. Ehrlich, near Leipzig.
6857. Breakwaters, &c., G. H. Beamish, Queenstown.
6858. Safety Apparatus for Mine Cages, &c., J. Large, near Chippenham.
6859. Drying Granular Materials, P. Fichet, Paris.
6860. Frames of Swings, J. M. Rogers and C. J. Sayer London.
6861. Collecting Soot, C. D. Abel.—(*S. Schomburg, Berlin, Germany.*)
6862. Elevating Grain, &c., J. B. Stoner, London.