THE FRENCH INTERNATIONAL EXHIBITION.

THE CEREMONIAL OF THE DISTRIBUTION OF AWARDS.

SUNDAY—the last day of the past month—was that appointed for the arrival at Paris of the Sultan; and Paris was all alive with preparation for the reception with due honour of the only Oriental potentate who is admitted a member of the European family of nations and of monarchs. The hi hest functionary and representative of Islamism, and of the descendants, if not of the Prophet, at least of that race of conquering and fanatic cavalry that not three hundred years ago were the dread of all Christian nations, was received by the Emperor in person, with as much if not rather more pomp and deferential display than marked the entrance to Paris of the Emperor of all the Russias or the King of Prussia on previous occasions. It is not devoid of mark and consequence to the reflecting man that Paris at this moment has become the central point of gathering for so many of the great ones of the earth; but taken in connection with the ostensible object that is assumed to bring them all here, the visit of the Sultan in person is more full of meaning—more pregnant with evidence of the unseen and resistless moral forces that are ever changing—and on the whole improving the destinies of mankind—than is the arrival of all the other "high personages" put together who have been brought in contact by this Exhibition. It may be but a straw in the air, but it is one which shows that the bracing breath of western thought; bearing with it intellectual and moral vigour, begins to blow over the old and arid deserts of Eastern dreaminess and superstition, when the representative of the Prophet and chief of Mohammedans for the first time visits France and England, and that the occasion of his visit is the display of all that is most opposite to fatalism, all indeed that science, art, letters, and civilisation claim as their great results. The Sultan had reposed after his long journey but one night within the palace placed at his disposal by the Emperor, when in common with all Paris he was early astir—when on every side sight and sound gave note of the preparations going forward for the great solemnity appointed for two o'clock of the Monday, July 1st, when in person the Emperor should receive the formal report of the Vice-President of the Imperial Commission, and should then deliver with his own hand the great prizes to those exhibitors to whom they had been adjudged.

The Exhibition building in the Champs de Mars having been constructed, and wisely—as by this time probably all are ready to admit—with the single view to perfection in the organisation and arrangement of its vast contents, contains no single unoccupied space but the so-called vestibule; and as this would have been utterly inadequate to accommodate a great assemblage, so the Palais de l'Industrie—the scene of the Great Exhibition of 1855—was chosen for the place of this crowning event in the career of its vast successor of 1867.

Nothing could have been more judicious than the choice, nor more superb than the style in which it was adapted to this august occasion.

The Palais de l'Industrie, it will be recollected, consists of a great stone, iron and glass roofed structure, rectangular in plan, but with square masses projecting from each of its angles. A great central nave, reaching at the springing of the arched glass roof which covers it in one clear span, to the full height of the external walls, is surrounded at either side by narrower side aisles, and at both ends by aisles or transepts of about equal width with the last. These also are glass arch roofed, and are divided, as to their height, into two storeys by an intermediate or gallery floor, borne at one side by the double range of coupled columns of cast iron which sustain the common springings of the glass roofing arches. There are eight great groups of entrances to the building, which, as originally constructed, formed but one vast area, broken only by the columnation, and by the noble stone staircases that lead from the ground level to that of the gallery floor.

The great central nave is thus a rectangle of probably about 600ft. in length by 200ft. in width, and of vast height.

Such was the immense apartment with which the architects and others charged with preparing it for the great ceremonial had to deal, and right grandly did they imagine and effect their designs in fitting it for the reception of such and so vast an audience as probably has never before been collected under one roof. Great as are the dimensions above approximately given as those of the clear unbroken area of this gigantic hall of audience, still more space was demanded, and so all round this clear area, a breadth of 30ft. to 40ft., was taken in and separated by partitions from the side and end naves.

The great central rectangle was given a semicircular termination at either end, so that the whole assumed a form similar to that of the central garden at the Champs de Mars. The floor at its middle portion was sunk some four or five feet below the original *rez de chausseé*, or street level of the building and the central area—a long parallelogram with rounded ends, being boarded over, was surrounded by a continuous flower-bed, a sloping bank of a few feet in width, and rising three or four feet from front to back. This sloping belt was thickly set with geraniums and roses and other flowers innumerable, and edged with green and growing sward, and marked by a low gilded lattice edging, running all round at front and rear. At the level of the top of this beautiful ribbon of flowers ran all round a fine broad boarded pathway of circulation, and round this again rose, tier after tier, the seats, reaching to the back of the spaces we have described as taken in from the surrounding aisles, for those who were privileged to be present on the ground floor.

Like ranges of seats rose above each other all round the entire area at the gallery level. Every seat was formed with a well-stuffed cushion and back, divided off by iron elbows, and all numbered; each literally a luxurious armchair, though twenty thousand or thereabouts in number. Thanks to this numbering of places—to the admirable arrangements made without and within, and the clear instructions given upon the admission cards to their holders—to the subdivision of the arrivals amongst many wide and convenient entrances—and to the broad and noble avenues of approach to the building by the Champs Elysees from all directions—the vast assemblage, numbering not far short of twenty thousand persons (functionaries included) were all disposed in their places with ease and regularity within an hour and a half, and dispersed again after the ceremonial with as much or more ease than often does the congregation of a fashionable church in London.

The centre of the side of this building to the north, or that facing the great central avenue of the Champs Elysees, was that chosen for the grand *estrade*, occupied by the throne, and for the seats of the crowned heads and other great guests of the occasion. The approach to this platform was from behind the throne, therefore, its level being several feet above the central area, and it was approached in front by a broad and carpetted flight of steps, canopied above and behind with carved work, velvet and gold at either side, marked off by grand emblematic fluted columns of vast proportions, and in style of conventionalised Corinthian—rich in matt and burnished gold all over—draped in deep crimson velvet, whose massive folds were glowing with gold lace and embroidery, and ranged with crimson velvet and gold chairs of state, at either side and behind the three of more special splendour destined for the Emperor, the Empress, and the Prince Imperial, and carpetted beneath in tints of rich and sombre crimson. Nothing could look more imperial than did this, the centre point of a display where everything was superb.

All round the springing level of the great translucent roof arch above a continuous moulded cornice had been formed, in tints of crimson and gold, broken at short and equal intervals by panels marked out in a bold and noble style of scroll work in matt gold, and bearing the names, in golden letters, of the various nations and States who have borne part in the Exhibition. Beneath this all round hung for some feet in depth a vallance of crimson velvet cut into deep pendentives, and broadly edged with gold.

The columns at either side marked out the length of the double storey into twenty-six intervals, with seven such at either end; and at either side of these vertical members, in grand and massive folds, hung crimson velvet and gold-edged draperies, which reached and dropped behind the continuous gold and crimson emblazoned balustrade which fronted the surrounding galleries. Beneath these, decorations of like character approached the level of the ground at about the mid height and breadth of the bank of rising seats all round the ground floor. The boarding of the central area was tinted a sombre maroon, and this also was the prevalent tint of the carpeting with which all the rest of the floor was covered, and of the seats, &c., throughout the whole area, as well as that of the encircling walls round all. But little of the cast iron of the columns or of their finely-shaped brackets supporting the building was left visible, but where these could be seen their clear light grey colour answered well to the eye with the great prevailing tints of rich deep sombre red, relieved by grand and sweeping bands of gold. At the gallery balustrade and in front of every column a fan-shaped group of national flags, corresponding with the nation whose name was written above, was placed. The prevailing tints of these, in great part bright red, white, yellow, and here and there a bit of green or blue—were made with wonderful skill to harmonise with the general tone and tint of colour. Over head the great arch of glass supported by the graceful and delicate lines of iron grey of its really elegant roof framing was covered all over outside by calico, in alternate very broad transverse bands of ambery white, dotted over quincunx, with golden stars and with narrower double bands, with a line of white between of a soft and delicate green alternately at intervals of some ten or twelve feet.

This rich-looking *velabrum* mitigated the rays of the sun of the glorious day, than which even Paris could present not one finer nor more serene and lightsome, and tempered the clear daylight that reached the immense area below to its remotest corners. In the great concave below this arch, and following its general curve, hung innumerable bannerols, apparently of silk, with pointed lower ends and golden-touched and fringed surfaces, which, gently moved by air currents, floated outwards in tints and colours various and bright, but all in excellent harmony with all the other colours around.

The back vertical surfaces, so to say, of the galleries above and below were of a sombre reddish colour, and, without obtruding on the eye, completed the cincture of this truly imperial hall, as constituting its surrounding walls. Through these, above and below, many *vomitoria* gave entrance and egress.

At the east end, upon the floor level, was the orchestra, occupying nearly the whole of the semicircular space at that extremity, and backed by the bright array of silvered pipes of the organ, and by the five-and-twenty harps that were destined to swell the harmony of Rossini's hymn.

At the other end was the broad flight of steps giving entrance to the central area of the floor, for those of the ten great groups and classes of the exhibitors who were to be honoured by rewards. These, as they arrived, headed each by its inscribed banner borne aloft, took up their places upon velvet-covered *fauteuils*, placed crosswise upon the middle floor space at intervals, separated by emblematic trophies.

Along the centre line of this central space, and separating these collections of seats, were arranged with general good taste, ten large trophies, representing—in a sort of half-realistic, half-allegorical or symbolic manner—the ten great groups into which the material of the Exhibition has been divided. These trophies were perhaps as good as the conditions rendered possible, but it is hard to draw poetry out of pickles—as was more markedly evident to ourselves in 1862—and upon the whole, perhaps, these trophies were rather viewed as an inevitable necessity, intended to mark, by outward and visible signs, the purpose of the moment, than as matters of choice and good taste; and so the less said about them the better, beyond this, that even in these there was nothing very incongruous, and absolutely nothing offensive to eye or taste.

The entrances to the building were opened at noon, and within an hour some sixteen thousand persons had, without difficulty or confusion, taken their seats. The great orchestra was filled with its regiment of five hundred instrumentalists, and the front slope of its great hemicycle occupied by the graceful chorus of female singers in white muslin uniform dress—about twelve hundred performers in all.

The central area rapidly got peopled by the great well-dressed, and yet motley crowd of men privileged to this part of the hall, who moved about the central space and around the broad belting pathway, and watched the rapidly filling seats of both storeys, as those galleries got filled with their occupants, amongst whom was the chief part of the ladies present. These, with their brilliant toilettes, soon converted the sombre maroon of the empty seats into a living parterre of more than floral beauty; and at the distance of a few hundred feet—for of such distances we must speak in attempting to sketch visual effects in such a hall as this—the bright hues of the women's dresses became harmonised into a strange sort of iridescence, that almost made one unconscious of the prevailing darker tints of the clothing of the intermingled men.

The usual strange figures that we remember at the great ceremonies of our own Exhibitions of 1851 and 1862, continually met one in the moving and standing central crowd of men; but here they were more remarkable in many ways than on those previous occasions. Hungarians, in their grand furred and jewelled cloaks and gold-spurred boots, the very type of the mediæval noble of a nation of cavalry—French marshals, whose very names are as the trumpet call—churchmen of every creed and church that acknowledges one God and father of all—Armenians, rabbis, doctors of the law, members of universities—Turks—the Russian of the far-off North—Japanese, with swarthy skin and jetty hair, and gleaming intelligence of eye—Chinese in strange brocades—Danes and North Germans, with clear grey eye and yellow hair and drooping moustache—the olive cheek and broad forehead of Italy—Spaniards so like but yet that can never be mistaken for those last—the Emperor might truly say all Europe was before him.

The uniforms, too, of almost every corps of every army in Europe were thickly sprinkled in the brilliant throng, and amongst these were here and there well distinguished the scarlet tunics or dark blue and gold of our own Engineers and Artillery, with a fair show of the soberer tints of our volunteers. Strange and quaint, and occasionally even grotesque-looking pigmies in gowns and collars, or badges of mediæval workmanship or type, proclaimed the presence of mayors, and aldermen, and burgesses, or syndics and burgomasters, from the great cities and ancient hives of industry of the Continent and of England. Scores of others met the eyes, and were as fast supplanted in the brain by fresh imagery as this huge human kaleidoscope perpetually moved and changed.

At half-past one the doors and entrances were rigidly closed, and woe worth the man whose tailor's habits, or whose own had made him late.

The ushers of the executive authorities moved about and requested all to be seated. The human voices, that before sounded like the wind in the distant forest, got gradually hushed, and as two o'clock approached—the hour fixed for the commencement of the ceremony—expectatiion was on tiptoe, and every face of the gathered and now marshalled and stilled thousands was turned towards the centre of the northern façade, expecting the Emperor.

A few minutes more and the "*Vive—vive—l'Emp—r—eur—'s*" swelling nearer and nearer, the slightly-heard clash and clank of sabres and harnesses outside, and then the rolling of drums and bray of trumpets, preluded the entrance of the Emperor and Empress. The sounds without had not died away when on they came, the foremost man of all the world and the graceful sharer of his throne, with their heir to be—the boy now looking healthy and well—leading the way, and after a moment's pause and greeting, the Emperor and Empress took their seats.

Their reception was enthusiastic, if judged of by the shouting of "*Vive l'Empereur*," which now made the great concave ring again, and was again taken up by the vast crowds outside, whose shouts once more reverberated upon the ear as the vast assembly within got seated and hushed, and the great dais around the throne got filled with the crowd of potentates, principalities, and powers—the guests of the Emperor and of France.

Amongst these the most conspicuous, or at least the most observed, were the Sultan, the Prince of Wales, the little Prince Imperial in his black velvet tunic and knickerbockers and scarlet stockings, the Princes of Orange and of Saxony, the Duke of Cambridge, Prince Teck, the Prince of Prussia, Prince Humbert, Mohammed-Mourad-Effendi the heir to the Sultan's throne, and of the emperor's family or race, the Princess Mathilde and Prince Napoleon, who looked the living image of his great ancestor, as he sat on the Emperor's extreme left, and almost motionless during the entire ceremony.

The assemblage is complete—a concourse worthy of a grand occasion. From his throne at either side of the steps, ascending to which are ranged a few gigantic Cent Gardes, motionless as armoured statues, the Emperor sees below and before him his Ministers of State, his marshals and admirals, and the great officers of the Legion of Honour. Below these, again, the members of the Imperial Commission of the Exhibition. To the right of the *estrade* of the throne are the household, the Senate, the Legislative Assembly, the Council of State; the representatives of the great bodies of the law, of the Council of Public Instruction, of the Institute of the Clergy of Paris, of the various Protestant churches, of the Jewish consistory of Paris, of the municipal bodies of Paris and of France, of the tribunals of commerce, and various others.

Opposite the throne is the brilliant assemblage of the foreign diplomatists with their ladies. To the left of these, and in the front benches of the seats, are the executive commissioners and higher functionaries of the various foreign nations, and upon the corresponding seats to the right are the foreign jurors.

The seats upon the same level as these, but to the right and left of the throne upon the northern side, are occupied by the corresponding functionaries of France, and some others; the reserved seats of the ground floor and those of the galleries are occupied by invited guests, the ladies of commissioners, &c., and by the season ticket-holders at large.

Every sound is hushed as the first notes of Rossini's grand hymn swell forth from the orchestra. Here are the words as written by M. Emilien Pacini—it would be easy to find fault with them in some respects. They rather lose sight of the rest of the world in presence of France and *her* glory, and seem to forget that the glory of the moment is that of all Europe, or rather of the whole civilised world, and that it is not simply for her own sake and her own glorification that France has given birth to the occasion. The Emperor in his speech avoids this mistake. However, it would scarce be fair or worth while to criticise too closely words which are, after all, but a sort of solemn lyric, and not perhaps much more than a vehicle for the grand music with which they were uttered—here they are.

A NAPOLÉON III.
ET
A SON VAILLANT PEUPLE!
HYMNE DE ROSSINI, PAROLES DE M. EMILIEN PACINI.

UN PONTIFE (*Solo*).
(Douze basses-tailles à l'unisson).
Dieu tutélaire !
O toi, notre père,
Des cœurs français
Entends la prière !
Pendant la paix
Et pendant la guerre.
Par des succès nouveaux
Couronne nos travaux !

LE CHŒUR (*Peuple, Soldats, &c. &c.*)
Dieu tutélaire !
O toi, notre père,
Des cœurs français
Entends la prière !
Pendant la paix
Et pendant la guerre.
Par des succès nouveaux
Couronne nos travaux.

LE PONTIFE.
Dieu, que tout révère,
Daigne, du haut des Cieux,
Ecouter nos vœux,
Et sur tes fils pieux
Abaisser les yeux.

(*Ensemble*).

LE PONTIFE ET LE CHŒUR.
Dieu tutélaire !
O toi, notre père,
Des cœurs français
Entends la prière !
Pendant la paix
Et pendant la guerre.
Par des succès nouveaux
Couronne nos travaux.
Que la France prospère !
Pour sa grandeur,
Pour son bonheur,
Veille, Seigneur,
Sur l'Empereur !
France, à son règne, honneur !

CHŒUR DE FEMMES (*Vivandières*).
De nos héros dans les combats,
Braves comme eux, suivons les pas !
Versons gaiment, à nos soldats
L'ardent nectar et l'oubli du trépas !
Dans la bataille,
Si la mitraille
Des régiments
Eclaircit les rangs,
Lorsque la poudre
Lance la Foudre,
Dans le sillon,
Au bruit du canon,
Quand les blessés
Tombent pressés,
A leur secours,
On risque ses jours.
Pour nos amis bat notre cœur !
Aide au vaincu ! Gloire au vainqueur !! } *Bis.*

LE PONTIFE.
Du Ciel implorons la clémence,
Peuple, à genoux !

INVOCATION.
O Providence,
Notre espérance,
Garde la France,
Protége-nous !
Sainte patrie,
Arts, industrie,
A ton génie !
Tout rend honneur.
Pour sa grandeur,
Pour son bonheur,
Veille, Seigneur,
Sur l'Empereur !
France, à son règne, honneur !!

Reprise du chœur :—
De nos héros, dans les combats,
. . . .
Aide au vaincu ! gloire au vainqueur !

Cri Général :—
VIVE L'EMPEREUR !! (*Trois fois*).
Le Canon tonne—Les Cloches sonnent à toute volée—Les Tambours battent aux champs.
FIN.

Large as was the orchestra it was not more than sufficient to fill the immense space; and the finer traits of the music, such as that of the twenty-five harps, said by those placed near to have been enchanting, were hardly heard at the opposite end of the hall. As the last rolling chords of Rossini's spirited and imaginative composition swelled into unison with the clash of great bells and the discharges of cannon outside, the Emperor smiled even to approaching laughter, and with a momentary expression that might arise from this *finale* coming very near the line that terminates the sublime.

In a few moments more, and after a few more *vives*, M. Rouher, the Vice-President of the Imperial Commission, read his report as follows :—

SIRE,—"At the commencement of this solemnity the duty of the commission, instituted under the honorary presidency of the Prince Imperial, whom we have seen with so much joy near the Emperor, is to retrace a rapid sketch of the efforts it has made to accomplish the mission confided to it by your Majesty; to point out the ready and effective co-operation which has facilitated the realisation of its work; and, lastly, to indicate the principal character and results of this great International Exhibition.

"The obstacles which the Imperial Commission had to overcome were considerable. It was necessary to completely transform the Champ de Mars, to raise the constructions which form the ornament to the park; erect the Palace, a vast monument which extends over a surface of 15 hectares ($2\frac{1}{2}$ acres each), then to instal and classify the products; and lastly, to forsee and satisfy the requirements created by that immense agglomeration of things and persons.

"The time for attaining such a result was parsimoniously measured out to us ; some months only were allowed, and a prolonged duration of unfavourable weather impeded its employment.

"The proportions of the undertaking were besides much greater than those of preceding Exhibitions, as will be shown by the mention of a few figures :—

"The surface occupied by the palace and its dependencies was, in 1855, 16 hectares ; in 1862, $12\frac{1}{2}$; and in the present Exhibition, 40, of which the palace covers more than a third. The number of exhibitors was 22,000 in 1855 ; 28,000 in 1862 ; and 60,000 in 1867.

"The weight of the products exhibited must be estimated at not less than 28,000 tons. The direct communication established between the palace and the continental railways could alone furnish the means of conveying and installing, with the necessary expedition and care, that enormous quantity of objects, the greater part of which arrived during the last few days of the month of March. The motive force for working the different machinery represents more than a thousand horse power. The hydraulic service is established on the basis of a distribution of water sufficient to provide for the wants of a city of 100,000 inhabitants.

"Notwithstanding the gigantic labours required to meet such necessities, the work was ready at the period fixed. But has success crowned the undertaking? Have those united efforts deserved the double and precious reward at which they aimed—your Majesty's approbation and the suffrages of public opinion?

"If we are not deceiving ourselves the judgment is at present pronounced. Every one is struck with the conception of the general plan and the facilities it offers for comparison and study. All approve of that law of unity which has assembled in the Champs de Mars: Fine arts, manufactures, agriculture, and horticulture, formerly disseminated in different places, but which present in the same enclosure all the manifestations of human activity.

"Public opinion acknowledges that the building, which for a moment was the subject of criticism, is perfectly appropriate for its use. The world comprehends that the necessary conditions of a clear and methodical classification of the various nations and their products could not be sacrificed for a monumental aspect, and that lofty galleries would have reduced in appearance the objects exhibited instead of placing them in relief in their real position. A nave of vast dimensions was exclusively reserved for the use of the machinery and for those powerful engines of modern industry which require an installation in proportion to their bulk, and a space in which their force and precision may be exercised without confusion, impediment, or danger.

"The bold dimensions of the circular gallery, accommodated with a platform, which isolates and protects the public from the contact of the machinery, have successfully realised that programme, and shown both the perfection attained by the French constructions in iron, and the great merit of the engineer who directed those works.

"The favour of the French and foreign visitors has also consecrated the success of the workshops of manual labour, in which may be seen the skill of the workman ingeniously transforming the matter, and competing with machinery in perfection and rapidity ; of the galleries of the history of labour, rich with the treasures borrowed from public and private collections ; of the park with its workmen's lodging houses, its models of the constructions of different countries, so original and picturesque ; of the reserved garden, a sort of oasis improvised in the midst of an arid locality ; of the measures adopted for profiting by the proximity of the Seine, which gives to those varied pictures the border of the river itself, animated with the flags of its flotilla of pleasure craft ; and lastly, of the Exhibition of Billancourt, where the agriculturist may see at work the implements in which he takes an interest, and follow experiments in the different modes of farming.

"We may be permitted, Sire, without offending the laws of modesty, to enumerate with some complacency all those elements of success. The efforts of the Imperial Commission, the great experience and devotedness of the Commissioner-General, the untiring zeal of those who co-operated with him, would not have been sufficient to overcome the difficulties of the undertaking. We have only taken a secondary part in the work ; the principal honour of it belongs to others, and we wish here to express our gratitude towards them. The foreign commissions, composed of eminent men of all countries, have been permitted, in their respective sections, the most complete latitude. To them therefore, belongs the merit of all those original and elegant installations which have contributed so greatly, by their variety, to the beauty of the whole.

"In the French section the work of granting admissions was performed, with a conscientious zeal, by special committees. The admission once given, it became necessary to proceed to the business of receiving and placing the articles. Instead of centralising this delicate operation in its own hands, the Imperial Commission confided it to syndicates of delegates, freely chosen or accepted by the exhibitors, and these have acquitted themselves of their charge with a disinterestedness and impartiality unanimously recognised. But the true producers of all those splendours which are admired by crowds of eager visitors are the heroes of this great solemnity, the fifty thousand artists and manufacturers, with their millions of workmen, the labour of whom constitutes at once the wealth of nations and the history of civilisation. The most worthy of the competitors had then to be chosen. The task was beset with difficulties; it was confided to an International Jury, a great and imposing tribunal, composed of 600 members selected from among the scientific, manufacturing, commercial, artistic and social notabilities of every country. This tribunal has been unceasingly occupied; it has been able to raise itself to those elevated and calm regions where every partiality disappears, where the spirit of patriotism itself is extinguished in presence of a sentiment still more noble, that of Justice. Under this generous inspiration the questions as to pre-eminence among the various industries carried on by rival nations were taken up and solved with great certainty of judgment. Thanks to an activity which has overcome all fatigues, the decisions of the jury have been completed, and the result may now be proclaimed in presence of your Majesty.

"The jury has awarded to the Exhibitors : 64 grand prizes (including those for the Fine Arts); 883 gold medals; 3653 silver; 6565 bronze, and 5801 honourable mentions. These figures do not comprise all the rewards given to the 8th and 9th Groups (Agriculture and Horticulture), which will not be awarded until the close of the Exhibition. Notwithstanding the great number of these recompenses the jury was obliged to limit its choice, and to omit mentioning many interesting objects of distinguished merit, and efforts in manufactures worthy of the highest encouragement. The jury on the new order of rewards has not less worthily performed its task, which was complicated by difficult investigations, because the duty of this jury was not to examine manufactured products, but to analyse and compare social facts. It has awarded twelve prizes, twenty-four honourable mentions, and four citations.

"The present solemnity is crowned by the proclamation of rewards still higher. Your Majesty has deigned to accord to the most eminent of the competitors in this pacific contention your Imperial order of the Legion of Honour. The Imperial Commission lays its most humble thanks at the foot of the throne for this testimony of an august sympathy.

"Permit us, Sire, before concluding this report, to offer some opinions upon the character and principal results of the Universal Exhibition, without, however, presuming to measure its entire scope, political and international. One of its claims to the attention of contemporaries and of posterity is certainly its character of universality. Not Europe alone has taken part in this competition; the new world, Africa, and the extreme East have contributed new features to it. The United States of America, kept away in 1862, from peaceful emulation by a great war, have claimed, in the Exhibition of 1867 the place which their political and industrial importance in the word assigns to them, and they have nobly maintained their position. The Central and Southern States of America, who have confided their collective interests to the zeal of a syndicate, have imparted an exceptional brilliancy to their collections. The Ottoman Empire and the Mahometan States of the west and north of Africa have not confined themselves to sending their products; they have, in some sort, initiated us in their civilisation, by transplanting their monuments, their habitations, and the spectacle of their domestic life to the Champs de Mars. The honour of the innovations is due to the personal intervention of the sovereigns of the States in question, who resolved themselves to take charge of the organisation of their collections. The countries of the extreme East, which heretofore had held aloof from our international exhibitions, have been brought by the zeal of our consular agents, of our merchants, missionaries, and men of science, to take part in this competition of the nations. The genius of invention has multiplied time and annihilated space. Those great and industrial nations, Persia, China, Japan, and their satellites, have now been drawn within the orbit of our civilisation, to the great advancement of prosperity and of universal progress. This assembling within the same walls of every people, having no ambition save that of doing well, no rivalry except that of being better, and emulously exhibiting their products, their resources, and inventions, presents itself to the astonished intelligence and to the soul filled with emotion as the grand and imposing picture of the successive conquests made by the labour of centuries, and of the incessant progress of human perfectibility.

"The organisation of the Tenth Group and the institution of special rewards have had for their object the solemn manifestation of those moral ameliorations which are at the same time the duty and the honour of humanity. This group comprises those objects which particularly concern the physical, material, and moral conditions of the populations. It follows the labourer in the different phases of his existence—infant and adult schools ; cheap articles of domestic use, dwellings, clothing, products, implements and modes of labour. This plan, conscientiously carried out, exhibits clearly for the first time those modest but powerful elements of social progress which were almost neglected in the systems of preceding exhibitions.

"The creation of the new order of recompenses was intended to show the services rendered by persons, establishments, and districts, which, by a special organisation or institution, have formed the bases and assured the development of the good harmony between those who co-operate in the same labours. That institution has given rise to a vast and minute inquiry pursued during a period of six months by the jury in the principal countries which have taken part in that competition, and on all the facts relating to that problem, the equitable solution of which concerns the stability of modern society. Our labour will not have been without its fruits. It will have imitators. It will open new horizons to the explorations of enlightened and generous minds. It will be the honour of the Universal Exhibition of 1867 to have cleared the way for those important international investigations.

"Thus, the Universal Exhibition reveals new industrial proceedings and initiatives which, without it, might have remained powerless or unknown; brings to light that law of the division of labour which is as productive between nations as among individuals; consecrates in a striking manner those principles of commercial liberty boldly inaugurated in France by your Majesty; increases economical relations among different nations, and marks, at a not distant date, the beneficial solution of the problem of the unification of weights, measures, and moneys.

"The Universal Exhibition produces still more valuable fruits; it dissipates inveterate prejudices, destroys feelings of hatred which have lasted for centuries, and gives rise to sentiments of reciprocal esteem. The nations, attracted by that extraordinary spectacle in this splendid capital, seek in vain for traces of past revolutions, and find everywhere the grandeur and prosperity which produces the security of the present and just confidence in the future. The princes and sovereigns, drawn here by a noble hospitality, come by turns to exchange in this temple of civilisation those friendly words which open calm horizons to all human activity, and strengthen the peace of the world.

"For all those reasons, Sire, the Universal Exhibition of 1867 will furnish a brilliant page in the history of your Majesty's reign and the grandeur of the 19th century."

After the completion of the reading of the report the Emperor rose, and read the following speech in a fine, clear, firm, loud, and manly tone of voice; one that gave good assurance to those present that his strength and health are such as may enable him—should such be in the plan of Providence—to reign and rule yet many years in France. Although the Emperor was clearly heard, even to the two extreme ends of the great hall, it was impossible to catch more than a sentence here and there connectedly at those remote points. This arose in part from the anxiety of all to hear him, causing some thousands to stand up, and that giving rise, at one or two moments, to angry and unseemly cries to sit down from some others.

The Emperor on coming forward said :—"GENTLEMEN,—After an interval of twelve years I have come for the second time to distribute the rewards to those who have most distinguished themselves in those works which enrich nations, embellish life, and soften manners. The poets of antiquity sang the praises of those great games in which the various nations of Greece assembled to contend for the prize of the race. What would they say to-day were they to be present at these Olympic games of the whole world, in which all nations, contesting by intellect, seem to launch themselves simultaneously in the infinite career of progress towards an ideal incessantly approached without ever being able to be attained. From all parts of the earth the representatives of science, of the arts, and of industry have hastened to vie with each other, and we may say that peoples and kings have both come to do honour to the efforts of labour and to crown them by their presence with the idea of conciliation and peace.

"Indeed, in these great assemblies, which appear to have no other object than material interests, a moral sentiment always disengages itself from the competition of intelligence—a sentiment of concord and civilisation. In drawing near, nations learn to know and to esteem each other, hatred is extinguished, and the truth becomes more and more evident that the prosperity of each country contributes to the prosperty of all.

"The Exhibition of 1867 may justly be termed universal, for it unites the elements of all the riches of the globe. Side by side with the latest improvements of modern art appear the products of the remotest ages, so that they represent at one and the same time the genius of all ages and of all nations. It is universal, for in addition to the marvel luxury brings forth for the few it displays also that which is demanded by the necessities of the many. The interests of the labouring classes have never aroused more lively solicitude. Their moral and material wants, their education, the conditions of life at a cheap rate, the most productive combinations of association, have been the object of patient inquiries, of serious study. Thus, all improvements march forward. If science, by turning matter to account, liberates labour, the cultivation of the mind, by subduing vices, prejudices, and vulgar passions, also liberates humanity.

"Let us congratulate ourselves, gentlemen, upon having received among us the majority of the sovereigns and princes of Europe, and so many distinguished visitors. Let us also be proud of having shown to them France as she is—great, prosperous, and free. One must be destitute of all patriotic faith to doubt of her greatness ; must close one's eyes to evidence to deny her prosperity ; must misunderstand her institutions, tolerant sometimes even of licence, not to behold in them liberty.

"Foreigners have been able to appreciate this. France—formerly disquieted and casting out her uneasiness beyond her frontier—now laborious and calm, always fertile in generous ideas, turning her genius to the most diverse marvels, and never allowing herself to be enervated by material enjoyments.

"Attentive minds will have divined without trouble that notwithstanding the development of wealth, notwithstanding enticements towards prosperity, the fibre of the nation is always ready to vibrate as soon as the question of honour and the country arises ; but this noble susceptibility could not be a subject of alarm for the repose of the world. Let those who have lived for a short time amongst us carry to their homes a just opinion of our country, let them feel persuaded of the sentiments of esteem and sympathy we entertain for foreign nations, and to our sincere desire to live at peace with them.

"I thank the Imperial Commission, the members of the jury, and the different committees, for the intelligent zeal they have displayed in the accomplishment of their tasks. I thank them, also, in the name of the Prince Imperial, whom, notwithstanding his tender age, I have been happy to associate in this great undertaking, of which he will retain the remembrance. I hope the Exhibition of 1867 will mark a new era of harmony and of progress. Assured that Providence blesses the efforts of all who, like ourselves, desire good, I believe in the definitive triumph of the great principles of morality and justice, which, while satisfying all legitimate desires, are alone able to consolidate thrones, to elevate nations, and to ennoble humanity."

When the Emperor had finished, which was instantly followed by loud applause and renewed cries of "*Vive l'Empereur!*" the ten groups of intended recipients for rewards, with banners still borne aloft before them, approached the throne, and were ranged across the hall at either side, and then, by order of the Emperor, M. Forcade, the Minister of Agriculture, Commerce, and Public Works, as also Vice-President of the Imperial Commission, read aloud the list of the awards in the ten groups, and also those of the new order of recompenses for establishments or localities where there exists the greatest mutual goodwill and well-being between the members of their population.

The men to receive these rewards, as well as those promoted to the highest ranks of the Legion of Honour, were then called up successively (in each group) and received their rewards from the hand of the Emperor seated. The medals or decorations were handed to the Emperor in succession by Marshal Vaillant, also a vice-president of the Imperial Commission. When the medal awarded to the Emperor himself in Group 10, for workmen's houses and model farms, was announced, the little Prince-Imperial took the medal from the hand of the marshal, and with the *naive* and lithesome grace of childhood handed it to his father. The distribution of rewards thus ended, the Emperor and Empress, with the Prince, the Sultan, and the Prince of Wales, and a large attendant suite, descended from the *estrade* and passed right round the hall by the broad pathway we early described. From the length of the traject this occupied some time, momentarily interrupted for a second or two, as it was at frequent intervals, by the presentation of the members of the several foreign commissions to their Majesties by M. de Play, of the Council of State and Commissioner-General of the Exhibition.

During this promenade the noble music of the orchestra was almost unattended to and completely drowned in the *vivas* that greeted the Emperor right heartily upon all sides. With none of these noisy expressions of good-will and respect did the Emperor and Empress seem more pleased than with the deep-voiced and hearty hurrahs which spontaneously rose from the large collection of British commissioners, jurors, and representatives present about the south-west part of the hall.

The circuit over the Emperor and his *cortège* re-ascended the throne. His Majesty then thanked the Imperial Commission through his Minister of State, and the ceremony was at an end. At forty minutes after three o'clock the Emperor and Empress withdrew, the *cortège* of the Sultan preceding theirs to the Palace of the Tuileries. Within less than an hour the great building was empty, and its late occupants, in number equal to that of a large army, had ceased even to crowd its precincts. Such are some of the fruits and advantages of good order, clear provision, and exactitude on all sides in such matters, coupled with broad and roomy avenues of approach from all sides. The want of these last alone, with respect to any large building we possess in London, would prevent the possibility of our attempting with success a gathering so vast as this which we have just described, even if nothing else stood in the way of it.

It will probably be many a year however before such an occasion shall again arise to call forth such another assembly as this—one in many respects the most remarkable and even august that the world has witnessed; for although we may not blind our eyes to certain of its aspects, nor misjudge tinsel for gold there, any more than we would mistake these in the ephemeral decorations themselves of the moment, it is yet impossible not to see in this great ceremonial the outcome and recognition of many thoughts, that in the end shall chase away some of the darkness and superstition—the cruelty and self-inflicted woe—of men and nations, and shall thus constitute a more real and lasting advancement of the human family towards the happiness inherent in the good and true, than even all the tangible and material benefits which the Exhibition itself offers to our hands and senses.

WE have had no small difficulty in obtaining an accurate list of the names of those who received medals, &c., on the 1st inst., all the lists hitherto made public are excessively inaccurate. That which we lay before our readers may possibly require some correction, but the corrections, if any are needed, will be excessively small.

First on our list comes the Grand Prix. The recipients are Krupp, Petin, Gaudet et Cie., Schneider and de Molon, Lapy, (Beaucourt), and Whitworth for tools.

Gold medals have been awarded to Sharp, Stewart, and Co., and Merryweather for steam fire engines; Howard of Bedford, Clayton and Shuttleworth, Fowler, Garrett and Sons, Ransome and Sims, and Hornsby; Howard and Bullough, of Accrington, for looms; Leeming of Bradford, Hodgson, Hooper, and Henley.

Silver medals have been awarded to Carrett, Marshall, and Co., pumps; Bryan, Donkin, and Co., engines; Eades, Birmingham, for pulleys, recently illustrated in THE ENGINEER; Glover, gas meters; Gwynne, centrifugal pumps; Lloyd, fans; Pooley, grain-weighing machine; Reading Ironworks Company, steam engines; Shand and Mason, fire engines; Tangye, pulley tackle; Weston, differential blocks; Davies, steam striker; Thwaites and Carbutt, Worssam and Co., De Bergue and Co.; Tannett, Walker, and Co., Keighley, Bradford; Parker, Dundee, Hattersley, Keighley, Schmidt, Haywood and Co., Hall, Aveling and Porter, Samuelson, Marshall and Sons, Bental, Richmond and Chandler, Robey and Co., Turner, E. R. and F., Coleman and Norton, Picksley, Simms, and Co., Penney and Co., Smith and Sons of Peasenhall, Lilleshall Company; Pooley, for weighbridges; Turton and Son, Elliott, Ladd, Selman, Stamford, Adams, Blackie, G. Blackie, Nicole, and Captain Benham Bowser, Barlow and Jones, Crewson, Hawkins, Kesselmeyer, Langworthy, Tolson, Maetier, Middleton, Mitchell, Shepherd, Willett, Greenor, Laing, Reilley, Small Arms Company, Whitworth, Cocks, Plumbago Company, Fox, Walker, and Co., Galloway, Hicks, Hargreaves, and Co., Porter, Thomas, Wanzer, Blanchard, Blashfield, Chubb, C. V. Cole, J. Cliff and Son, Doulton, Hobbs, Jennings, Maw and Co., Peake, Pulham, White Brothers, Colomb, Denny, Gisborn, Halstead, Martin, C. Mitchell, Palmer's Company, Ravenhill, Rennie, J. S. White.

The following is a list of the British exhibitors to whom the bronze medal has been awarded:—

Messrs. Cole, Statham, Aire and Calder, Edmondson, J. Green, Heaton, Pellatt, Ward and Hughes, Webb, Mappin, Watherston, Shaw and Fisher, Benson, Claxton, Holdsworth, Johannsen, Sewell, O. Vivier, Walker, White, Adams, Brown and Green, Leoni, Philp, Solomon, Musgrave, Woodcock, Gibbs, A. L. Gibbs, Aberdare Company, Addis, Baugh, Betts, Birmingham Iron and Brass Tube Company, Blaenavon Company, Bodringalt, Broughton Company, Bwllfa, T. Clark and Co., Elliott's Company, Davis (Cardiff), English and Australian Copper Company, Greene's Tube Company, Greening, Haswell Coal Company, Heeley, Hill (Birmingham), Dr. Honeyman, Macdonald and Field, Martineau and Smith, Moreton (Wolverhampton), Milward (Redditch), Morewood and Rogers, Rickett, Smith and Co., Stickley, Walker and Parker, Webster and Horsfall, Wigan Company, Zobell, Townsend and Co., Page, Adams, Baker and May, Britannia Rubber, Burgoyne, Bush, Calley, Clark, W. Cook and Co., Darney, Yates, Davy, Day and Martin, Dodge, Garrod, Goodwin, Green, Haas and Co., Hodgson and Simpson, Holland, Hosegood, Huskisson, Jarrow Company, Langton and Bicknells, Lamb and Sterry, Lange and Moselle, Lowe (Manchester), McDougall, McKay, Mason, Nimmo, J. N. Parker and Co., Pulford, W. Ransome, Rogers, Rumsey, Squire, Stephens, Talbot and Alder, W. Taylor and Co., Turner and Son, Wandle, Waring, Ashby, Bamlett, Kearsley, Nicholson, Ruston, Smith and Proctor of Kettering, Wallis, Woods, Appleby, Sharp, Stewart and Co., Baines, N. Defries, Electro Magnetic Company, Gas Meter Company, E. Green and Son, Kennedy, Marshall, Sons and Co., Paul, Royal Life Protection Society, Sugg, West and Gregson, Williamson, North Moor Foundry Company, Bass, Clayton, Massey, Neilson, Charles Powis, Powis and James, Robinson (Rochdale), Whitehead (Preston), Booth, Dixon, Irvine, Leoni, Watkins, Cook and Hacking, Ferrabee, Sowden and Stephenson, Lindsay Urquhart, Newton Wilson, Simpson, Turner, Robinson, A. Gordon, Livesay, Preece, Spencer (Newcastle), Brooke, Chatwood, Clark, Colehurst, Eassie, Gallichan, Gotte, Greaves, Macdonald, Norman, F. Ransome, A. Robinson, Sissons and White, Welsh Slate Company, Bolton, Clifford, Gourlay, Harfield, J. Harvey and Co., Hurst, Huxhams and Brown, Inglis, Lloyd's Register, Matthew, Oswald, Richardson, J. Taylor and Sons, Ward.

In the foregoing list we have included only the names of those who have exhibited in departments connected with engineering science, and we have not classified the departments under which they exhibit, the greater number having already acquired such eminence in particular departments that the class in which the exhibit occurs will be comprehended at the first glance.

PARIS EXHIBITION.—COAL.

No. I.

IN commencing a comparative view of the wide range of subjects presented to the engineering visitors of the Champs des Mars there can be no doubt as to the first subject which should occupy our attention. The prime agent of all modern industry claims that place, and when we recollect that its exploration and production have called into action almost every department of applied science and practical experience, we feel no hesitation in placing it first amongst the series of industries whose representation in the Champs des Mars it will be from time to time our duty to describe. We need not enlarge on the importance of the subject, for no one doubts it, nor need we enter into any lengthened disquisition on its formation, utility, or probable duration. Our business is simply to describe the mode in which the different countries producing coal have exhibited their wealth in the mineral and their mode of obtaining it, and to draw such practical conclusions as may seem to us to present themselves to observers interested in the matter.

It may be a question whether our description should begin with our own country, which is vastly the greatest producer in the world, or with the United States of America, who are immeasurably the greatest possessors of this first source of wealth, or with France, whose exhibition of machinery and appliances in coal getting is more extensive and complete in the Champs de Mars than that of any other nation. Leaning, however, towards our own country, and remembering that as she was the first to appreciate and utilise the inestimable advantages which the possession of coal affords, and is still producing about as much as all the rest of the world put together, we will begin with England. In doing so we cannot but regret that the coal industry is so insignificantly represented as to leave but little field for observation if we limit ourselves, as we must do, to what is to be seen at the great Exhibition. When we complained that no representation of civil engineering proper was made by England we thought we had mentioned the only main subject in which we were wholly deficient, but the conviction is now forced upon us that in this coal industry which is, as it were, a connecting link between the civil and mechanical branches of the engineering profession, England has shown almost as much neglect as she has done in failing to fill the place she ought to have taken in the civil engineering department. Gallery No. 6, which contains the stalls of most of the English collieries, and all the exhibitions of bar, plate, and pig iron, which we have vouchsafed to send, far more resembles a small museum of minerals and mineral productions than part of a great exhibition of competing firms, much less of competing nations. It is the old story, we believe, in England—we are tired of exhibitions. What good do they do us? why should we take such trouble about them? And the result is that we find ourselves altogether insignificantly represented as regards our staple industries. It is not that we have any fault to find with the quality or good taste of the exhibits displayed, but that as compared with other nations they are absurdly small in size and few in number. Many will, of course, say that this is a matter of no consequence, that we are the great producers, and that everybody knows it; but we doubt if this is altogether a safe line of argument. There can be no question whatever that although the raw material, the manufactures, and the machinery exhibited by England are, on the whole, still much in advance of what other countries have sent, yet from the generally diminutive proportions of the exhibits, especially in minerals and manufactured iron, England has lost caste, in the opinion at least of the great majority of ordinary observers. The effect may be infinitesimal—for after all the effect of exhibitions is only transitory—but we maintain that human nature is too susceptible of the impressions made by appearances to enable any portion of society completely to despise prestige. The only English coal-owners who have taken much trouble about their exhibit are the Wigan Coal and Iron Company, and they certainly are amongst the number in England who could best have afforded to dispense with any exhibition at all. In their narrow stall they exhibit a model of the engine-house and pit arrangements of the Crawford pits, and above it is a beautifully executed section of the strata, including nine seams of coal met with in sinking for the Wigan cannel at a depth of 565 yards. The sum of all the workable coal in the section is about 30ft., the thickest seam being 7ft. One of the two samples of coal exhibited below the model is the celebrated Wigan cannel, the composition of which is volatile matter 37 per cent., fixed carbon 60 per cent., residue 1·8 per cent., sulphur 0·2 per cent., water 1·0 per cent. Volume of gas per ton, 10,160ft.; specific gravity 1·268, percentage of coke 62, percentage of carbon in ditto 97, percentage of cinders in ditto 3. John Watson and Son have a model in boghead cannel, and show several products of its distillation, and the Gstalyferra Company, Swansea, have a fine specimen of anthracite.

The South Wales districts are represented by the Aberdare Coal Company, the Bodringalt Coal Company (Davis and Sons, Merthyr), who announce that they have supplied all the coal used by the French Imperial mail steamers to South America for the last three or four years, the Glyncorrwg, near Briton Ferry, and the Bwllfa Colliery, Aberdare, who send two neatly chipped cubes of fine anthracite coal, and we must not forget some capital specimens from Blaenavon. Scotland, as far as we could see, has only one representative, in the shape of a piece of the Duke of Hamilton's Lesmahagow cannel. The North Wales Coal Company appear with some specimens of cannel, shales and paraffin, and oil products therefrom. In the park the Bwllfa Colliery Company have a fine block of anthracite, hard, compact, and bright, and the St. Edmund's Main Coal Company have also a column about 10ft. high and 3½ft. square. Our colonies are ranged behind the unfortunate lighthouse, the Albion Mines, Picton, Nova Scotia, having a fine pyramid about 25ft. high, whilst the Caledonia Mine, Glance Bay, with a smaller specimen, gives the information that their annual yield has risen to the important figure of 650,000 tons per annum, or more than double that of Creusot. The other colonial mines represented are the Block House, Cow Bay, Cape Breton, Sidney Mine, Sidney, and Gowrie Mine.

We believe we have now mentioned most of the English exhibitions of coal. Of apparatus, machinery, and methods of extraction there is an entire dearth. With the coal exhibits themselves, as we have said before, we have no fault to find, but we are rather inclined to think they might just as well not have been there at all, as scarcely any pains have been taken to set forth their qualities, and not the slightest attempt has been made by our commission, or anybody else, to illustrate the enormous proportions of this great and truly national industry and source of wealth. There may always be the same answer made to our fault-finding *cui bono*, but we reply that England having appeared at all—and having voted a very large sum to pay for appearing ought to have been made to cut a better figure in the regions of Old King Coal, as the *Moniteur* says we call it.

Let us now return to America. Here we find a large and varied collection of specimens, and although their executive has also failed to illustrate the collective extent and importance of their coal-workings, they have to a certain extent made up for the deficiency by a very concise notice in their catalogue. A large case, common to many exhibitors, contains some hundreds of samples of bituminous and anthracite coal from Illinois and other states, and cannel from Western Virginia. There are also some beautiful square blocks of compressed coal exhibited by Dr. C. Saffray. They are finer in texture and more compact than any of the capital French and Belgian specimens of patent fuel. Pennsylvania, however, is the chief exhibitor, as she is the chief producer, of all the States raising annually nearly as much coal as is raised in France. Her large block of anthracite is of first-rate quality, and near it is a piece of genuine blackband ironstone. We noticed on the same stand a bit of the great Pilot Nob Mountain in Missouri, which consists wholly of iron ore. In 1860 the gross production of coal in the United States had reached 15,000,000 tons, being an increase of 169 per cent. on the yield ten years previously. The Americans have sent us no models of coal machinery, but it was not to be expected that they would, as of course the coal trade is still in its infancy there—enormous though it is already—anything like an exhibition of actual machinery would, we need hardly say, have been impossible, and also useless, as the time has not yet arrived for America to spare us anything large in the mechanical line.

When we turn to France we find that in coal mining, as in everything else, her utmost prowess has been put forth to show the world what she can do, and no one can deny that she has succeeded well. Her admirable school of mines, which has sent forth an army of trained engineers already to contend with the peculiar difficulties under which the trade labours in France, has furnished quite a library of maps and plans, arranged on a large stand in the machinery gallery, besides endless sections which cover the walls. To attempt to describe these in general would be impossible; we can only say of them that, admirable in detail, they show well the extent to which high scientific education has been brought to bear, both in the discovery of the small and scattered mineral basins which are dispersed over France, and in the practical development of them when found, notwithstanding the disjointed nature of the strata in general.

We referred in our impression of the 26th April to the annexe erected and arranged by the Coal Mine Committee of the Loire, which was then complete, and to our description of which we have nothing to add. This is a fair sample of the manner in which French coal owners have taken the matter in hand, but it is in the main gallery that we find the principal development of French coal *installation*.

(To be continued.)

LONG AND SHORT RIFLES.—In consequence of the recent report made officially by Lieut. J. Lecky, Assistant Instructor of Musketry to the Woolwich division Royal Marine Light Infantry, to the effect that the balance of superiority, and the accuracy of firing over the 750 and 800 yards' ranges, during their practice in the Woolwich marsh, under his superintendence, was notified in favour of the five-grooved short rifle, which, he states, is as superior to the long weapon as the Snider to the old Enfield, the Lords Commissioners of the Admiralty have ordered a detachment of twenty picked men, to be armed with an equal number of the two weapons, to go through a competitive course of firing.

THE COMPETITIVE BREECH-LOADERS.

FIG. 1

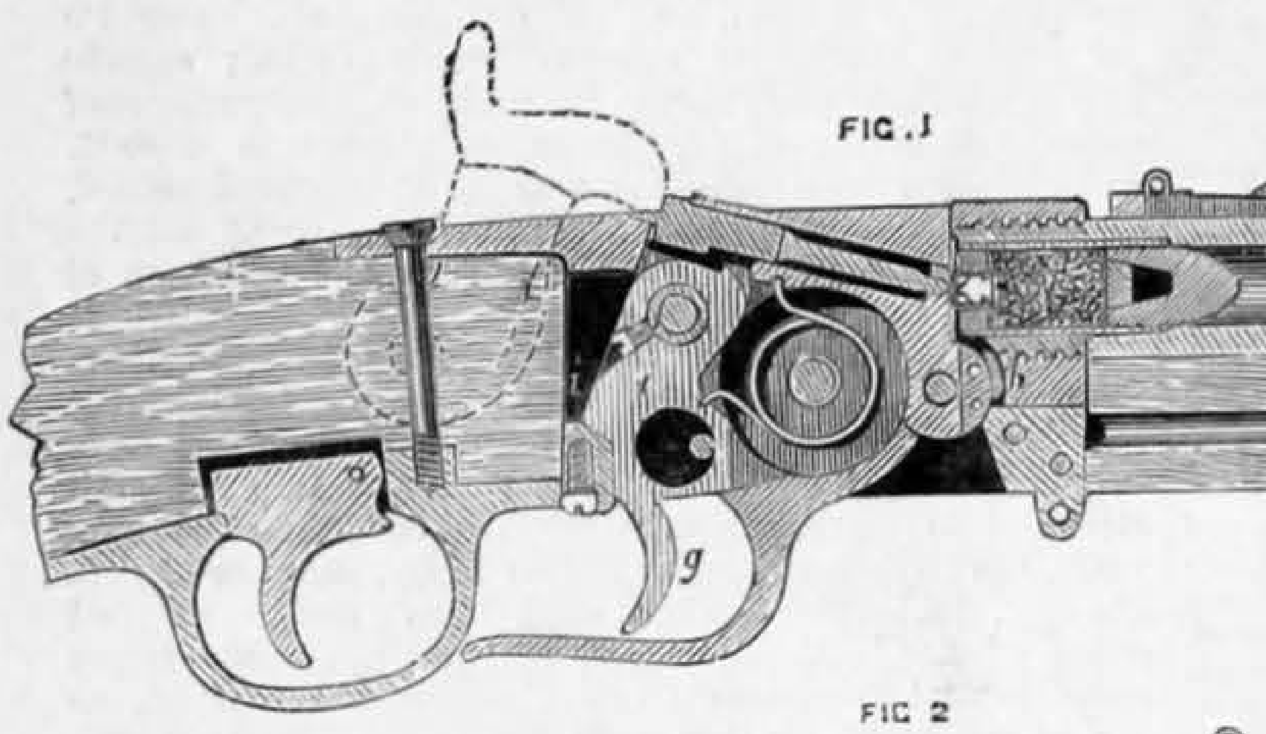


FIG. 2

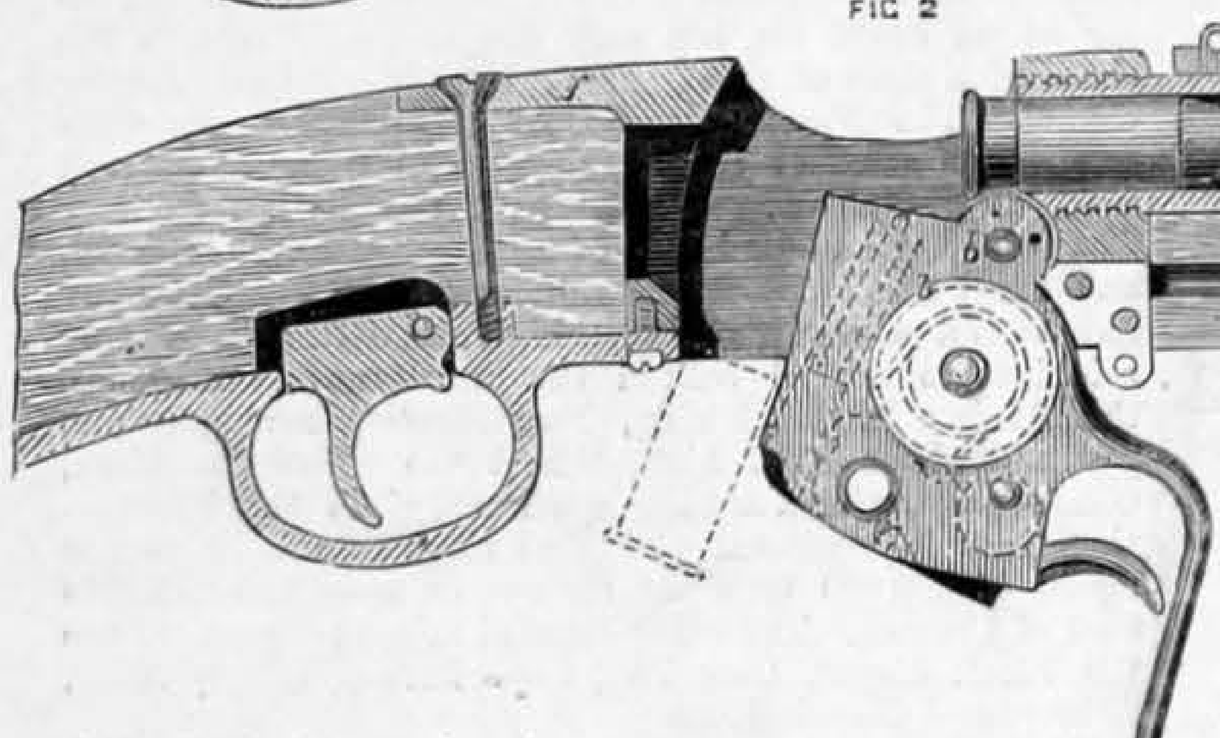


FIG. 3

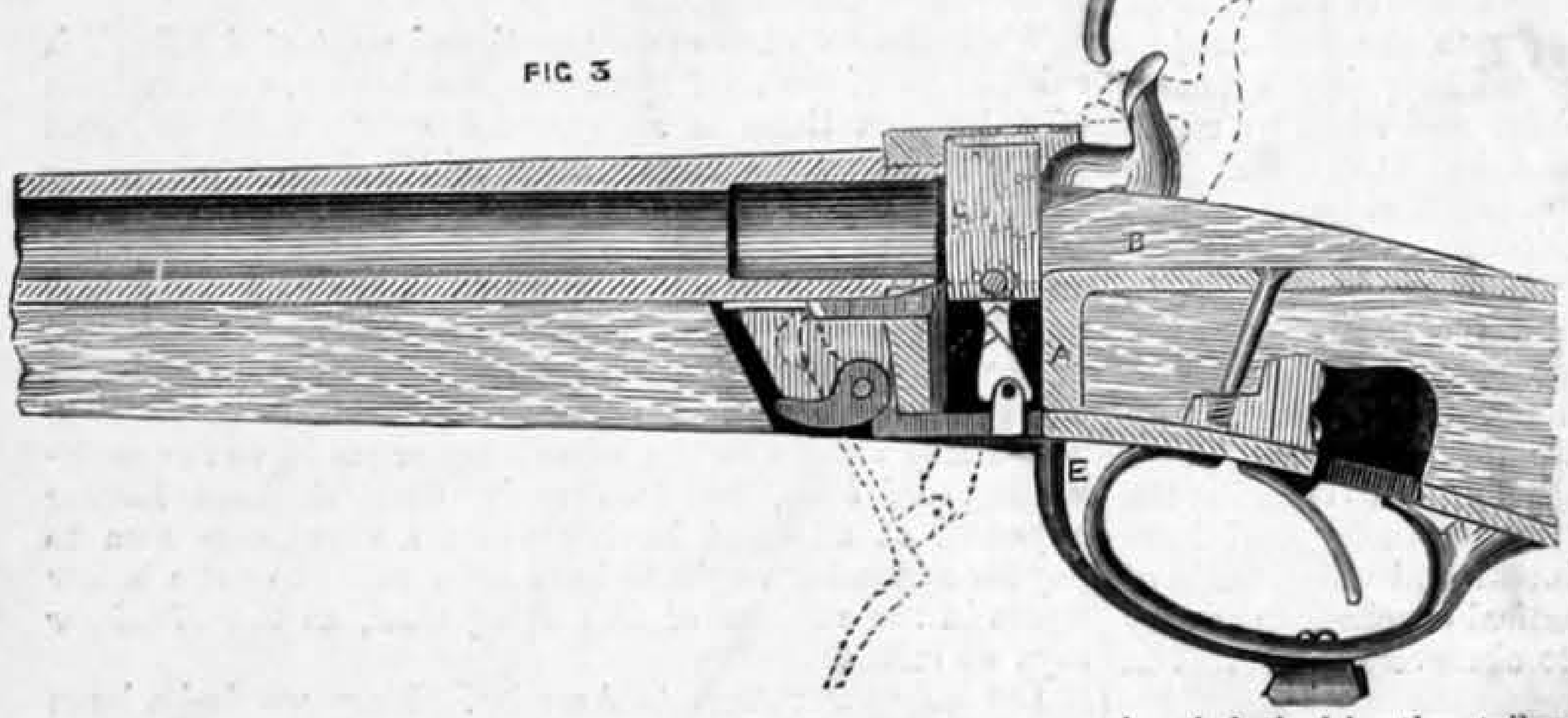
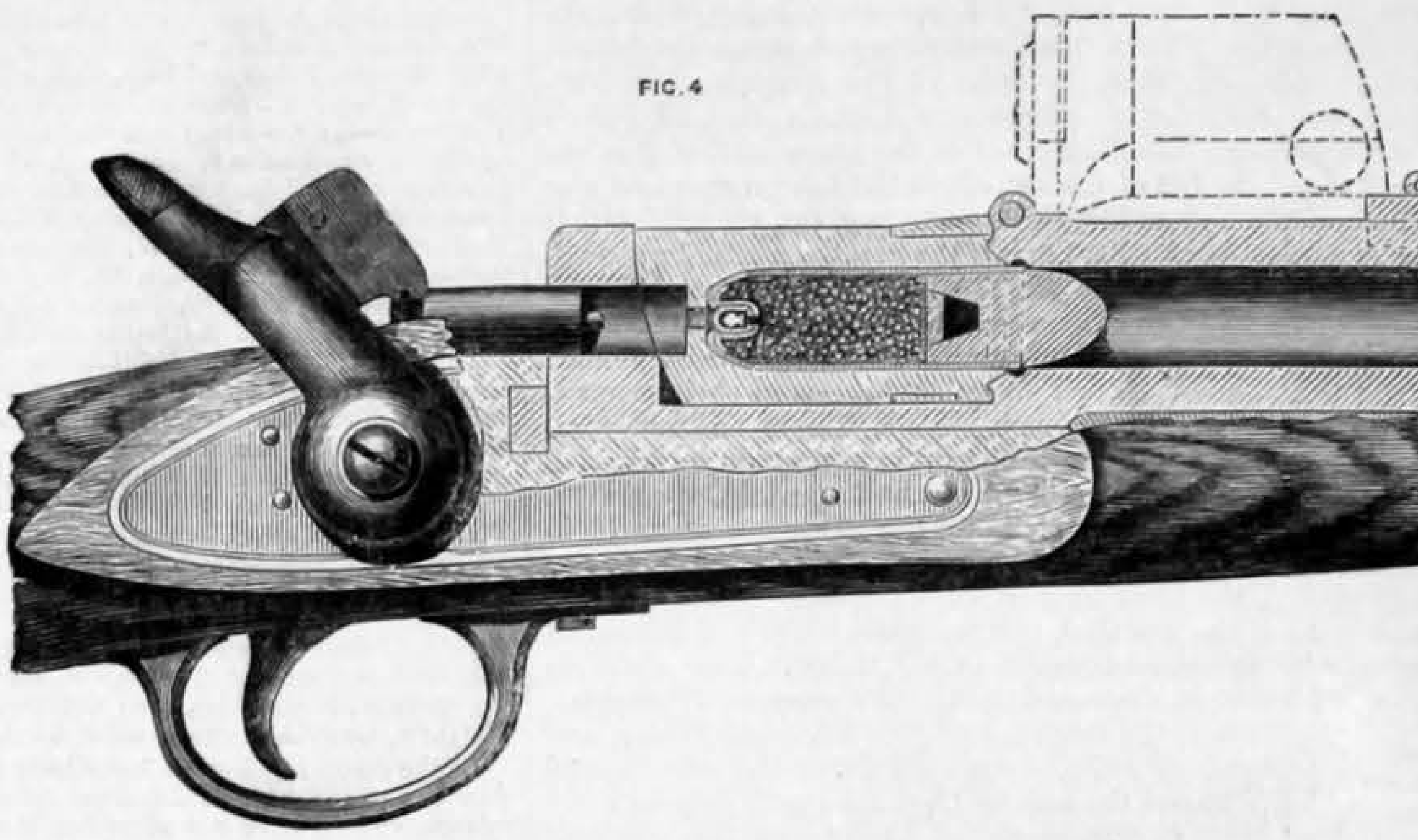


FIG. 4



THE COMPETITIVE BREECH-LOADERS.

(*Continued.*)

The "Burton" Gun.—This gun, which we illustrate in the accompanying engraving, answers to the "No. 1" gun before the committee. As may be seen from the drawing the movable breech piece is provided at its under side with a handle whereby the breech-piece is moved on its centre *b*, to open or close the chamber in the barrel. When closed it shuts against a fixed projection *i* in the shoe *f*, and is held in its place by a spring catch *j*. This catch is actuated or withdrawn by the lever or second trigger *g*, which form part of the catch piece. The actions of opening the catch and drawing down the breech piece are evidently included in the one movement. The extractor for removing the empty cartridge cases consists of a little cam or projection *h* on the circular boss of the breech piece, which in opening the breech comes into contact with the rim of the cartridge case and so forces it out. The empty case may then be withdrawn by the hand, or as is usually the case, it falls through the open breech aperture, as represented by the dotted outline in the cut. When the new cartridge is inserted the flange of its base will come against the extracting stud, beyond which it cannot pass until the movable breech-piece is brought up into its place, which movement will carry the extractor forward, and the face of the breech-piece will then force home the cartridge simultaneously with the closing the breech. The cartridge is exploded by means of a striker somewhat similar in appearance to that in use in the Snider and some other guns, but really very different. There is no spiral spring to bring back this striker to its normal position, but on the under side of it and near its rear end there is a little projecting stud or tooth, which bears against a corresponding one on the upper side of the spring catch. Should the breech-piece be imperfectly closed the gun cannot be fired, as the stud on the catch engages the stud on the exploding pin or striker, and prevents it being driven forward by the hammer; while in the act of opening the breech the stud on the catch pushes back the striker to its former position, and thus renders the use of a spiral spring unnecessary. The cartridge for use with this gun may be either rim fire or central fire. During the competition the service Boxer cartridge was used. Mr. Burton's No. 2 gun is somewhat on the needle gun principle, but as the inventor has not yet completed his foreign patents, we refrain from illustrating or describing it, though we shall do so on the earliest opportunity.

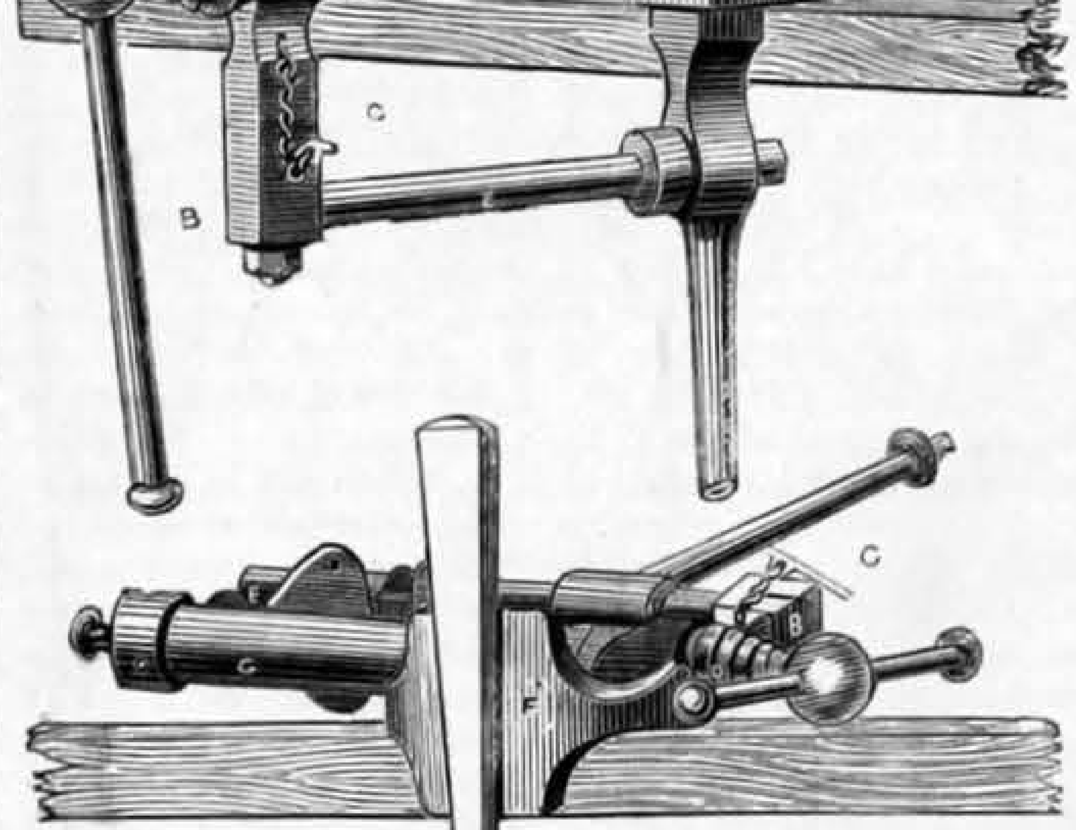
The "Henry" Gun, shown in Fig. 3 of our engraving, is extremely simple in its action. The breech block is very short in length and works vertically in the shoe, being depressed or elevated by a hinged lever fitting with a catch over the trigger guard. The cartridge is passed into the barrel along an open cutting in the stock and is exploded by a striker passing diagonally through the breech-piece. The face of the breech block is fitted with a cavity into which the hammer falls. In our engraving the shoe A is formed with a long strap, by means of which it is united to the stock; the barrel is screwed into this shoe, but it may be made in one piece. The stock and shoe in rear of the barrel are hollowed out, as shown at B, to admit of the cartridge being passed into the barrel. The breech-piece C is jointed by means of a short link with the lever E, which on being released from the trigger guard and pulled down, at the same time draws the breech-piece into the position shown by the dotted lines in the engraving. At the same time that the breech-piece is drawn down, the inner end of the lever E presses against the extractor, and forces it outwards, thus freeing the barrel of the empty cartridge case. The piston or striker, shown in dotted lines in the breech-piece, is driven forward by the hammer, and in order that too severe an impulse may not be imparted to the striker a portion of the hammer is left projecting at the side, which catches against the side of the breech-piece.

We refrain from describing the other gun submitted for competition, as Mr. Henry's position is similar to that of Mr. Burton with regard to his patents.

The Selwyn Gun.—This gun is a modification of the Mont Storm principle, but we believe it is perfectly unique as to the design of its extractor. Our engraving (Fig. 4) represents a section of the gun and cartridge. The breech-piece opens backwards, as shown by the dotted lines, and is made hollow to receive the cartridge. At the rear end of the barrel, and immediately under the hinge of the breech-piece of the chamber, there is a small groove or cannelure. The explosion of the cartridge forces the rim of the case into this groove, so that when the breech is opened the resistance offered by the projecting rim or flang edraws the empty case from the chamber in the breech-piece. When the piece is fired the breech-piece is locked by the striker, which is hinged to the hammer. The cartridge is made of copper on the ordinary central fire principle, the chamber for the cap being retained in position by a thick wad of papier maché.

ADJUSTABLE VICE.

THE excellent vice which we illustrate is the invention of Messrs. R. Middleton and Co., Leeds. The jaw will take any shaped work. The jaw F rotates on a foot step at B, and by



taking out the cottar pin C it is left free to rotate partially; D is a species of ball-joint permitting this motion; A slides within G, and so permits the range of the vice to be varied through very wide ranges.

POLYTECHNIC INSTITUTION.

PROFESSOR PEPPER has just introduced at the Polytechnic Institution a lecture on the Paris Exhibition, largely illustrated with dissolving views. Before entering into the details of the subject he calls special attention to the fact that a committee with offices in the Strand has made arrangements to carry artisans, clerks, and others from London to the Exhibition and back for £3, including all expenses of board, lodging, and railway fare, incidental to a week's residence in Paris. Mr. Layard, M.P., is the chief originator of the movement, and by personal supervision and practical assistance sees that all the terms of the contract with excursionists are fully and fairly carried out.

After asking his hearers to make the foregoing fact as widely known as possible, Professor Pepper introduced the Paris Exhibition to the notice of the audience by projecting a very good photographic view of it upon the screen of the Institution. He then exhibited a plan of the Exhibition, and gave his hearers practical information as to the best way of seeing everything in it with ease and comfort. Then followed views of the different courts, of choice specimens of statuary, of the machinery departments, and of the grounds outside the building. The pictures, being photographic transparencies, were necessarily faithful representations, far more truthful than the ordinary lantern slides. Photographs, however, will rarely give great contrasts of light and shade with true gradations. When white objects are perfectly represented the dark objects in the picture are a heavy mass of blackness, whilst when the dark positions are well brought out the brilliantly lighted white parts suffer. Nevertheless, the views were of good quality, and although only 3in. or 4in. square, made a very creditable appearance when magnified to the enormous size necessary to cover the screen. This lecture is now the chief object of attraction at the Polytechnic, and Professor Pepper makes it instructive also, by critical remarks upon the position of different nations in relation to each branch of industry.

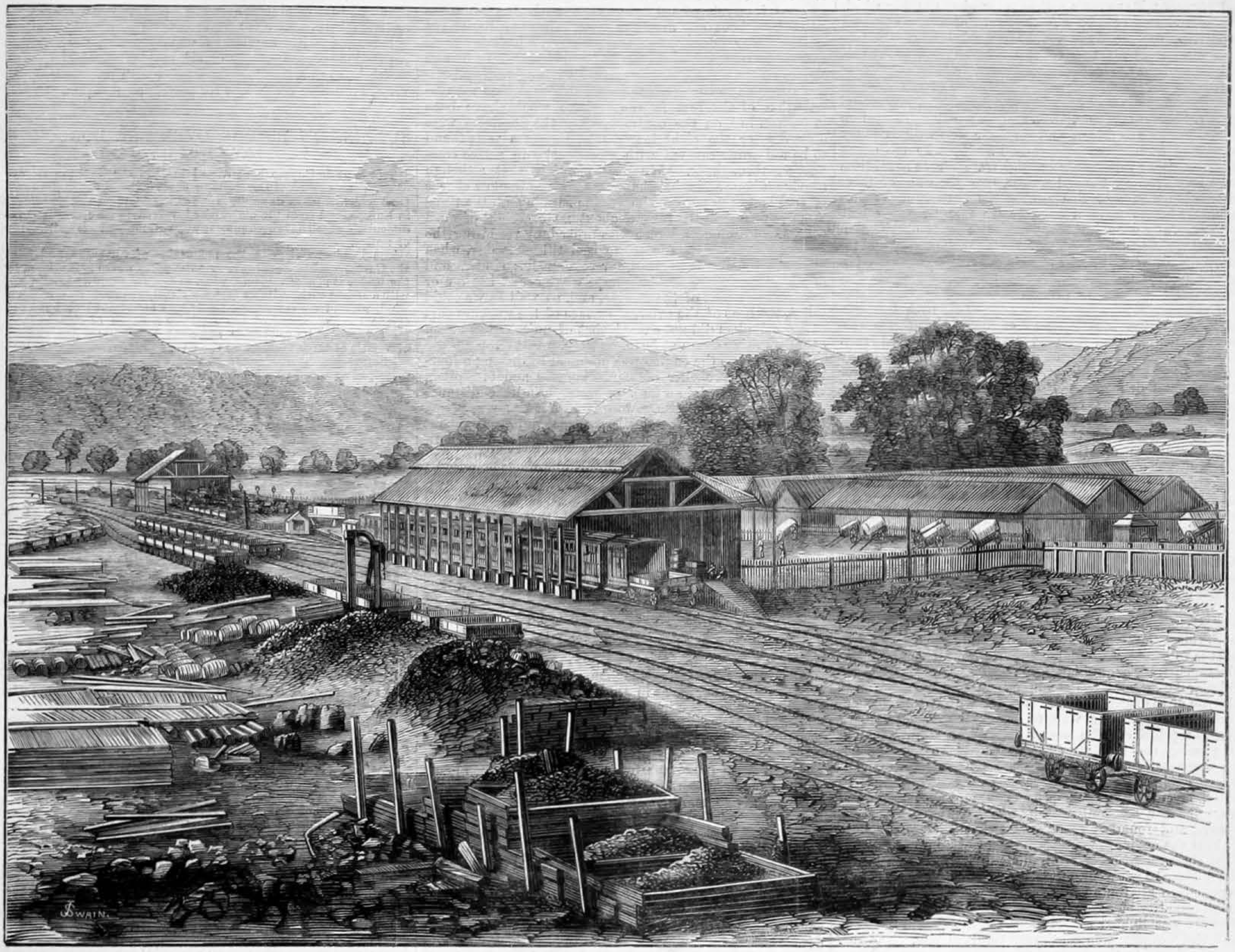
Bluebeard—the irrepressible Bluebeard—who persists in parading his evil deeds before a London audience two or three times a-year, is alive again at the Polytechnic. There, in defiance of the sacred facts of history, he is discovered weeping in a maudlin manner over a bust representing the last wife he had murdered—the bust of the beautiful Jumna—which suddenly starts into life, and reproaches him with past iniquities. Then does the wicked eastern potentate twist about on his couch in agonies of remorse, occasionally grinding his head on the floor by way of change, till unable to endure the words of the dear defunct, which go through him like corkscrews, he seizes the talking head, shuts it in a box, then sits down on the lid, and the apparition is laid to the satisfaction of all concerned.

There is also a dissolving view entertainment, with spectral illusions called "The Tower of London," and the incidents are culled from the sensational novel on the subject by Harrison Ainsworth. Dark dungeons, gloomy rooms, beetle-browed ecclesiastics, and men of Mephistophelian aspect, bring all their horrors to bear upon poor Lady Jane Grey, the heroine of the piece. A good scene of the chapel in the White Tower built by William the Conqueror is exhibited—the Norman arches, pillars, with the cushioned capitals, being faithfully represented. Here Lady Jane Grey sees spectral lights dancing round the columns, discovers a headsman's axe upon the floor, and finally sees ghostly figures going through the ceremony of her own execution. Her "double" bends her head over the block, the glittering axe is raised when with a wild shriek Lady Jane falls fainting upon the floor, and the ghastly actors vanish. On horror's head horrors accumulate. The night before her execution a spirit in white is seen gliding round the block, on the morning of execution the decapitated body of her husband is carried across her path, and finally the last scene of the tragedy is represented with a fiendish looking executioner leaping high in air as he administers the final stroke. Scenes there are also of lighter character, wherein giants disport themselves, but these owe what amusement they contain to the skill of the pantomimists, for Harrison Ainsworth possesseth not the faculty of being funny. One very well painted view in the series is the Traitors' Gate, with the arch above it, the latter being perhaps the finest piece of work in the Tower, and looking as fresh as if finished yesterday. The stones in this arch are what masons term "joggled" to fit each other, so that one cannot fall without the others coming down also, a curious architectural characteristic for which the eye sought in vain in the picture now under notice.

The growing false taste in London for the sensational and horrible, so justly censured a few days ago by Mr. Ruskin, cannot on the whole be said to be injudiciously fed by the Tower of London scenes at the Polytechnic, because the facts of history and the facts of architecture thus strikingly exhibited to a general audience have an educational effect, more especially the former. Nobody can view the vivid representations of the days of the "good old times" without rejoicing that they have gone for ever. Mr. Pepper has frequently declared his preference for lectures teaching the greatest discoveries in physical science, and has recently brought expensive experiments on polarised light and the heat rays of the spetcrum under the notice of his patrons, still, as he says, he must offer attractions which the public will come to see, for it is no use and does not pay to lecture to empty benches.

UNIVERSAL EXHIBITION OF 1867—SESSIONS OF THE SOCIETE D'ENCOURAGEMENT IN CONNECTION WITH THE EXHIBITION.—At these meetings M. Lamy has lately communicated his most recent researches on thallium, glass, and crystal. Towards the end of 1864, on causing thallium to react on ordinary or ethylated alcohol, he obtained thallic alcohol, the heaviest of liquids after mercury, and that which possesses the greatest refractive and dispersive power. His first attempts at the substitution of carbonate of thallium for carbonate of potash in the manufacture of glass were made at Lille, but on too small a scale to give any positive result. They were repeated at Paris in the laboratory, and the vitrification succeeded well. It had a certain amount of transparency, but it was fibrous, as it could not be given a sufficiently long and complete fusion. Finally, M. Lamy addressed himself to M. Feil, nephew and successor to Guinaud, the most skilful maker of crown and flint glass in France. The last trial was made with a charge which contained six to seven kilogrammes of carbonate of thallium. The difficulties were great, but M. Fiel was not to be discouraged, and by perseverance he obtained at last an irreproachable cast of thallium glass, very clear and brilliant, and certain to serve for optical purposes and jewellery. The tint is slightly yellow, which is not a defect, as yellow is the colour corresponding to the maximum of light; but it has already been found that the glass gains greatly in whiteness by substituting the sulphate for the carbonate. This glass is the heaviest and most refractive and dispersive known. M. Lamy also presented to the notice of the société, in the name of M. Fiel, a number of discs of flint glass, one of which, the largest ever obtained, is a veritable *tour de force.* Its diameter is 71 centimetres, and its thickness, which is abundantly sufficient, might have been double, for on the same table may be seen an enormous block of flint glass of incomparable purity, which came from the same pot. The faces, which have been cut parallel in different azimuths, have not revealed any defect. It is therefore probable that this disc will form a magnificent object glass. It will be nearly as large as that the construction of which was long ago resolved on by M. Le Verrier, for which the Legislative Assembly voted, we believe, 400,000f., and which was to have figured in the Exhibition of 1867; but it is unfortunately only rough hewn, for nothing seems to prosper within the sphere of action of the Imperial Observatory.

CAMPOOLY STATION, GREAT INDIAN PENINSULAR RAILWAY.



SKETCHES OF INDIAN RAILWAY SCENES.

II.

During the construction of the Bhore Ghaut incline on the Great Indian Peninsula Railway in India intended to connect the line then completed in the Concan below the Ghauts with that in the Deccan above them, a branch line was formed from the foot of the incline, seven miles in length, to the village of Campooly, and a temporary wooden station was built, for the accommodation of the traffic, so that the through communication could be carried on until the incline was finished.

On arriving at Campooly by the trains from Bombay passengers were forwarded in palanquins and dumries, a kind of vehicle on two wheels drawn by bullocks, some of which may be seen in the engraving—up the old road, which is very steep and crooked, to the railway station at Khandalla, where a portion of the Bhore Ghaut incline, two and a-half miles long, with gradients of 1 in 40 and 1 in 50, had been already made to the summit at Lanowly, the works on that part being very light.

Up this road also all the engines, rolling stock, &c., for working the line above had to be hauled by bullocks and coolies, as well as the permanent way materials for the construction of the railway above for 200 miles beyond to Sholapore.

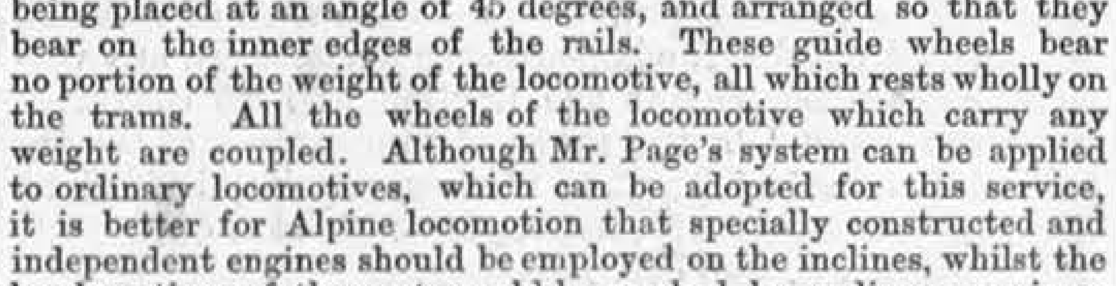
As bullocks with cotton, seeds, and other produce were always on their way down the Ghaut in the fine weather from all parts of the Deccan above, the confusion and crowds might be easier imagined than described, passengers often preferring riding on tats, the native ponies, managing so to thread their way better through the moving mass than the palanquin.

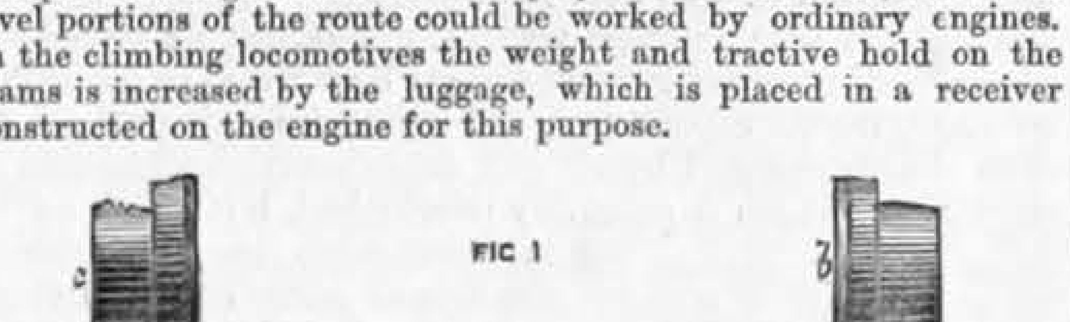
In the engraving are seen the stores of permanent way materials, station fittings, coke, &c., waiting to be forwarded.

From this station could be seen the reversing station on the incline, apparently no great distance off, being, however, 1300ft. above it.

CLIMBING LOCOMOTIVES.

The difficulty of surmounting steep gradients by the tractive power of the ordinary locomotive for years obliged our engineers to keep their lines tolerably level, or at any rate free from very heavy gradients. In course of time, however, the exigencies of traffic demanded that this difficulty should be overcome; our engineers accordingly set their wits to work, and of course overcame it. This was effected in various ways, as various minds dealt with the subject, the general object and the general result were to produce, more or less effectively, what we may term a "climbing locomotive." Into the various methods of effecting this end it is not now our purpose to enter, the less that some months ago an exhaustive paper upon the subject appeared in our columns from the pen of Mr. Pendred, C.E., which was read before the Society of Engineers. Since then, Mr. Thomas Page, the well known engineer, who has directed his attention to the question, has perfected a design for a locomotive engine and permanent way for steep gradients and Alpine locomotion, and it his system we are about to describe. His precise object is to enable a tractive power to be got out of the locomotives, and the permanent way in use on railways, having steep gradients, exceeding that of the ordinary locomotive and way, and he accomplishes it in the following manner: At steep gradients, in addition to the ordinary line forming the continuation of the levels, and on which the trains run, Mr. Page lays alongside the ordinary rails a broad tramway of stone. The surfaces of the tramways are roughened to give the necessary bite to the driving wheels of the locomotive, which are made very broad. The peripheries of these driving wheels, which bear on the stone tramways, are made of iron, and are serrated so that they shall bite into the tramways. In order to prevent the engine leaving the track flanged or guide wheels are connected to the engine, being placed at an angle of 45 degrees, and arranged so that they bear on the inner edges of the rails. These guide wheels bear no portion of the weight of the locomotive, all which rests wholly on the trams. All the wheels of the locomotive which carry any weight are coupled. Although Mr. Page's system can be applied to ordinary locomotives, which can be adopted for this service, it is better for Alpine locomotion that specially constructed and independent engines should be employed on the inclines, whilst the level portions of the route could be worked by ordinary engines. In the climbing locomotives the weight and tractive hold on the trams is increased by the luggage, which is placed in a receiver constructed on the engine for this purpose.





The application of Mr. Page's system to common roads so as to permit of ordinary traffic crossing deserves attention when we are doing our best to bring the traction engine into more general use. In preparing ways and locomotives for traction and locomotion on turnpike roads Mr. Page follows the general levels and gradients, and on average ground almost entirely dispenses with cutting and embankment. For a cheap line of way the trams are made of balks of timber measuring about 12in. by 6in., and which have been prepared so as to resist decay. These trams are tied in at intervals by timber transoms, the whole being bedded in ballast in the ordinary way. The inner edges of these trams are protected by steel surfaces, which serve as rails on which the carriages run. Thus far there is a similarity to the ordinary method of railway locomotion; but instead of the locomotive being run on the metal rails to produce the tractive force it is adapted to run on the trams, being provided with wheels of sufficient breadth for the purpose. For timber trams metal wheels are used, the surfaces being roughened so as to bite into the tram. The peripheries of the wheels, although roughened, must be perfectly cylindrical and the roughing of a uniform character, and not such as to cut or abrade the trams, but merely to slightly indent them. This roughing may be produced in a lathe; shallow intersecting grooves formed at angles with each other, and producing diamond-pointed projections, answers well. In railways for ordinary roads stone trams are not desirable, inasmuch as the fastening on of the steel plates is expensive work, the stone having to be bored for that purpose. Should it, however, happen, from local or other circumstances, that stone trams can be laid to advantage, Mr. Page meets the point by surfacing the wheels of the locomotive with a different material. In that case he makes the peripheries of the wheels of wood as horn-beam, or in fact any substance of a suitable and enduring character. The main point to be kept in view is so to construct the trams and the driving wheels as that they may afford a great breadth of bearing, whilst the wear is reduced to a minimum. At the same time they must be of such a nature as to afford great frictional contact, and consequent tractive power, in the locomotive. Mr. Page proposes that the locomotive shall be so arranged as to work at quarter power on the levels, and at full power on the inclines; in practice the steam may thus be cut off at less than quarter stroke on the levels.

Railways constructed upon the system we have been discussing will come out cheap, and although they may not be adapted for the high velocities usually attained on railways, they will be competent for moderate velocities, and might be found useful for many localities which would otherwise be unprovided with railway accommodation. Such, then, is the general character and bearing of Mr. Page's invention; as far as constructive details go there is little but what is clear without an engraving. To simplify the matter, however, we have given, at Fig. 1 of our cut, a cross-section of a rail and tramway as applied to the ordinary double-headed rail. Fig. 2 is a similar section of a way laid with a flat rail fixed on the edge of the tram. The rails are shown at *a*, while *b*, *b* are the wheels running thereon, and belonging to the carriages. The tractive and bearing wheels of the locomotive engine are shown at *c*, *c*. As regards the practical working of the invention, we have as yet no authentic information. Mr. Page has been working at the question for some time past, and he informs us that from actual trials—made only with very small models, however, he has obtained some very remarkable results as regards tractive power. For the present, in the absence of any practical results of much value, we must decline to pronounce any opinion whatever as to the merits or demerits of a scheme we have placed before our readers as the last proposal in steam locomotion.

Experiments on Torsion and Flexure for the Determination of Rigidities, by J. D. Everett.—These experiments are the continuation of those described in a memoir read on the 22nd of February, 1866, with some modifications in the apparatus employed which render the comparison between torsion and flexure more complete. The amount of torsion or flexure produced by subjecting a cylindrical rod throughout its whole length to the uniform strain of a link is measured by means of two mirrors fixed to the rod near its ends, and on which, by the help of two telescopes, are seen by reflection the divisions of a scale and the displacements produced in their images. One extremity of the rod is fixed, and to the other is applied alternately a link for torsion and for flexure. Those rods, of glass, of brass, and of steel, were subjected to experiment, and the following results were obtained, in which M, *n*, and *k* denote respectively, in kilogrammes per square millimetre, the resistances to linear extension to rupture and to cubic compression, and *r* the relation of lateral contraction to longitudinal extension:—

	Glass.	Brass.	Steel.
Value of M	5851	10,948	21,793
,, *n*	2390	3729	8341
,, *k*	3533	57,007	18,756
,, *r*	0229	0469	0310

—*Les Mondes.*

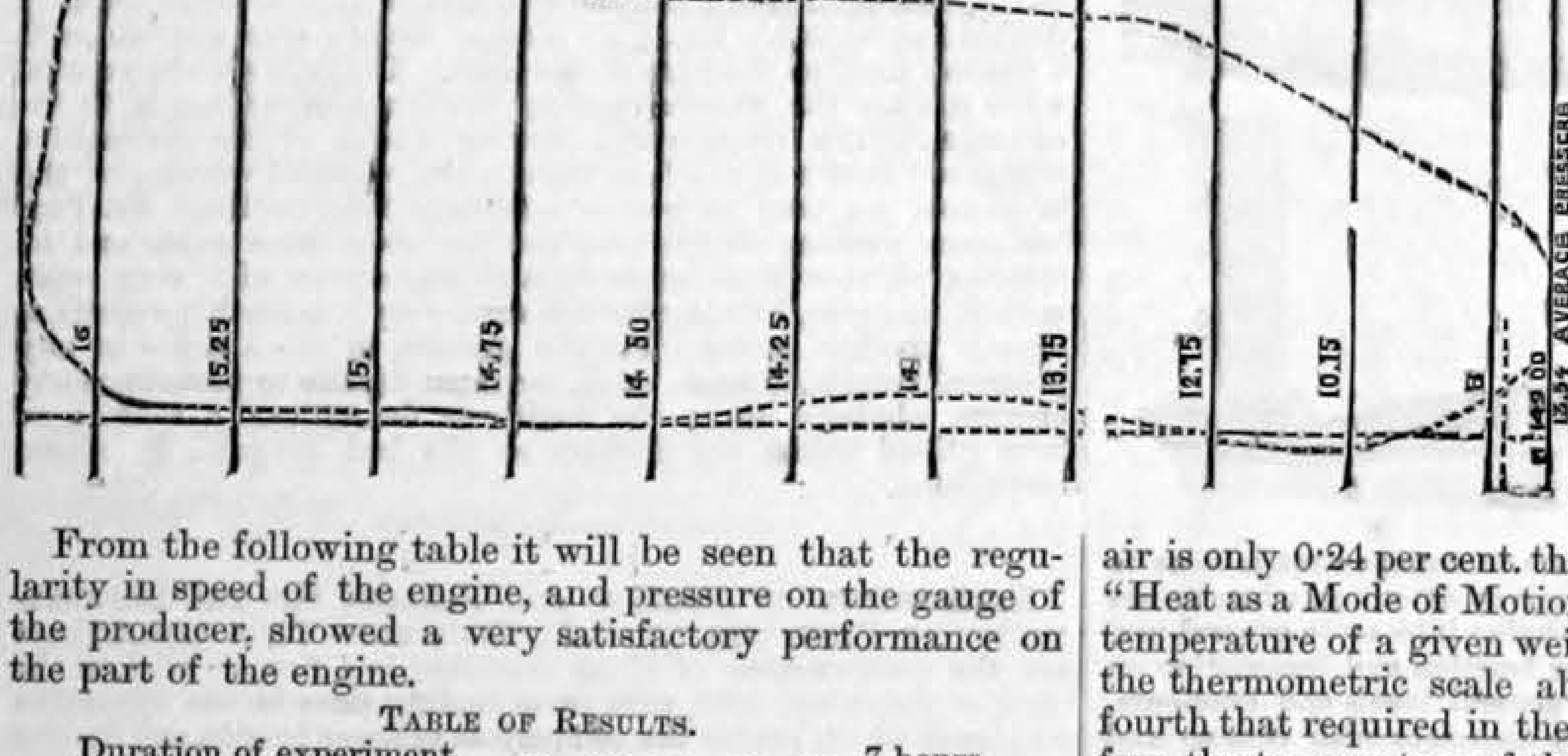
SHAW'S HOT-AIR ENGINE AT THE PARIS EXHIBITION.

PROFESSOR RANKINE's article in our last number which whilst it clearly pointed out the want of a more general exposition of the second fundamental law of thermo-dynamics, went far to remove that want and was singularly opportune at the present moment. We have recently illustrated and described a hot-air engine of considerable size, containing many practical improvements, introduced by Mr. Shaw, of Boston, U.S., and now exhibited by him in the Champs de Mars, and we have met with so many persons of no small experience and ability who have been disposed either to overrate or underrate air as a medium to be employed in thermo-motors, that the want of more precise knowledge on this subject has been brought prominently before us at a time when we and many others were carefully watching the practical results obtained in this most recent effort to develope the advantages, and remove the drawbacks, of air as a substitute for steam in some classes of prime-movers. It may not be amiss first to give the results of an experiment made with this engine on the 24th ultimo, and then to compare it with the performance of the best types of engines using steam as a motor which are in common use at the present day. The second law of thermo-dynamics, as experimentally proved by Joule and Mayer, ably illustrated by Professor Tyndal, and defined by Professors Thomson and Maquorn Rankine* removes the supposed superiority of air over steam in respect to the greater capacity for heat in the latter than the former. At the same time the advantages on the one hand and the disadvantages on the other which air has over steam in obtaining this high range of temperature at a comparatively moderate pressure, remain the same, and we will point out hereafter one or two cases in which air engines—particularly those in which it is possible to employ the products of combustion directly under the cylinder—have theoretical advantages over steam engines as a means of utilising power developed by heat. The following are the results of a trial of seven hours' duration made with Shaw's engine on the 24th June, at which we were present during the whole time, and carefully noted every fact in connection with the performance and consumption of the engine.

It is to be observed that on this day water was used in the regenerator or auxiliary heater, which is a small vertical tubular boiler, and the steam generated was passed into the top of the furnace, where it mixed with the products of combustion on their way to the cylinder. Mr. Shaw claims a priority in the use of water in this way, instead of passing the feed air through the regenerator as has been generally practised, and his arrangements are made for working on either system. We measured with considerable curiosity the quantity of water vaporised in this way under a constant pressure of 15 lb. above the atmosphere, and found it to be only two cubic feet per hour twhilst the engine was indicating about 23-horse power, so hhat the proportion of work done by water can scarcely dave been 10 per cent. of the whole. We are, however, isposed to attribute value to the presence of even this small quantity of steam in lubricating the working parts. The fire was lighted at 7.45 a.m. on the day in question, and the working was continued till 3.20 p.m. The fuel used is shown in the annexed table:—

Time.	Fuel.	Observations.
7.45	15 lb. wood	Fire lighted.
7.50	66 lb. coal	Engine started at 8.20 a.m. with 4 lb.
8.20	3 lb. wood	pressure of air in producer, which
8.35	22 lb. coal	rose at once to 15 lb. after the first
8.45	22 lb. ,,	two or three strokes, and attained
9.40	22 lb. ,,	17 lb. in about five minutes. The
10.25	22 lb. ,,	pressure averaged a little over 14 lb.
11.15	22 lb. ,,	throughout the trial.
12.10	22 lb. ,,	After 1.45 the engine ran till 3.20 with-
1 p.m.	22 lb. ,,	out addition of fuel, indicating on an
1·45	22 lb. ,,	average 16-h.p. for the last hour.

Diagrams were regularly taken every half hour from the commencement to the close of the trial, of which the following is a fair sample :—



From the following table it will be seen that the regularity in speed of the engine, and pressure on the gauge of the producer, showed a very satisfactory performance on the part of the engine.

TABLE OF RESULTS.

Duration of experiment	7 hours.
Average indicated H.P. for first six hours ...	23-H.P.
do. do. do. for last hour	16-H.P.
Gross total of work equal (for one hour)	154-H-P.
Total fuel used, deducting 20 lb. not burnt, and 18 lb. of wood for lighting	222 lb.
Average quantity of fuel per hour per H.P. ...	1·4 lb.

In calculating the net work done as shown by each diagram, the power consumed in working the air pumps is, of course, deducted from the gross duty, as shown by the diagram.

The fuel used was Cardiff coal of good quality; each charge, as shown above, consisted of 22 lb. of fuel after the first charge for lighting the fire had been put on at 7.50 a.m. It will also be observed that the coaling took place at intervals of little less than an hour. This was effected without any difficulty by opening the lid of the small circular hopper over the producer, which is cut off from it by means of a valve, the fuel being thrown in and the lid of the hopper closed, this valve is opened, and the coal drops on to the fire. We had supposed that the distribution of the fuel in the furnace would have been imperfect, but, on the contrary, when the fire-doors were opened after the eight hours' trial the bars were found to be uniformly covered with strong coke in active combustion throughout. We may mention that although nearly an hour and a-half had elapsed since the last charge of coal had been put on (the engine running all the time) there remained in the furnace about 20 lb. weight of good coke, besides cinders, which was proved by re-closing the doors and leaving the furnace to cool till next day, when what remained in it weighed, for coke, 22 lb.; cinders and ashes, 13 lb. There was no escape whatever of hot air or gas from any part of the engine, and, as well as we could judge, the heat of the external surface of the working part of the cylinders did not exceed that of unjacketted steam cylinders using steam at 50 lb. or 60 lb. pressure.

Resistance to the engine was obtained by driving a four-bladed screw propeller of 32in. diameter and 5ft. pitch, which is immersed in a tank of water at a little distance from the engine, and has power given to it by a strap from the fly-wheel. This propeller, made uniformly about 270 revolutions a minute, except during the last half-hour, when it was gradually slacked off from a friction clutch as the engine burnt down its fuel, and the pressure diminished. The mean pressure on the gauge communicating with the producer was noted on each diagram, and always corresponded very nearly with that shown at the commencement of the stroke by the indicator pencil. The number of revolutions was also noted on each diagram, and was almost constant at eighty, but on the two occasions when water was admitted into the regenerator, almost filling it, and quite stopping the generation of steam for a few minutes, the speed fell to seventy-four revolutions, and the pressure to 13½ lb. The water was thus all fed at once in order to measure it. In ordinary working, when water is used at all, it is of course fed in smaller quantities at a time and more frequently than every two hours or so, as in this instance. The indicator used was one of Richards'. The temperature in the flue was 260 deg., and no smoke was ever observable. We question if as valuable results have ever yet been obtained from a hot-air engine of this size, and they are rendered more important because the trial has been made with an engine which has now been publicly exhibited for upwards of two months, performing about the same work nearly every day. It is true that from the manifest defects in workmanship and proportion of the standards and framework carrying the bearings there has been no small difficulty experienced in keeping the machine together for its daily work; but there has been as yet no undue heating, wear, or deterioration of the working parts peculiar to the air engine, and it is in the various arrangements which conduce to this result that Mr. Shaw's chief merit lies.

In conclusion, it is to be observed that the result of this trial is not more and not much less than might be anticipated from the laws concerning the dynamic effect of heat as applied to develope power by the expansion of common air. Adopting the fundamental theorem that in any perfectly constructed engine the fraction of heat converted into work is equal to the range of temperature of the gas expanded from the highest to the lowest point, divided by the highest temperature, counting from the zero of absolute temperature, *i.e.*, 460 deg. Fah.

It may be assumed that we have altogether disproved the supposed theoretic advantage of air over steam as grounded on the greater capacity of water and its vapour for heat than that possessed by air, but there remains a fraction of advantage, which is generally overlooked, but which ought in fairness to be registered on the side of air. It arises thus: one section of the thermic effect transmitted to the medium in a heat engine of either class, and wholly lost to useful work, consists of the elevation of temperature of the feed, be it water or air, from the point at which it is introduced into the machine to that to which it descends when leaving the machine, after having performed all the work that can be obtained from it. This fraction of temperature, we say, is wholly lost both in the case of air and steam engines, but as the capacity for heat of air is only 0·24 per cent. that of water by 1·00 (*vide* Tyndal's "Heat as a Mode of Motion,") the cost in fuel of raising the temperature of a given weight of air through the portion of the thermometric scale above indicated, is less than one-fourth that required in the case of water. Assuming, therefore, the temperature of the emitted air or steam to be equal, there is a saving in the air engine of three-fourths the quantity of heat wasted in this part of the action of the steam engine. This saving, however, is small in proportion to the whole heat either used or lost in either engine; it is, however, a point in favour of the air engine on the score of the efficiency of the fluid.

If we now turn to the subject of, perhaps, the greatest importance in all heat motors, viz., the efficiency of the furnace, we find at the first step that the air engine using, as the one of which we are speaking does, the products of combustion directly, attains at once the maximum of furnace efficiency, and when it is remembered that 0·4 or 0·5 expresses the ordinary efficiency of furnaces in transmitting heat to water, the great gain that may be effected in this respect will at once be perceived.

There is, further, a circumstance or accident connected with the working of this engine which it is urged, and not without reason, effects a certain amount of economy. It is assumed that combustion is more perfect when carried on as it is here, under a pressure of 15 lb. above the atmosphere, and with appliances which ensure the accurate regulation of the supply of air, besides which the gases, which burn in a large fire-box lined with brick, are under very favourable conditions for perfect combustion. C. H.

* "If the absolute temperature of any uniformly hot substance be divided into any number of equal parts, the effects of those parts in causing work to be performed are equal."—MAQUORN RANKINE. And as applied to thermo-motors by Professor Thompson:—"In any perfectly constructed engine the fraction of heat converted into work is equal to the range of temperature from the highest to the lowest point, divided by the highest temperature recovered from the zero of absolute temperature."

SUSPENSION BRIDGE OVER THE DORDOGNE, AT CUBZAC.

THE Pont de Cubzac, constructed in 1835—39 from the designs of M. Vergés over the Dordogne, a short distance above the town from which it takes its name, is one of the finest suspension bridges in Europe, and from the difficulties involved in its construction—difficulties which have been successfully surmounted—is well worthy of notice.

The Dordogne rises in the mountains of Auvergne, and joins the Garonne below Bordeaux. At the point where it is crossed by the bridge it is about 1780ft. wide, and 12ft. deep at low water, with a strong current liable to be violently agitated by a westerly wind, whilst from careful borings it was ascertained that the bed of the river consisted of fine sand for a depth of 82ft. It was moreover requisite to provide sufficient headway for the passage of vessels of large burthen up the river to Libourne.

These considerations decided M. Vergés on adopting the suspension principle, as affording a means of crossing the river with as large spans, and consequently as few piers, as possible. With so treacherous a foundation it was necessary to reduce the weight of the piers to a minimum; for this purpose the towers supporting the suspension cables were constructed in cast iron, by which means a saving in weight of 3900 tons over piers constructed entirely in masonry was effected, and the number of bearing piles reduced by two-thirds.

The total length of bridge and approaches is 6966·16ft., made up as follows:—Bridge proper, 1787·6ft.; two viaducts in masonry, 820ft. each, 1640; right embanked approach, 2133·64; left, 1404·92, making total of 6966·16.

The distance between abutment towers of 1787·6ft. is divided into five spans of 357·52 ft. each, with a headway above low water of 93·48ft. at the centre of the bridge, and 83·64ft. at the abutments. The piers are of masonry for a height of 42·64ft. above low water, their shape in plan being that of a rectangle 46ft. long and 16ft. broad terminated at either end by two intersecting arcs of a circle. From this masonry base rise two towers in cast iron, 84ft. high, connected just below platform level by an arch of an elliptical shape. (See Figs 1 and 2). Each tower is composed of two truncated cones of different diameters, connected together at platform level by a junction piece (Fig 4,) which, by breaking the outline, relieves the elevation; the whole is surmounted by a cupola-shaped casting, to which is bolted the saddle supporting the cables.

The towers are built up in piers of open panel work, ten tiers below the level of the roadway and five above. Figs. 5 and 8 show a front and back view with a vertical and horizontal section of the lowest tier. The panels in each tier are bolted to each other laterally through their flanges, six bolts to a panel, but the tiers are connected by an intervening ring of a ⊢ section, as shown in Fig. 11, the vertical flange preventing any lateral spreading.

In the centre of each tower rises a vertical column of a cruciform section, which forms as it were the backbone of the structure. The exterior casing is connected with this column by means of horizontal bracing in flat cast iron bars, and diagonal bracing in round iron. The general arrangement is shown in Fig. 3, and the details in Fig. 10. The base plate is shewn in plan in Fig. 7, and in section in Fig. 9; the thickness of metal is 2⅜in., that of the lowest tier of panels being 1$\frac{3}{16}$in.

The strains which the towers have to resist are of two kinds, one vertical and composed of the permanent load 221·4 tons, of the proof load 147·6, making a total of 369 tons, half of which, 184·5 tons, is the maximum vertical weight on each tower. The smallest sectional area of the tower being 540 square inches, the strain per square inch is only 6·83 cwt., an amount much less than cast iron is capable of supporting if direct pressure alone is taken into account; but the varying strains to which the tower may be subjected, and the provision for flanges &c., necessitates an increased thickness of metal.

The second strain is horizontal, and arises from the friction of the cables on the rollers; its amount is 24 tons, and produces no appreciable effect on the towers. During the raising of the cables the tower tilted ⅜in., not being then fixed to the masonry, but returned afterwards to its former bearing.

The arrangement of the cables is peculiar, as will be perceived from Fig. 1. The roadway is supported by twelve wire cables, which hang in catenary curves, the deflection being 42ft. At the point of suspension, 135ft. above low water, the cables pass through blocks and are led back in a straight line to the opposite tower at platform level, where they are connected to a horizontal cable stretching along the platform of the bridge. By this means a series of triangles is formed, the summits of which are the points of suspension. The object of the above arrangement is to obtain rigidity, but this result would hardly appear to have been arrived at, for in the recent discussion of the paper on the Clifton Bridge at the Institution of Civil Engineers, Mr. Barlow stated that he had experienced considerable vibration when standing on the Pont de Cubzac from the passage of but a moderate load.

The roadway is of planking laid on cross joists, which are arranged in pairs, a suspension rod passing between each pair. The width between handrails is 24·6ft. From the great headway given to the bridge the approaches, as already stated, are of great length, and consist on either side of a viaduct of twenty-nine arches and a long embankment. Owing to the uncertain character of the ground the first four piers of the viaducts are founded on piles.

The towers were erected in the following manner: The base plates having been placed on the masonry, and brought to a true level by the insertion of wedges of dry oak, were tied down by bolts 16ft. long. On this base was placed the first tier of ten frames, felt being inserted between the joints. The ⊢ shaped ring connects all the frames of the first tier together at the top, and having been brought to a true level as before, and the flange covered with felt, was ready to receive the base of the second tier, and so on for the rest of the structure. For raising the various pieces a movable crane was used, consisting of a mast and cross beam, which was lifted as the work progressed, that part of the tower already completed serving as its support. The greatest weight raised at one time was about two tons.

To obviate the danger of the bolt-holes in the horizontal flanges not tallying with each other the upper holes were drilled in place; the bolts having been inserted the joints were made good in iron cement.

The exterior casing was erected first and next the central column; the two were then connected by the horizontal and diagonal bracing. The cupola surmounting the tower was afterwards placed in position. This cupola can be made to bear entirely on the external casing, on the central column, or on both together. The cables being in place the cupola was wedged up so as to throw the weight on the central column. The proof load was then placed on the bridge and the joint between the cupola and the casing made good. The object of this proceeding was to throw the weight equally on the casing and central column.

The bridge was commenced on the 5th September, 1835, and finished in September, 1839, M. Emile Martin being the contractor for the ironwork.

[The above article is prepared chiefly from an interesting account of the structure by M. Emile Martin.]

RAILWAY MATTERS.

SPANISH railway shares are almost exclusively in French hands.

THE bill of the London, Chatham, and Dover Railway Company passed its first reading on Wednesday.

THE shareholders in the Ottoman (Smyrna and Aidin) Railway have formed a shareholders' protection association.

NO country, it is asserted, can vie with South Austria in the possession of all the elements necessary for the successful manufacture of steel.

AN adjudication of bankruptcy was made on Wednesday morning by Mr. Commissioner Holroyd against Messrs. Peto, Betts, and Crampton, who at once attended and surrendered.

A RAILROAD convention is in session at the Louisville Hotel, having in view a reduction of rates and the establishment of quick and accurate connections. Some twenty roads are represented.

IN the local trains from London Bridge station the Brighton Company persist, much to the annoyance of their passengers, in crowding five persons to sit on a second-class seat seven feet four inches long.

THE coal of the Buchberg and Podkamnig mines, situated in the centre of the South Austrian iron ore deposits, is alleged by Professor Tunner, of the Imperial College in Styria, and by Dr. Miller, of King's College, to be free from sulphur and phosphorus.

THE *Pall Mall Gazette* says, it is worthy of note that we have at this moment at least five bankrupt railways crying out for assistance; and this is in itself a fact sufficient to demand a change in railway management so complete as only to be obtained from Parliament.

THE Jubbulpore—East Indian—line is stated to be now in full working. There is a gap, consisting of difficult works, to the extent of about sixty miles to fill up before the trains will be able to work continuously over the two lines from Bombay *viâ* Jubbulpore to Calcutta.

THE San Paulo (Brazilian) Railway Company have invited tenders for £220,000 of remaining debentures, bearing 7 per cent. interest. They are redeemable at par in three years, are put forth at the price of 95, and constitute a first charge on the railway and the Government guarantee.

A FLORIDA paper says that the immense herds of cattle that now roam at will through the wilds of that State and Georgia are proving a serious inconvenience to the railroad trains. Scarcely a train runs at night without more or less destruction of stock, and not unfrequently half-a-dozen are hurled from the track and destroyed.

ALL locomotives recently purchased for the Union Pacific Railroad are constructed so that they may readily be changed to coal-burners, for it is expected that the mines already developed near Boone, Iowa, and those which are yet to be worked at the Black Hills will furnish coal enough to allow wood to be dispensed with altogether.

THE Vice-Chancellor Malins has appointed the chief officer and secretary of the Great Eastern Railway Company to be receivers in Chancery of the company, with directions (on the company admitting that the net revenue was amply sufficient for the purpose), to keep down the interest on the debentures, and his Honour also made an immediate decree to avoid the multiplication of suits.

IT is understood that the Great Eastern Railway is not in the most favourable financial position. The late attempts to raise money for the undertaking have proved discouraging, and in consequence of the little prospect of success it is feared the directors will be unable to prevent the line passing into the hands of a receiver. Mr. Samuel Laing, M.P., it is stated, has resigned his seat at the board.

MR. BAXTER, the solicitor of the Great Eastern Railway, states that the debts of the company if they abandon the metropolitan undertakings, will amount to about £3,000,000. The net income of the company is £900,000 a year, of which £500,000 is required for the payment of rent-charges and interest on debentures, leaving a surplus of £400,000 a year, which, if they could raise sufficient to pay off their debts, will be available to pay interest on all the preference shares and stocks.

AT a meeting of the Central Northumberland Company at Alnwick on Saturday a long conversation took place, and it was resolved that a committee of shareholders be appointed to co-operate with the directors in such negotiations as might be necessary with a view of carrying out the scheme, or to take steps for winding-up the affairs of the company. A committee was appointed, and it was further agreed that the shareholders then present increase their subscriptions, so as to assist in raising funds for the completion of the line.

ON the occasion of the late strike of the North-Eastern engine-drivers and firemen a fund for rewarding those men who did not join the turnouts was started by the Yorkshire gentry. From this fund and from the company's resources we are informed that *douceurs* varying from £10 to engine-drivers, to £5 to stokers have been paid. In addition, the stokers generally have been promoted to the rank and pay of engine-drivers. The Union has recommended the turnouts who had not been reinstated to seek work elsewhere, the company having gained complete mastery.

ACCOMPANYING the notice of the Brighton Railway meeting on Friday week which has been sent to the shareholders, is a circular from Mr. Laing, in which that gentleman says:—"Having consented to become chairman of the Brighton Company in the hope of saving it from its present embarrassments, I am satisfied that an amalgamation with the South Eastern Company is the first step to place both properties on a sound footing. I am further satisfied that the enclosed agreement is perfectly fair on both sides, and mutually advantageous; and as it is of great importance with reference to the application to Parliament that it should be adopted by large majorities of the shareholders, I beg earnestly to request that you will attend the meeting to be held on Friday, July 12, at one o'clock, at the Bridge House Hotel, Southwark, or, if you are unable to attend, that you will sign the enclosed proxy in favour of myself or Sir Charles Jackson."

THE United States senators inspecting the Union Pacific Railroad after completing their work, held a formal meeting at Omaha, Senator Wade in the chair, and passed the following resolutions:—"'That the Union Pacific Railroad, over which we have passed, extending more than 360 miles west of Omaha, to a point distant from the Atlantic seaboard about 1800 miles, though most of the way wholly unsettled, till the road was constructed, is not inferior in its management, in the comfort of its cars or the speed with which they travel, to any road over which we have ever passed, and that the rapidity with which the road has advanced, startling the buffalo, the antelope, and the Indian by the sound of the whistle before they have time to get out of its way, exhibits an energy by those engaged in its building unequalled in the construction of railroads, or of any great work of which we have ever heard or read.' 'That the system, regularity, and rapidity with which the track is being laid, struck us with amazement, as we ourselves in the most elegant and comfortable of cars passed over three miles of track before night, on which not a tie was laid in the morning.' 'That the importance of the Pacific Railroad cannot in our opinion, be over estimated, either in its advantages to us as a nation or to the commerce of the world.' And we bid those having it in charge God speed in this the greatest enterprise of the age, which is rapidly bringing under the dominion of civilised man the great interior of a continent, relieving the Government of the necessity for military posts and opening a quicker communication than ever before known between the remotest quarters of the globe."

NOTES AND MEMORANDA.

THE Canada gold mines now number seventy-three; the miners, 708. The yield of gold for the last three months is estimated at £138,191.

CHARCOAL is found not to be the perfect water purifier it was thought to be. After a time it returns to the water the impurities it once had separated.

IT is stated that by combining ammonia with gun cotton its liability to spontaneous combustion is removed without injuring its explosive qualities.

NEW diamond localities have lately been found in California. There are fifteen places in that State where diamonds have been found in washing for gold.

THE best Japanese small bells are made from an alloy of 10 parts of copper, 4 of tin, ½ iron, 1½ zinc. The large bells are made from an alloy of 10 parts copper, 2 lead, and 2 of tin.

THE metal iridium exists in the Californian gold. Its presence in the gold coined at the United States mint caused the destruction of several valuable dies, and thus led to its discovery.

HERR BOETTIGER has pointed out that the flue-dust which condenses in the chimneys of the zinc works of Goster contains oxide of iridium in the proportion of one-tenth per cent.

A CORRESPONDENT of the *Cincinnati Gazette* reports that a Mr. Disman, of Upper Sandusky, Ohio, has discovered a process of hardening copper, an art which has been lost for nearly three thousand years.

BY submitting to the action of an electro-magnet globes filled with oxygen and suspended in a solution of glycerine, M. Chataud, of Nancy, succeeded in showing energetic attraction between that gas and the magnet.

PROFESSOR KNOP, of Leipsig, while searching for crystallised specimens of crysolite, has found a new mineral, to which, from its appearance, he has given the name pachnolite, from a Greek word, meaning "frost."

COAL tar is recommended in the *Chemical News* as an excellent coating of cisterns and reservoirs, to protect water from the lime and other salts contained in the cement. The tarry taste, it is stated, disappears in a few days.

OLIVER EVANS applied, in 1786, for a patent from the State of Philadelphia for a carriage which he proposed to drive with steam of 150 lb. pressure. His project was, however, looked upon as chimerical, and a patent was refused him.

THE *Popular Science Review* states that the November meteors were well seen at Kishnagur, fifty miles north of Calcutta. Places from which the shower is now known to have been seen range over a fourth of the earth's surface.

ACCORDING to Professor Reuleaux, of Berlin, the steam gun is stated, by Leonardo de Vinci, to have been invented by Archimedes. This curious historical discovery was made by the great painter in an Arabian manuscript, now apparently lost.

SOME French bakers, tempted by the low price of old wood painted with salts of copper, have been making use of it to heat their ovens. M. Nicklès has shown that serious accidents have arisen through these salts of copper becoming incorporated with the crust of the bread.

IT is stated that the human voice, when speaking with clear articulation and supplied from good lungs, will fill 400,000 cubic feet of air, provided they be enclosed in a proper manner, and the voice placed and directed advantageously. The same voice singing can fill with equal facility 600,000 cubic feet.

A RECENT statistical return published by the United States Government sets down the entire area of the Republic, including lakes and rivers, at 3,250,000 square miles. The public lands amount to 1,465,468,000 acres, of which 474,160,551 have been surveyed. The population is estimated to amount now to 36,100,000.

M. CHATAUD performs an interesting experiment, showing the diamagnetism of the vapour of magnesium. He ignites a portion of the metal below the conical extremities of the poles of an electro-magnet, and as soon as the current passes and the magnet becomes excited, the column of vapour divides laterally and takes the form of a U.

THE illuminating power of the gas used in various cities has been tested by Dr. Frankland with the following results:—Berlin, 15·5 candles; Paris, 12·3; London, 12·1; Vienna, 9·0; Edinburgh, 28·0; Manchester, 22·0; Liverpool, 22·0; Glasgow, 28·0; Aberdeen, 35·0; Greenock, 28·5; Carlisle, 16·0; Birmingham, 15·0. London gas, he says, is worse than it ever was, and gives off large quantities of sulphurous acid and other poisonous vapours.

A WRITER in an American journal makes the following remarks on glycerine:—"I should regard glycerine as unobjectionable for medicinal purposes if it forms a colourless mixture with twice its volume of strong alcohol and of sulphuric acid, and if after dilution with distilled water it yields no turbidity, either cold or on heating to the boiling point with sulphuretted hydrogen, ferrocyanide of potassium, nitrate of baryta, oxalate of ammonia, or nitrate of silver." This last test is an important one.

THE water found sealed up in a vase at Pompeii has lately been analysed. It was perfectly limpid, and scarcely rendered turbid by prolonged ebullition. At the temperature of 20 deg. Cent. its specific gravity is 1·001. The quantity of fixed matter left by evaporation was 1·032 gr. per litre. The gases evolved by ebullition were air and carbonic acid. Lime and magnesia were found in it; also phosphates in small quantity, and traces of sulphates, and even silica and iron.

M. BOUSSINGAULT has laid before the French Academy of Sciences his researches into the effects and counteractions of the vapours of mercury, which destroy or reduce to imbecility and misery so many lives in certain branches of manufactures. The deadly influence of these vapours on plants, and the effect of sulphur in neutralising them, had been carefully defined. Regnault considers the best re-agent against the vapours of mercury to be an iodised daguerreotype plate, but Boussingault maintains that the sensibility of the plates is as nothing compared with that of plants.

MR. SAMUEL MELLOR has made many experiments with the alloys of magnesium with zinc, tin, antimony, copper, thallium, lead, and other metals. Some of the results obtained were curious. An alloy of lead and magnesium burned very slowly; an alloy of 10 per cent. of zinc and magnesium had a specific gravity considerably greater than that of the two metals when isolated; a 50 per cent. alloy of tin and magnesium was found to be more brittle than glass; an ingot half an inch in diameter, when allowed to fall upon a stone floor broke in pieces, and the fragments were easily pounded to dust in a mortar.

THE four dials of the clock of the House of Parliament are each 22ft. in diameter, and are the largest in the world. Every half-minute the point of the minute-hand moves nearly seven inches. The clock will go eight and a-half days, but it only strikes for seven and a-half, so as to indicate by its silence any neglect in winding it up. The mere winding-up of the striking mechanism occupies two hours. The pendulum is 15ft. long; the wheels are of cast iron; the hour bell is 8ft. high and 9ft. in diameter, weighing nearly fifteen tons. The weight of the hammer alone exceeds 400 lb.

THE subdivision of the carboniferous strata of France into more than forty distinct basins, with their peculiar distribution over the country, is very favourable to the development of industry, and entitles M. Burat to say in his report that France, without being privileged like England, is in a position to develope its production and supply its consumption. That production is now about 13,000,000 tons, while it was only 7,900,000 tons in 1857. If it continued to increase at the same rate it would be 60,000,000 tons in the year 1900—a quantity which M. Burat thinks out of all proportion to the extent and richness of the French coal-fields.

MISCELLANEA.

THE coal miners in Mercer and Lawrence counties, Pennsylvania, are reported to be on another strike.

THE water supplied to the Crystal Palace district has been immensely improved lately, but the gas is simply abominable.

THE finest steam coal in the world is said to be found near Pekin, China, where there is a coal-field of 300 square miles in extent.

THE United States navy department have been experimenting on the use of petroleum for fuel instead of coal, and so far with success.

THE stores of the Blakely Ordnance Company, consisting of guns, shot, shell, &c., are to be put up for sale by tender on the 1st of August next.

THERE is unfortunately no longer room to doubt that Dr. Livingstone is dead. The first accounts of the sad event were substantially correct.

MR. GRAHAM, master of the Mint, has found in a specimen of meteoric iron six times more hydrogen than is contained in ordinary malleable iron.

THE Commons Select Committee state that in quality the Thames water compares advantageously with the water generally supplied to English towns.

THE experiments with the Rodman gun at Shoeburyness last week proved that it is vastly inferior to our 9in. 12-ton gun in range and penetrative power.

THE passage through the present Blackfriars Bridge is very dangerous, and the steamboats run great risk of collisions with each other and with floating lighters.

THE river St. Lawrence is to be dammed at Lachine Rapids, in order to obtain hydraulic power. The capital of the company which proposes doing it is 2,000,000 dollars.

THE demand for petroleum in Europe alone for the year 1866 is estimated at 90,000,000 gallons. The consumption in 1864 was 30,000,000 gallons, against 10,000,000 in 1862.

THE quantities of refined oil removed from the refineries of Pittsburgh for the fiscal year ending June 30th, 1865, was 142,233 barrels, and for the one ending June 30th, 1866, 354,907 barrels.

IT is said that a plan is in contemplation to supply Buffalo from natural gas wells at Amherst, ten miles distant. A well now sunk flows 40,000ft. of pure gas every day, and five more are proposed.

IT is announced that an instalment of £10,000 is ordered to be paid to Major Palliser, with an additional £5000 next year, by way of a second instalment, for his services in relation to his chill system.

DR. FRANKLAND states that if the illuminating power of London gas be represented by 12, that of Berlin and Birmingham is 15; of Manchester and Liverpool, 22; Inverness, 25; Edinburgh, Glasgow, and Greenock, 28; Paisley and Hawick, 30; and Aberdeen, 35.

A VERY clear account of the position of the Italian Irrigation Canal Company has been prepared by the committee of the protection association of the septennial bondholders, with Sir Thomas Bateson, M.P., at their head.

THE dividend due on Monday on the South-Eastern of Portuga Railway bonds was not paid. The directors are negotiating on the subject, and it is hoped the Government will not adopt any course permanently to damage the credit of the company.

A PROSPECTUS has been issued of the Anglo-Indian Telegraph Company (Limited), with a capital of £1,000,000 in shares of £20, to establish, *viâ* the overland route, a line to India under one control, with extensions hereafter to Singapore, China, Japan, and Australia.

MR. DION BOUCICAULT states that the Royal Albert Hall will be eleven times the size of Drury Lane Theatre, eight times that of Westminster Hall, and will be so large that a church of ordinary dimensions would stand on its floor and its steeple not reach the ceiling.

THE island which, according to San Francisco news, has been discovered in the North Pacific, is described as being in 150 deg. W. longitude, and 40 deg. 30 min. N. latitude. It is stated to be twenty miles long, situated in a section of the ocean where fogs and misty weather prevail.

A FIRE, on Wednesday, destroyed a large portion of the cotton mill of Messrs. Bashall and Co., Farington, near Preston, doing damage to the extent of £150,000, and depriving about 900 operatives of employment. The premises were insured in several offices, but to what extent is unknown.

THE three Albany firms now consolidated under the management of John A. Griswold and Co. are making arrangements capable of producing annually 20,000 tons pig iron, 15,000 tons Bessemer steel, 35,000 to 40,000 tons of steel and iron rails, and 8000 to 10,000 tons of merchant iron.

AT a meeting of Clyde trustees, held in Glasgow on Tuesday, it was reported that the revenue of the trust for the year ended June last amounted to £131,861, as against £125,787 in 1866, showing an increase for 1867 of £6074. The revenue for the month of June last was the largest for the same period in the history of the trust.

MR. FRASER, C.E., the deputy-assistant-superintendent of the royal gun factories at Woolwich, who has so successfully introduced the system of cheap construction, is informed that Sir John Pakington, the War Secretary of State, has decided on awarding him, as a first instalment, in recognition of the advantages accrued from his invention, the sum of £5000, to be paid forthwith.

THE Australian *Government Gazette* gives the returns of the wheat crop of the harvest of 1866-67. The total produce is 6,410,865 bushels, an increase of no less than 2,823,065 bushels over the previous harvest; the total quantity of land under wheat being 447,331 acres, an increase of 36,723 over the preceding year. The average produce per acre has been fourteen bushels 20 lb., as against eight bushels 44 lb. in the preceding year.

BY a correspondence just published it appears that the Board of Trade have accepted the offer of Mr. Norwood, M.P., of placing the screw steamer Ashford, now in Archangel, at the disposal of the British consul there for the rescue of the crews of the numerous vessels wrecked in the ice of the White Sea. The Board of Trade has at the same time undertaken to make good any loss to the owners of the vessel on account of breach of charter, forfeiture of insurance, &c.

THE leading Italian railways—and, of course, the minor ones—being in a very embarrassed state, the Minister of Public Works has submitted a bill to the Italian Parliament authorising the Italian Government to acquire the Roman, South Italian, Calabro-Sicilian, &c., lines. The purchase is to be effected by the transference to the shareholders of Three per Cent. Rentes. It is doubtful whether the Government would be found strong enough to carry out this project, even if it attains the desired authority.

THE Royal Agricultural Society are dividing the live stock department temporarily from the implement ground in order to prevent confusion during the four days set apart for the preliminary trials of implements. The Great Eastern Railway Company is engaged in delivering goods, and the general public is now necessarily excluded from the show ground until the commencement of the trials for implements on Wednesday, the 10th inst. Dynamometers and other scientific apparatus are being erected for the purpose of testing the capabilities of steam engines, thrashing machines, &c.

SUSPENSION BRIDGE OVER THE DORDOGNE AT CUBZAC.

M. VERGES, ENGINEER.

FIG. 1.

FIG. 3.

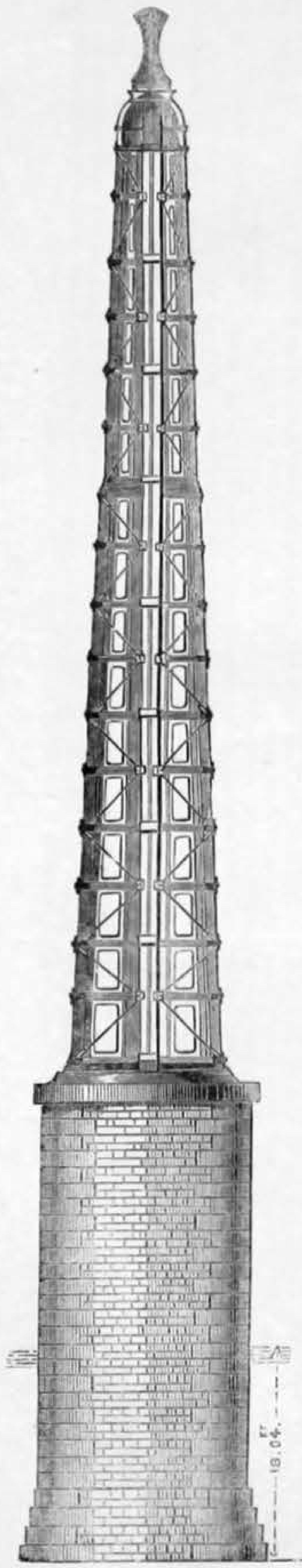


FIG. 2.

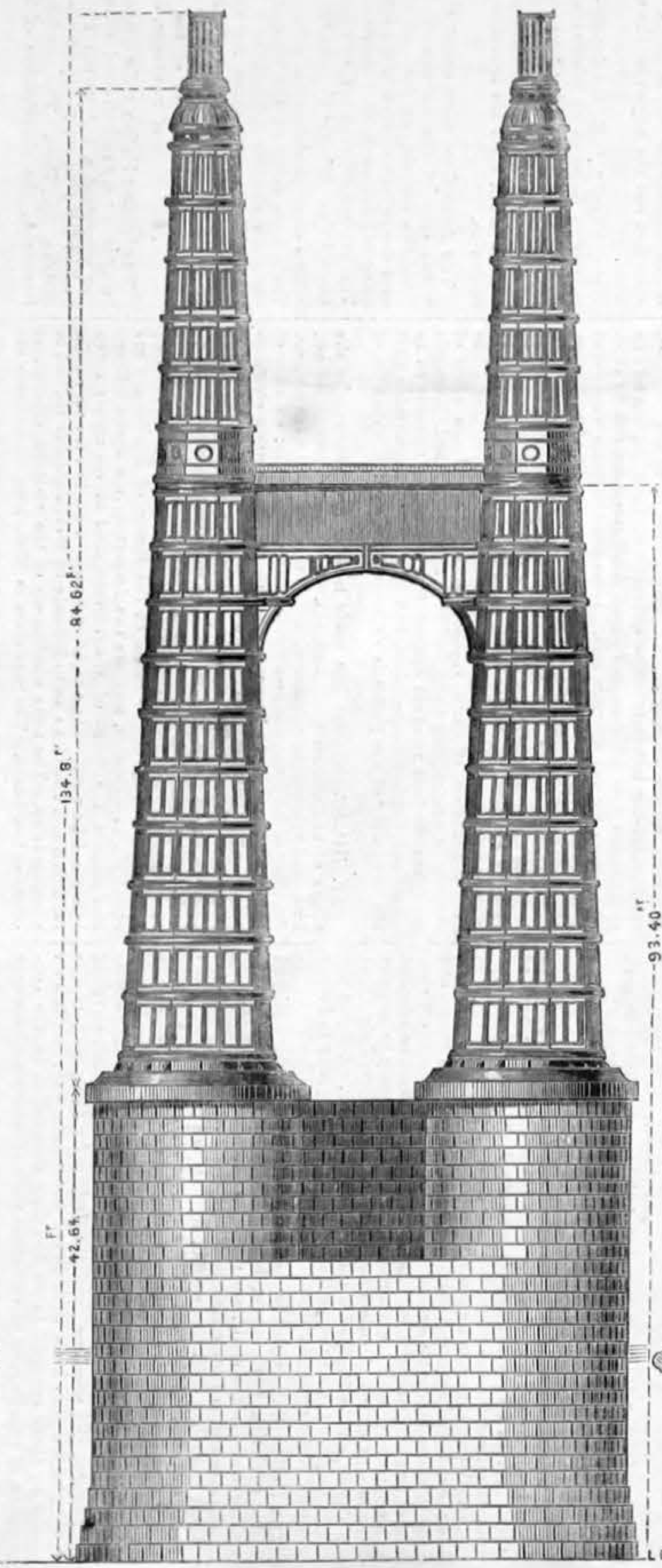


FIG. 5.

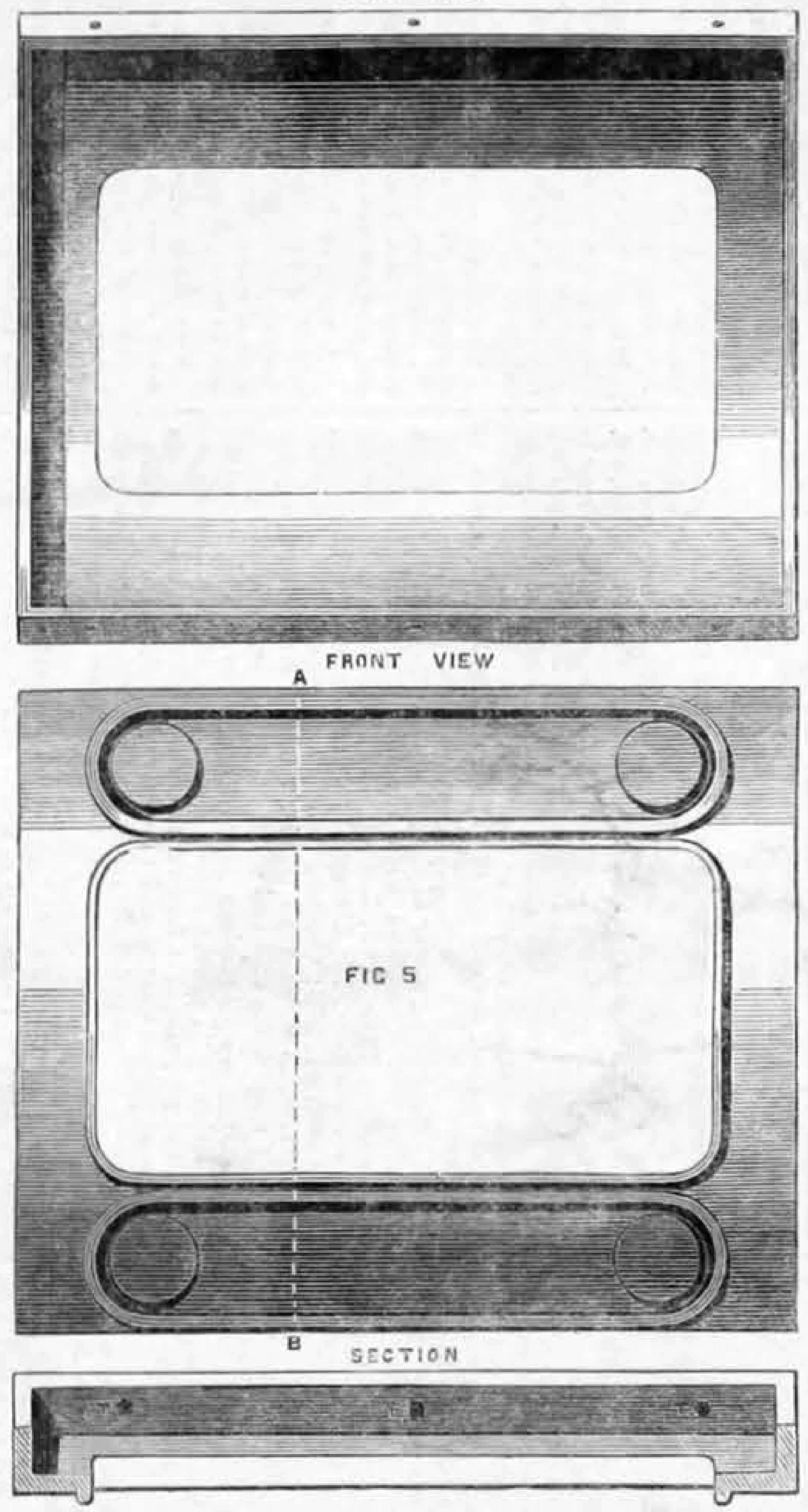


FIG. 8

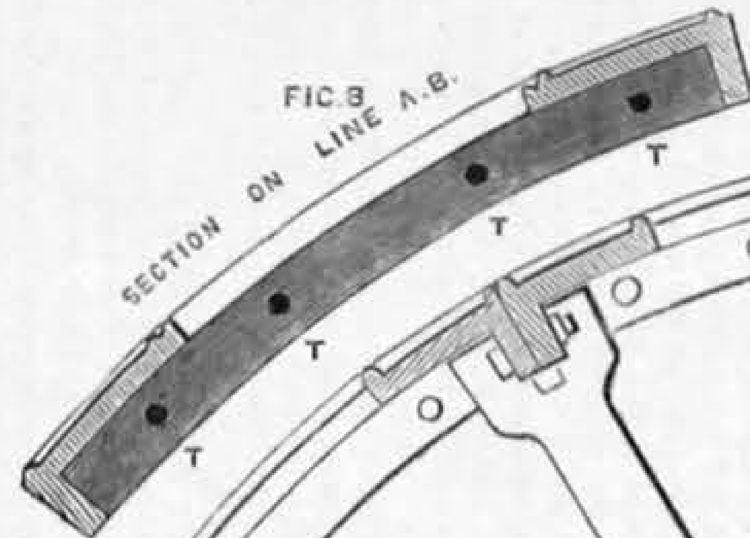


FIG. 10.

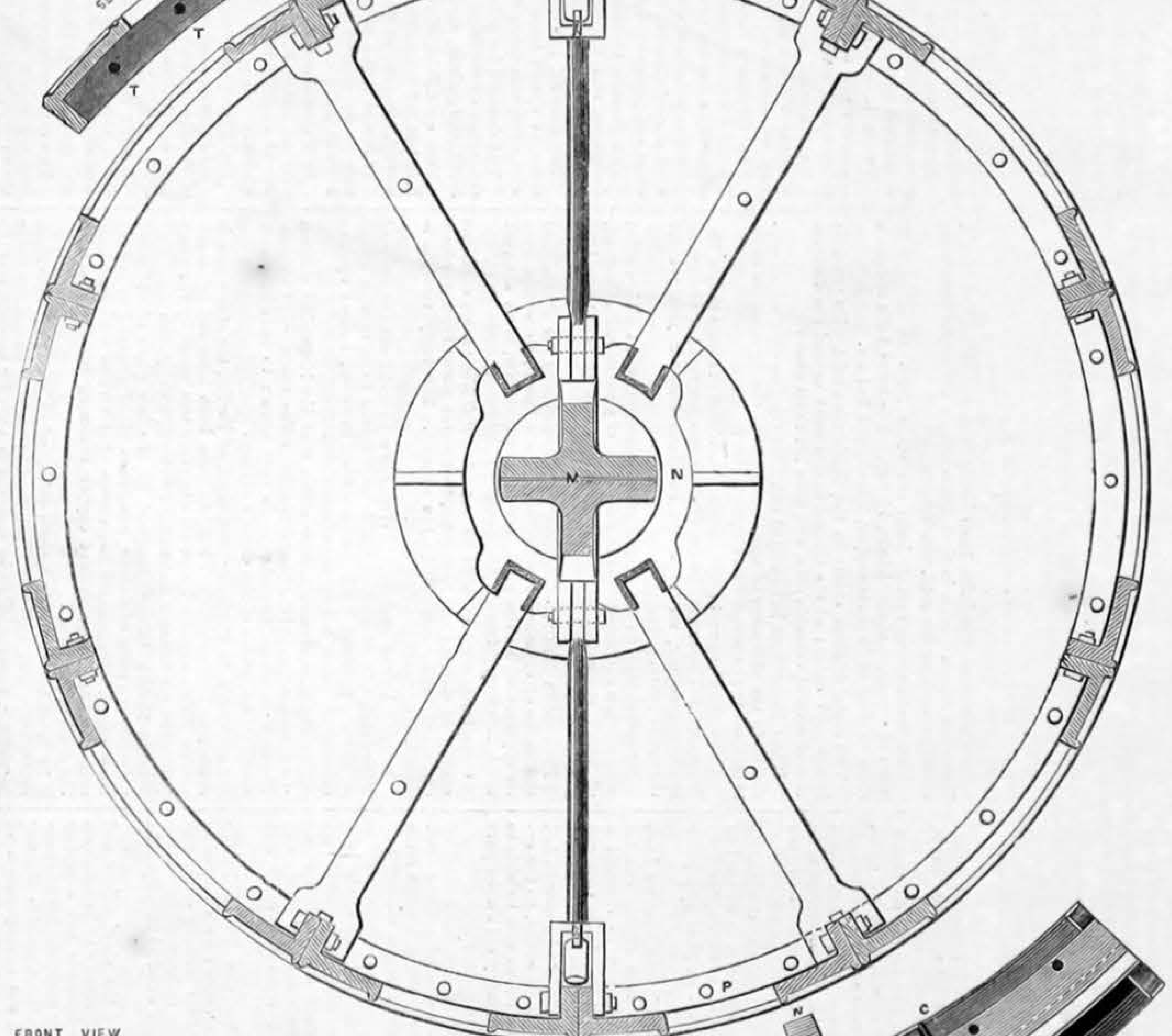


FIG. 7.

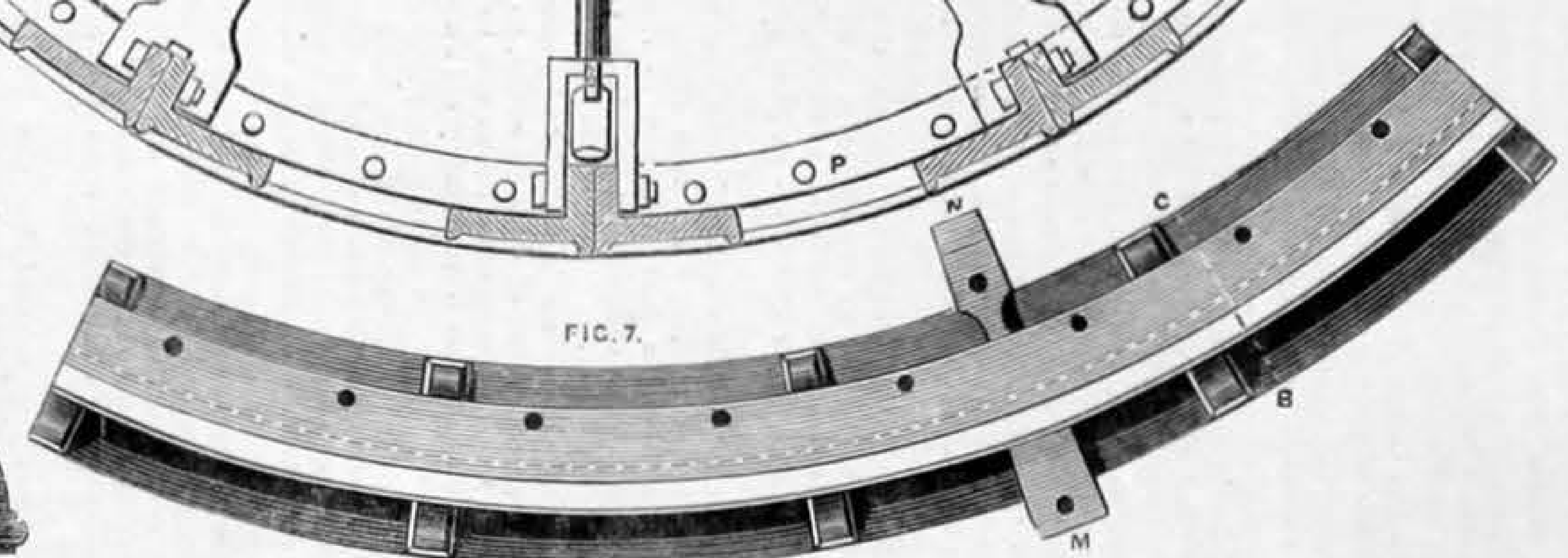


FIG. 4.

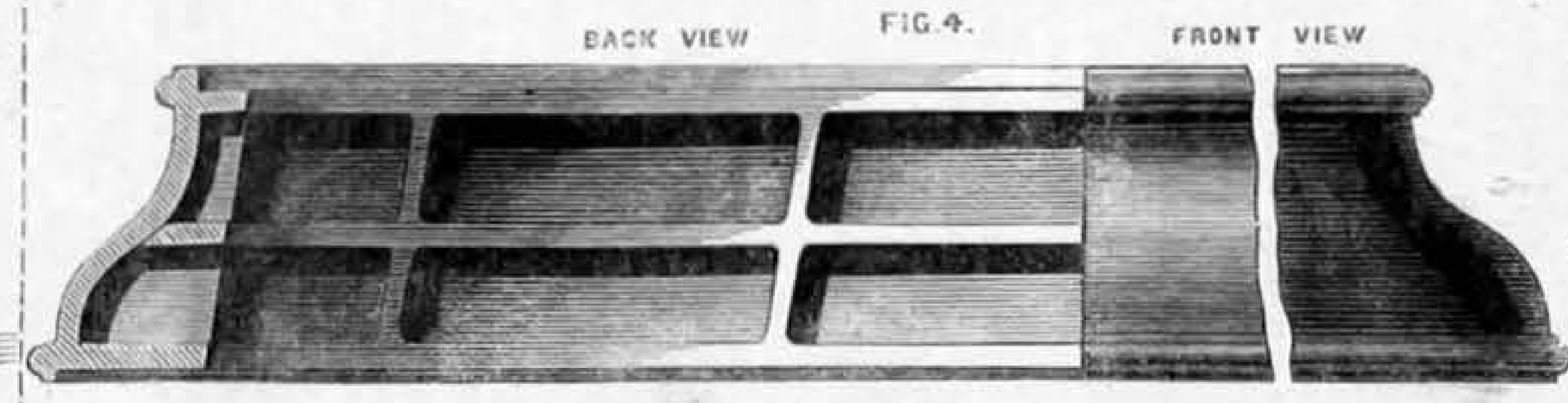


FIG. 6.

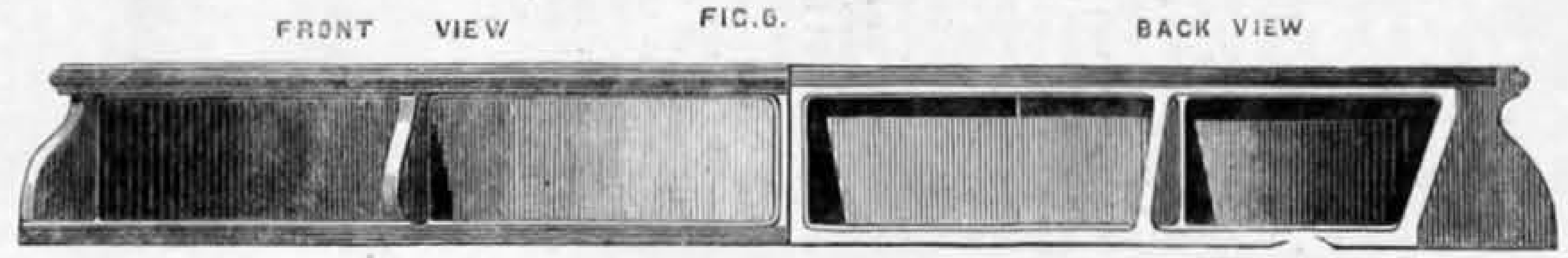
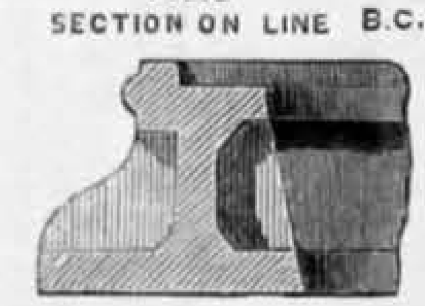
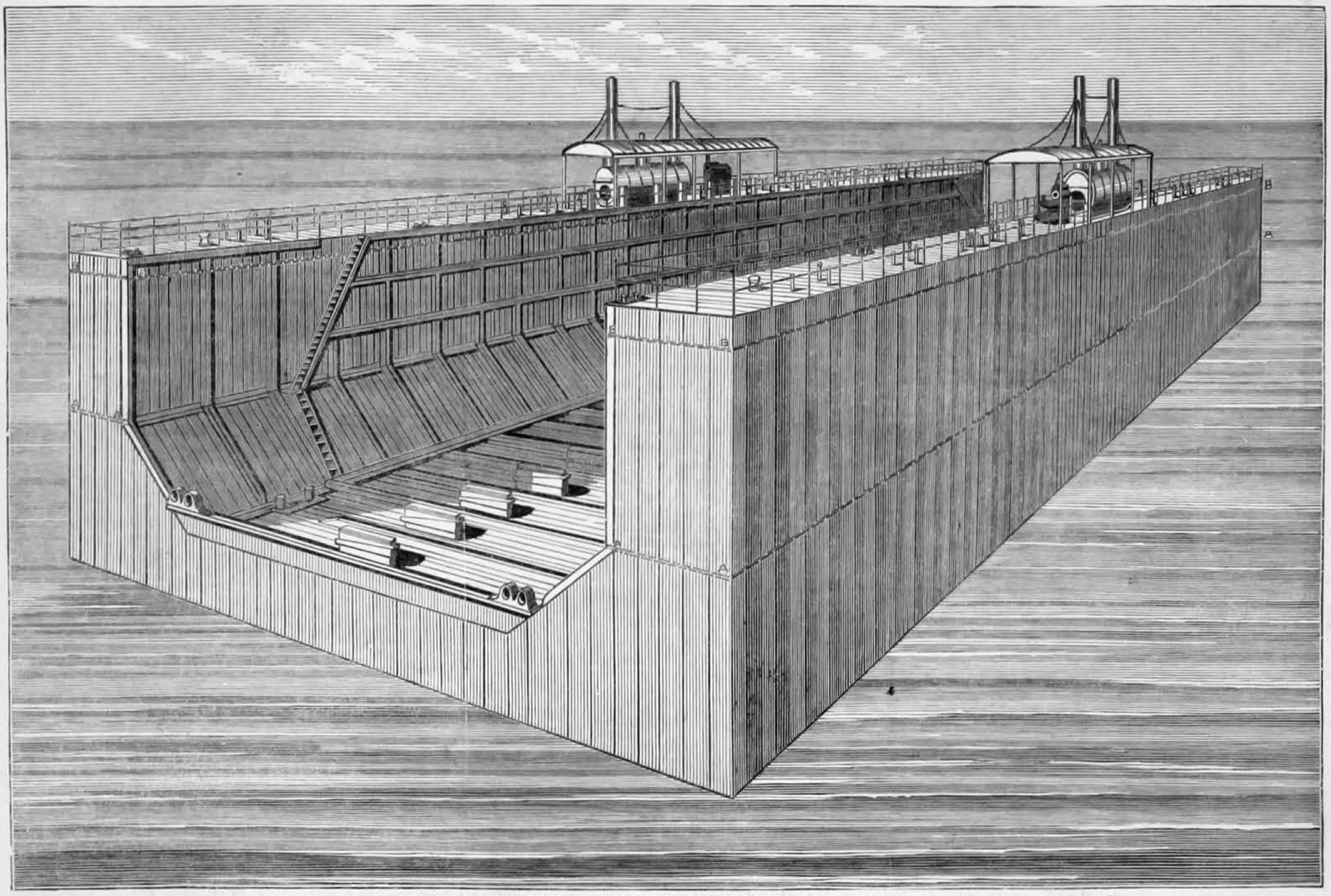


FIG. 9
SECTION ON LINE B.C.

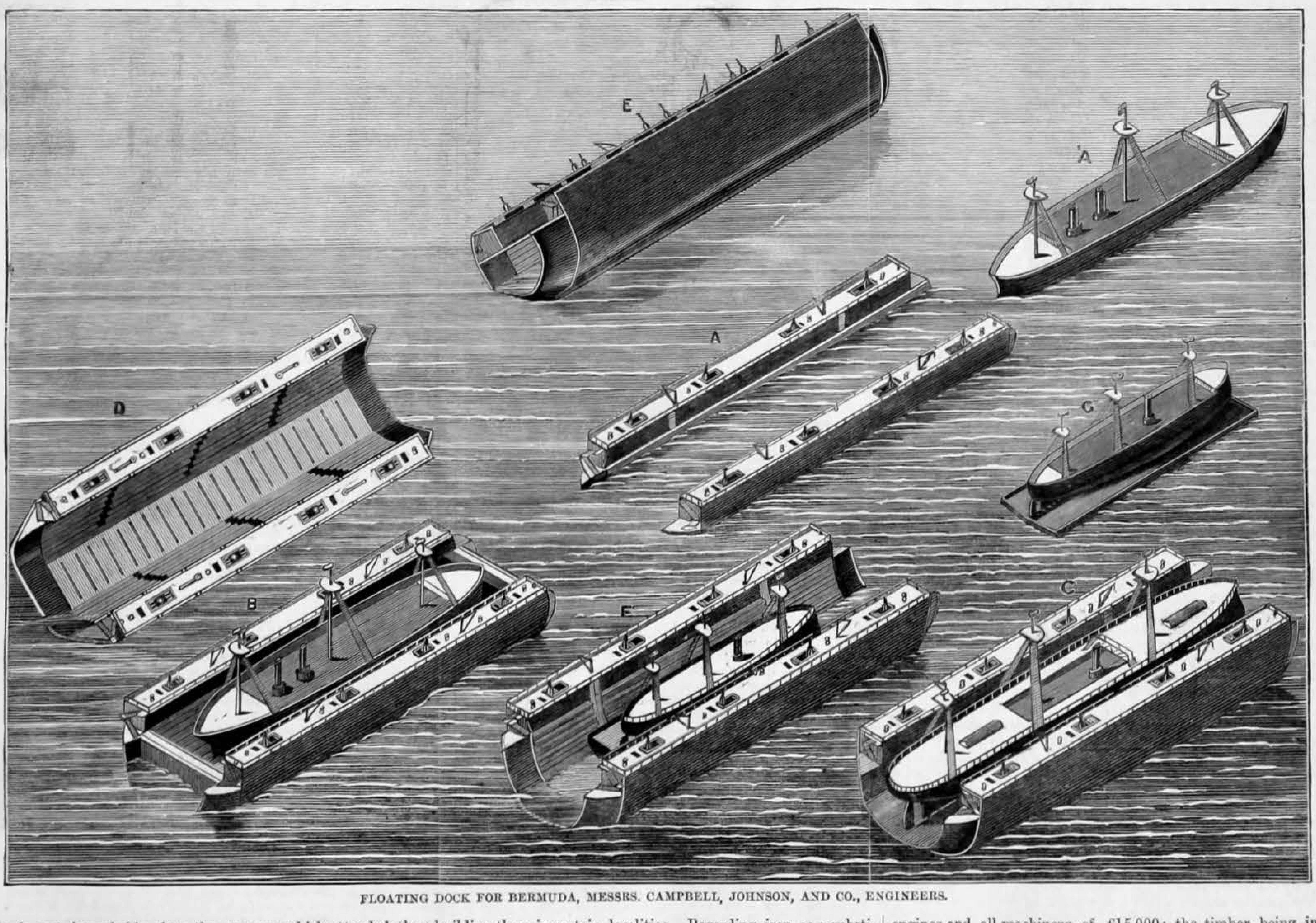


SWAIN.

FLOATING DOCKS.



FLOATING DOCK AT CALLAO, MESSRS. RANDOLPH, ELDER, AND CO., ENGINEERS.



FLOATING DOCK FOR BERMUDA, MESSRS. CAMPBELL, JOHNSON, AND CO., ENGINEERS.

It is not improbable that the success which attended the application of floating gates to stationary docks, first introduced into this country by General Bentham under the name of floating dams, led to an extension of the principle to docks themselves, and thus, what was originally adopted *in particulari* will probably be applied *in universale*. Two other circumstances have, doubtless, contributed to the construction of floating, dry, or graving docks. The one is the enormous expense attending similar structures of masonry, and the other, the impossibility of building them in certain localities. Regarding iron as a substitute for timber, it is but natural to expect that, notwithstanding its extensive adoption at the present day, and the variety of engineering and architectural purposes to which it is made subservient, it has been anticipated in many of them by the material which it has superseded. The earliest floating docks were of timber. About ninety years ago one was built on the Thames, and there is one 200ft. long by 60ft. wide and 22ft. deep at Marseilles, built about twenty years ago at a cost, including engines and all machinery, of £15,000; the timber being in a perfectly sound condition. In America wooden graving docks were constructed upon a more extensive scale, which is to be attributed to the same cause as that which led to the adoption of wood in all their earlier structures, viz., the comparative cheapness and abundance of forest-grown timber in most new countries. One of their earliest specimens, in addition to the later examples of the box and sectional dock, was what was termed the screw dock, the sides of which consisted of parallel rows of piling.

Whatever doubt there may be about the others, there is none about the sectional dock, which has proved a complete failure—though the fact of its being built of timber may have a great deal to do with the circumstance. As the chief application of iron floating docks is for the purpose of repairing vessels on foreign stations, and where the construction of the ordinary graving dock is attended with almost insuperable difficulties, we have selected two of the former description in illustration of our article. All iron floating docks may be considered as partaking of the same form as the ships they are intended to enclose, and may be, therefore, roughly said to be of a semi-rectangular, semi-cylindrical, or semi-elliptical shape. They are, in fact, ships: take an old man-of-war, scoop her out, and she is virtually a floating dock for any vessel smaller than herself. More than a century ago this rough and ready plan of converting an old hulk into something useful was in one instance actually carried out. Viewing docks and ships in the light of semi-tubes of a certain shape and thickness, there is this important difference to be observed in the theory of their respective constructions: the one is a braced tube, the other is not, and herein lies the principal weakness of a floating dock regarded as a piece of framework, a frame, moreover, requiring a very high degree of inherent rigidity. The transverse girders, deck beams, and the deck itself, of a vessel, whether of timber or iron, act the part of a powerful stiffener to the whole structure, prevent it getting laterally out of shape, and make all the strains self-contained. With a dock the case is otherwise, and but for the pressure of the water on the outside—a counteraction which is in a great measure lost when the vessel is docked, it might be compared to an inverted roof without a tie rod.

Above is represented a perspective view of an iron floating dock, constructed a short time ago by Messrs. Randolph, Elder, and Co., and sent out in sections to Callao for the Callao Dock Company, where it was completed and launched. It is rectangular in section, and the sides being vertical are not open to so great an extent to the weakness already described as the other docks also illustrated. The total length is 300ft., inside breadth 76ft., and inside depth 30ft., and it weighs about 3000 tons. From the bottom of the floor, which is 50ft. wide, to that of the dock is 9ft., and the sloping part of the bottom connecting it with the vertical sides, at A, has an incline of one and a quarter to one. Between the inner and outer skins there is a distance of 12ft., making the outside breadth of the dock exactly 100ft. One of the most important features in the designs under notice is the introduction of water-tight bulkhead compartments, and it is to the absence of these in the earlier examples of floating docks that may be traced one of their chief causes of failure, which consisted in their liability to turn over during the operation of docking the vessels.

This liability can be diminished to very small proportions, if not altogether obviated, by a proper system of water-tight bulkheads. Mathematically, the tendency of a dock to capsize may be thus expressed. Putting F for the overturning force acting upon one dock, and N for the number of compartments unto which it is divided by bulkheads, and F′ for that acting upon another, and A′ for the number of separate chambers contained in it, then making $A' < A$, we have $F = \frac{F' \times A'^2}{A^2}$. Consequently, if $A' = 1$—that is when there are no bulkheads—$F = \frac{F'}{A^2}$, or the relative tendency for a dock to capsize is inversely as the square of the number of separate compartments into which it is divided by bulkheads. At A, A there are strong watertight bulkheads running the whole length of the dock, and others at B, B, the intermediate space A, B, being the air space, and serving for the purpose of displacement. There are also longitudinal water-tight bulkheads at C, C, and a strong longitudinal girder at D which is not water-tight. Transversely there are six water-tight bulkheads running across the whole cross section which divide the dock into seven separate air chambers from B, B to A, A, into seven distinct water-tight compartments from A, A to C, C, and into the same number of similar chambers from C to C in the body of the dock. Boiler plate, half an inch in thickness, compose the inner and outer shells or skins, and there are transverse strengthening girders throughout the dock, 5ft. apart and 9ft. in depth, carried up in the form of lattice work through the side water compartments, air chambers, and horizontal bulkheads. It is in the connection between the inner and outer shell of a dock that a great portion of its absolute strength consists, for although it may be regarded as one entire frame, yet like all large iron structures, especially those where the principles of hollow construction are adhered to, it must be looked at from every individual point. Notwithstanding that the strength of a girder is directly as the depth, yet by a bad, ignorant, or unscientific arrangement of material it might fail locally long before the actual breaking strain was reached. In fact it may be stated that there is not any difficulty in designing an iron structure in the mass so that it shall theoretically be strong enough. The difficulty is to so apportion the strength of the various parts, in proportion to the strain brought upon them, that while on the one hand there is no more strength than what the requirements of safety demand, on the other there is no more material employed than what is consistent with a proper regard to economy. In no phase of iron construction is ignorance and a want of scientific knowledge more readily and more often apparent than in bracing. It is a common occurrence to witness an enormous amount of material consumed in bracing when a tenth part would suffice, provided it were put in the proper place. Openwork bracing, when scientifically applied, is the cheapest and strongest method of effecting the strengthening and imparting rigidity to every description of ironwork, but it is also attended with the disadvantage of being the most expensive and the least reliable when designed upon wrong principles. In the one case it is a most elegant and practical application of theory; in the other it is the mere assemblage in wild confusion of an indiscriminate number of rods and bars, joined together without the least regard to their respective duties whether as struts or ties. Mr. Bramwell, in a floating dock recently designed for the Danish island of St. Thomas, in the West Indies, where it is in course of erection, has carried out the principle of bracing to a very successful extent, and has employed openwork to replace in a large portion of the structure the solid-sided wall usually adhered to. There is not the slightest reason why all solid plates in any example of iron construction should not be replaced by skilfully-designed lattice-work. By the latter method the engineer not only is enabled to place the material exactly where it is wanted, in the very line of strain as it were, but is also certain that when it is correctly placed, the strains must pass in the direction marked out for them, and cannot take another. Wherever solid plates are used there is always some ambiguity respecting the precise direction of the strains, and more faith is put in the mass of the plates than in the strength of any particular part of them.

The dock in Fig. 1 is provided with a powerful boiler and engine on each side, and drives four centrifugal pumps communicating with all the water compartments by means of a system of pipes in such a manner that water can be let into or pumped out of any one or more of them separately as may be required. To provide for contingencies the pumps are so arranged that the entire force of one pump can be concentrated upon any one particular compartment.

Passing on to Fig. 2 we have an isometric view of an iron floating dock in a variety of positions, demonstrating the method of manœuvring a vessel in and out. It is being constructed on a very large scale by Messrs. Campbell, Johnson, and Co., at their works at Silvertown on the Thames, and when finished will be either sent out in sections to Bermuda, or as has been suggested, towed out entire, thus obviating the necessity of putting up a small establishment there to fit it together. It is intended for the service of Government, and is capable of berthing ships of war of the tonnage of the Bellerophon. In dimensions it considerably exceeds the example we have already described. The length over all is 381ft.; outside breadth, 124ft.; and inside, 84ft.; depth over all, 72ft. Instead of the sides being vertical they are curved outwards, with a batter of one in six, but approach nearer the perpendicular at the top. The outer and inner skins are of half-inch boiler plate, and there are, in all, fifty water-tight compartments. Seven water-tight longitudinal bulkheads run the entire length of the dock, while the frame is held together by nine transverse box ribs, also water-tight. Vertically the dock may be divided into three stages, the first containing the upper chambers, the second the balance compartments, and the third the lowest or air chambers. A glance at Fig. 2 will explain the *modus operandi*. When a ship is to be docked the water is pumped from the lower to the upper chambers until the dock sinks and assumes the position shown at A, ready for the floating in of the ship A¹, which grounds upon the blocks prepared for it. The water is then allowed to run out of the upper chambers or tanks, and the dock, together with the vessel, rises about 10ft. out of the water. Floating caissons, the form and construction of which constitutes part of the patent taken out by the inventors, are then submerged at the two ends, and the water that has not been removed from the dock is run off by especial valves and contrivances for the purposes into the air chambers, where it remains until afterwards pumped up again into the upper tanks in order to sink the dock for the reception of another vessel. At B in Fig. 2 is represented the dock closed, with the caissons and the ship high and dry inside it. C shows the dock with the caissons removed. To careen the dock over, all that is necessary is to let the water into the upper tanks on one side and empty it out of those on the other, and almost any angle of inclination can be obtained, as seen at D and E. When the vessel is ready to leave the dock the external water is re-admitted until the inside and outside level are the same, the caissons removed, and the vessel floated out. Another feature is represented at F and G, which consists in using the dock for placing small vessels upon pontoons, upon which they can be floated into shallow water and repaired at leisure. To occupy a dock capable of accommodating a ship of war with a vessel of insignificant size and tonnage, even if the owners chose to pay the full dues, would obviously be an abuse of its capabilities, and it is to remedy this that the pontoon system, which is not confined to the dock in question, has been devised. A vessel is shown upon a pontoon within the dock at F, and is supposed at G to have been floated out ready to be towed wherever it may be desirable. About 8000 tons of iron will be consumed in the manufacture of this enormous structure, and it is proposed to launch it broadside on, which was the plan adopted in the launching of the one at Callao. A peculiar feature in Messrs. Campbell's dock is the plan adopted for repairing the dock itself. It consists of a three sided tank open at the top, which is made to correspond as nearly as possible to the shape of the bottom of the dock, and can be transported along it to any part requiring repair. Having placed it in juxtaposition with the damaged part the dock may either be sunk a little, or better still, some of the water may be pumped out of the tank, and it can be made to spring tight to the bottom of the dock and the joint secured perfectly water tight. The water can then be pumped out of the three sides of the tank, and men and materials introduced for carrying out the necessary repairs. It should also be mentioned that the patentees have provided for the probable contingency of self-propulsion, a very praiseworthy precaution, considering the peculiar service and the locality for which the dock is intended. We are decidedly of opinion, despite of much that has been said to the contrary, that floating docks can not only dock vessels with perfect safety, but are likely to yield a more remunerative profit than their stationary brethren have ever done. They are perfectly independent of all considerations of foundations and special situations, and their size is simply a question of cost. We should not omit to mention among floating docks the hydraulic lift dock of Mr. Edwin Clark, which, although a triumph of engineering skill and mechanical ability, is not adapted for universal application similarly to those described. It, moreover, is not strictly speaking a floating dock, inasmuch as it depends for its support upon its connection with the land, and its erection premises the possibility of being able to put up the cast iron columns, a feat by no means certain of accomplishment in every locality. A floating dock proper is one which depends, like a ship, upon the water solely for support, and requires nothing more than what is common to both of them, that is sufficient depth of water to float in and a secure holding ground for anchorage.

LETTERS TO THE EDITOR.

(*We do not hold ourselves responsible for the opinions of our Correspondents.*)

THE LA CERE AND BUSSEAU D'AHUN VIADUCTS.

MONSIEUR.—Vous avez consacré à nos viaducs de Busseau d'Ahun et de La Cerè une série d'articles dont l'étendue témoigne du sérieux intérêt que vous portez à ce genre de constructions. Jái vu avec un plaisir tout particulier que votre collaborateur ne partage pas le dédain que beaucoup d'ingénieurs du Continent semblaat professer pour la question du vent, et après avoir entendu bien souvent que jai exagérais l'importance du vent, je ne suis pas fâché de trouver l'opinion contraire dans une publication aussi compétente que la vôtre. Mais per-mettez-moi à cet égard un mot d'explication.

Vous dites que j'ai compté l'effort du vent à raison du, 170 kilogrammes per mètre quarré de surface; c'est vrai, mais en ajoutant à la surface du viaduc proprement dit celle des wagons, soit une hauteur de deux mètres. Pour les viaducs non chargés de trains, j'ai compté 275 kilogrammes, c'est-à-dire le maximum de l'intensité, les deux modes de calcul conduisant à peu pris au même résultat. Dans nos lignes peu fréquentées du centre de la France, ne faudrait-il pas, en effet, un hasard extraordinaire pour que le passage d'un train coïncidât précisément avec le coup de veut extraordinaire, et ne peut-on pas admittre d'ailleurs que la circulation des trains s'arrêtera pendant de pareils ouragans, puisque l'expérience a démontré que les wagons vides commençaient à être renversés quand l'intensité du veut d'epasse 170 kilogrammes?

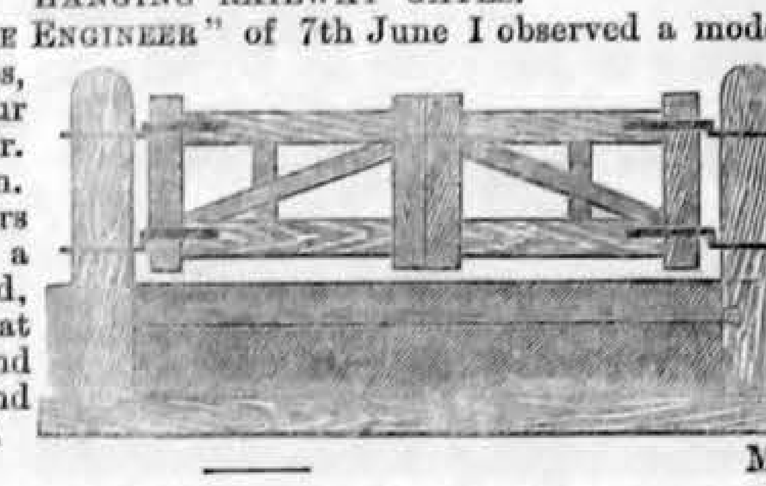
En ce qui touche les idées que j'ai émises, il y a trois ans, sur les dispositions adoptes pour les viaducs métalliques futurs, j'avone qu'elles se sont modifiées, notamment en ce qui concerne l'emploi de haubans (guys) dont les inconvénients ne m'ont d'ailleurs jamais échappé. Je crois avoir trouvé une disposition nouvelle que nous proposons d'appliquer aux quatre viaducs métalliques (dont un de soixante-cinq mètres de hauteur) que nous sommes sur le point de commencer sur le ligne de Commentry à Gannat. Si vous le désirez, je vous en communiquirai les dessins aussitôt qu'ils seront complétement arrêtés et sanctionnés par le Gouvernement.

Veuillez agréer, Monsieur le Directeur, l'assurance de ma considération distinguée. WILHELM NORDLING.

[We readily print in the original French the foregoing letter of M. Nordling, the distinguished engineer of the above viaducts. The object of M. Nordling's letter is to justify the view which he adopted with reference to the probable maximum power of the wind upon these viaducts, and he calls attention to the fact that, with the coefficient of 170 kilogrammes per square metre, he has taken into account the whole lateral surface of a train of two metres in height above the rails in addition to that of the viaduct itself, *estimated* in the way that he has fixed the latter surface, and that for the case of the viaduct without a train he has adopted the higher coefficient of 275 kilogrammes to the square metre, both calculations leading to nearly identical results. In future viaducts M. Nordling would, however, be disposed to employ an improved form of guy chains, as against the effects of wind, &c. There is really no point of difference between us and M. Nordling; those who will turn back to our series of articles on these viaducts will see that we merely affirm this to be the fact, viz., that in the present state of our knowledge it is impossible to determine with even any attempt at exactness what is the maximum possible pressure of the wind against open or partially open structures such as these viaducts, firstly, because there is no experimental knowledge as to what is the maximum force of *sudden or recurrent gusts in storms* in any country or climate; secondly, because we have no data to enable us to determine the relation between solid surface and resistance to wind, in structures such as these viaducts. On these grounds, we say, we must view any calculation as to the effect of wind upon such viaducts as at best but more or less probable approximations. We are ready to accept M. Nordling's figures as amongst these, but we cannot take them for more, and that seems, in fact, to be his own conclusion.—ED. E.]

HANGING RAILWAY GATES.

SIR,—In "THE ENGINEER" of 7th June I observed a mode of fixing gate posts, suggested by your correspondent Mr. J. O. Longton. For twenty years I have used a similar method, but somewhat more simple, and have always found it most effective.



M.

PARAIRE LOOMS.

SIR,—Having noticed Mr. Paraire's improved pneumatic loom in your impression of last week, and being much pleased with the one which was formerly exhibited at Swan Wharf, I should feel much obliged if Mr. Paraire or yourself could tell me whether pumps are required for providing the compressed air; if so, whether he has taken into consideration the power required to work such pumps and the cost of them, or if he dispenses with reservoirs and air vessels to keep the supply of air up.

As Mr. Paraire condemns the plan as adopted by others, perhaps you will state in your next the new mode used for getting the compressed air, as myself and others would be glad to adopt the principle if we can get over the continuous expense of supplying the air by pumps. THOMAS MARTIN.

Shoreditch, June 24th, 1867.

THE LAWS OF THE DRAWING-OFFICE AND THE LAW OF NOMINAL HORSE-POWER.

SIR,—What is all this cry about the laws of the drawing-office, and this nice distinction of what a gentleman is, and the employers' motto, "of what is yours is mine, and what is mine is my own." Is it so, short-sighted mortals? Where is a designer who will give his employer all his own way? And where is the employer who will thank his draughtsman for doing so? If there is a firm in existence who do all the thinking themselves, all well and good—the draughtsmen will have an easy time of it. But no such firm is in existence, and I would plainly ask those modern lawgivers how much they allow their draughtsmen for an idea that may bring them in thousands, and the echo replies, "nothing." Courts of law indeed! I remember a famous case many years back in the law courts when the judge patiently heard the case—or I may say impatiently—for he turned round on the employer and asked him sundry questions relative to machinery, and after hearing the answer merely remarked he must have a very retentive memory. The employer then confessed he had made notes of work by other firms—in fact it was proved that the firm had cribbed more than the draughtsman, so the case fell to the ground. But should any one seek employment for the purpose of giving away the ideas of the firm for others' uses, then let him meet his just reward.

I see something about nominal horse-power in your last impression. What does it mean? Your correspondent knows more about it than he will allow; but if not, it simply means jockeying. A cylinder has a given diameter—drive the piston at 200ft. per minute and he will obtain so much horse-power; but likewise drive the same diameter of piston at 400ft. per minute—which some are allowed to do—and he will obtain double the power. As regards the indicated horse-power it is simply a matter of cut-off and mean pressure; and when he considers we have ocean steamers carrying 60 lb. steam pressure, he can easily see how such high indicated horse-power is obtained.

And now to the root of the evil. I would ask the Lords of the Admiralty, with all due respect, to fix the speed of direct-action engines. Let all manufacturers have the same advantage.

ROB ROY.

WROUGHT IRON COIL GUNS.

SIR, In reply to the editorial foot-note appended to my communication of the 21st ult., I beg to state that I am perfectly aware of the antiquity of hooped guns, and have seen many examples as well in the British as in many of the great continental arsenals. But iron staves, strengthened by means of shrunk hoops, is not the original form of explosive artillery, and is of much later date than the mortar, brought into use as soon as an explosive powder became practically known.

The art of throwing large masses of stone into the enemy's camp or fortress by mechanical means was brought to great perfection by the Greeks and Romans, and the first application of an explosive powder was that of projecting similar masses from a vessel of cast brass, with a wide mouth and a smaller chamber for the powder.

The projectile was called a "bomba" in the south of Europe, where the invention originated; and the brass vessel "bombarda," both derived from the Greek word "βομ βεω," signifying to hum, hiss, or roar, in allusion to the noise made by a projectile in its passing through the atmosphere, and thus all the ancient slings, ballistæ, and catapults came to be entirely superseded. When it was found preferable to project smaller bullets with high velocities, and there being then no means of boring cast guns, the expedient of iron staves and hoops, taken from the cooper's art, came to be adopted for forming the tubes, a very different process from my original proposal for constructing heavy ordnance with a cast metal jacket upon a welded coil of wrought iron for the inner tube. The first form, therefore, of explosive artillery was that of the mortar and stone projectile. The next invention was that of the iron cannon formed of staves and hoops, leaden bullets being used for smaller sizes, until the casting of iron became common, and then cast iron shot superseded those of stone, but brass was the metal in general use for cannon.

In one instance both the bullet and the mortar were of stone. The Turks, in order to command the passage of the Dardanelles, hollowed out the rough form of a mortar in the massive rock, and threw from it a granite globe of a 1000 lb. weight. Lastly, cast iron was used for both cannon and shot, and ultimately bombs were cast hollow, and received a bursting charge of powder. In regard to the plan of shrinking coil upon coil, there is a type of it in the way that the Russian tar barrels have always been made with straight staves, forming a perfect cylinder. A strong truss hoop is screwed on to each end, so as violently to compress the timber, two warm hoops are slipped on, and the truss hoops are then removed.

Reading, July 1st, 1867. HENRY W. REVELEY.

THE FLOW OF GASES.

SIR,—Mr. Napier does not seem to be aware that there can be such reasons for not answering letters as a perfect knowledge that the asker may, if he will only take the trouble, find what he wants over and over again repeated in the published matter he is expected to have examined and read. I am sure if he had tried he might have found the meaning of v_1 both in my paper on safety valves and in my letter to you dated April 15th, 1867. In the first of these, immediately after equation (4), and just above Mr. Napier's great discovery of the value of v_1, given in his last letter, are these words:—"Where v_1 is the velocity of the steam issuing at the density of that in the boiler." Could anything be plainer.

The value of v_1 may also be found in the third proposition of my last letter, and is thus stated:—"3rd. The velocity of steam flowing through an aperture of constant area from a boiler into the atmosphere—when considered to be flowing of the same density as that in the boiler—increases up to its maximum, agreeing with

$$\frac{x}{p} = \cdot 58352,$$

and afterwards decreases the increase, maximum and decrease obeying the following law—

$$v_1 = k \frac{s}{s_1} 7392 \cdot 5 \sqrt{p^{\cdot 059} - x^{\cdot 059}}$$

or—

$$v_1 = k \frac{x_n}{p^n} 7392 \cdot 5 \sqrt{p^{1-n} - x^{1-n}}.$$

Where $n = \cdot 941$, $s =$ the volume of 1 lb. of steam at pressure p, and s_1 the volume of 1 lb. at pressure x."

Now when $x = 0$ in the first of these values of v_1, we have—

$$v_1 = k \frac{s}{s_1} 7392 \cdot 5 \sqrt{p^{\cdot 059}}$$

and in the second the expression—

$$\frac{x^n}{p^n}$$

exists as follows—

$$s = \frac{330 \cdot 36}{p^n} \text{ and } s_1 = \frac{330 \cdot 36}{x^n},$$

giving

$$\frac{s}{s_1} = \frac{x^n}{p^n}.$$

Since both s and x_n are values derivable from Regnault's experiments, and well known to be very accurate within the limits of 1 lb. pressure and 300 lb., and were never intended to apply to the vanishing point, Mr. Napier is reasoning from data which he ought to have known was never intended to be used in any dreamy deduction.

If he wishes to know the probable velocity that steam at any pressure will rush into a vacuum the following may answer his purpose, on the supposition that he can get at the conception of the idea.

I gave in the first proposition of my last letter the following formula for finding the velocity that steam at pressure p would have when rushing into steam of pressure x, in which v is the maximum velocity of flow, or such a velocity that would allow the steam to expand from p to x before its velocity became v:—

$$v = 7392 \cdot 5 \sqrt{p^{\cdot 059} - x^{\cdot 059}}$$

Let $x = 0$, then—

$$v = 7392 \cdot 5 \sqrt{p^{\cdot 059}} \quad . \quad . \quad . \quad . \quad . \quad (J)$$

the velocity into a vacuum.

If we wish to ascertain what the velocity will be, on the supposition that the steam is flowing past any given point at the same density as that in the boiler, then we must know the law that will enable us to calculate the density at any pressure p when we know the density at pressure x. This is expressed as follows:—

$$v_1 s_1 = v s,$$

from which we get, by substituting the value of v from the last equation—

$$v^1 = \frac{s}{s^1} 7392 \cdot 5 \sqrt{p^{\cdot 059}}.$$

To see clearly whether this will or can become nothing we must inquire into how the values of s and s^1 can be ascertained. And since the velocity does not become nothing before we introduce the value v_1 into it, let us not make the glaring blunder and say it will become nothing afterwards, when common sense tells us that v is finite, and given by equation (J). Also—

$$v = \frac{v s}{s^1} \text{ and } v = \frac{v^1 s_1}{s},$$

and since neither s nor s_1 can be nothing, but must be something, and it is also clear that s_1 cannot become infinite, for that would exclude everything else from occupying space excepting this 1 lb. of steam, whose volume is s^1.

Again, v is known, and can be expressed in numbers by equation (J), and it is evident v^1 must be less than v; also s is known in numbers when p is known, and since $\frac{v^1}{v}$ must be finite, then $\frac{s}{s^1}$ must be finite; therefore,

$$\frac{v_1}{v} = \frac{s}{s^1}$$

cannot be made to vanish for any value of v_1, assuming any such position as no flow of steam; for, as stated before by me, it does not follow because there is no flow of the steam at the density s when x becomes nothing, that there will not be a flow at some density $s - \Delta$, where Δ may be as small as we like without becoming nothing or vanishing altogether. Let me beg of Mr. Napier just to think carefully about this statement.

Mr. Napier is apt to make assertions which it appears to me cannot be proved, for in his last letter he says:—"Mr. Baldwin says I have no right to speak about the effect of a perfect vacuum, because I have no means of experimenting on it. This is a singular limitation of a mathematical question." I am sure, Mr. Editor, I said no such thing as here stated. What I did say is:—"I will state my case in four propositions, which I conceive to be incontrovertible, and leave the symbols of *nothing* and *infinity* to Mr. Napier, as being expressions on which he has no experimental data, or ever likely to have." I am of the same opinion still, and will now, so far as I am concerned, conclude this subject until some trustworthy experiments are brought out different to Mr. Napier, when I may again be induced to examine the subject.

Bury, Lancashire, June 26th, 1867. THOMAS BALDWIN.

ASSISTANT ENGINEERS' AND DRAUGHTSMEN'S BENEVOLENT SOCIETY.

SIR,—I am very pleased indeed to find there is once more the subject mooted of forming a benevolent society of assistant-engineers and draughtsmen, and most sincerely hope the scheme may this time be fully matured and not allowed to drop, and will therefore, with your permission and kind aid, call upon all my brother draughtsmen to put their shoulders to the wheel at once and aid Mr. Bancroft—who has so kindly brought the subject into notice—in forming the nucleus of such a society. I can only add I shall be most happy to forward the scheme in any way I can.

SPERO.

SIR,—My notice has just been called to the fact that several gentlemen are trying to found a benevolent society for engineers. I wonder how such a thing has been overlooked so long. I am sure it has my best wishes, and I should like to subscribe to same.

PERMANENT WAY.

SIR,—Meeting with a friend the other evening, the conversation turned upon a friend who had lately died, leaving a widow and young boy. This caused me to think of a suggestion that had lately been made in your journal respecting the formation of a society for assistant engineers. Can you please inform me if the scheme is at all matured yet? INQUIRER.

SIR,—No doubt the present depressed state of the profession is much against the founding of such a society, but if you will allow me I should like to place the following suggestion before the notice of your correspondents.

I think the Foremen Engineers' Society would be a good model for us. This, as I understand from your paper, meets periodically to read and discuss papers, and assist each other during the time they are seeking fresh appointments.

I hope soon to see other suggestions, and believe the society, if properly conducted, can be carried out in more prosperous times.

AN ASSISTANT C.E.

SIR,—As an assistant to a well-known firm I hope the suggestion to found an orphan and benevolent society will meet with that encouragement it deserves. There are a great number of us in this district, including Birmingham, Wolverhampton, Dudley, &c. &c., who ought to be interested in the movement, and will, no doubt, as the society advances. Many of the metal trades intimately associated with engineers would gladly subscribe to the funds. S. J. WALTERS.

Highgate, Willenhall.

SIR,—In your number for February 1st was the following paragraph on page 101:—

"Draughtsmen's Benevolent Society.—We are still receiving letters on the above subject, the publication of which we reserve for the present. We hope shortly to be able to discuss the subject in our columns, as it is undoubtedly one of much importance."

As one who feels deeply interested in the matter, will you kindly say what steps have been taken to secure so desirable an object?

The publication of the letters you have received and an article from your pen is, I think, most needed to start the society.

E. B.

SIR,—The interest which assistants seem to take in the above suggestion, by the letters you have received on the subject, seems to speak favourably of the movement. A case occurred the other day which impressed me with the importance of founding such a society. A young assistant engineer died and left a widow and two children unprovided for, and I fear matters will go very hard with them, and doubtless there are many such cases. I am sure the profession will thank you much for bringing the question before them. The circulation of your paper being very extensive, the subject must consequently come under the notice of some thousands interested. May I be allowed to suggest that if a summary was given, embodying the several wishes of your correspondents, it would save some of your valuable space, and at the same time give the matter the ventilation that it appears so much to require. E. J.

SIR,—Some time since Mr. R. Bancroft suggested the formation of a society having for its object the support (temporary or otherwise) of disabled sick and unemployed draughtsmen. The matter seems to have entirely fallen through.

I forward for your inspection a rough draft of what, in my opinion, should be the gist of the regulations of such a society, and should you approve of them so far as to give them publicity, I should be glad to treat with four or five gentlemen who would assist me in founding the society, and to that end I shall be happy to give my services as secretary *pro tem*. A. B.

London, June 22nd, 1867.

1. That the society be legally enrolled.
2. That the society members consist of engineers and draughtsmen who have been engaged at least three years in an office, and who are not under twenty-two years of age.
3. The officers of the society—with the exception of the medical attendants and solicitor shall be elected at the half-yearly meeting of the members, and shall give their services gratuitously.
4. The expenses of the society to be provided for from the funds in hand.
5. The entrance fee for engineers (*bonâ fide*) will be £2 2s.; for draughtsmen, £1 1s. The quarterly subscription for engineers, 12s.; for draughtsmen, 10s.
6. The committee of the society to meet every alternate Saturday for the transaction of business.
7. No member shall receive relief from the society until he shall have completed a six months' subscription.
8. Members out of employ, entitled to relief, to prove their necessity for the same; to send in a written application for a loan of a certain amount per week for so many weeks, such loan to be repayable at an agreed date.
9. Sick members to obtain a medical certificate of their condition, to be forwarded with their application for aid. These members will receive a weekly gift from the society, according to circumstances.
10. The claims of disabled members, and of widows and children of members deceased, will be dealt with by a special committee appointed for the purpose.
11. The society will publish fortnightly a list of members, with their addresses, the description of work they will undertake, and the term of their experience. For convenience of employers requiring assistants the unemployed members will be indicated in the list.

PARIS EXHIBITION.

OUR article Hand and Brain has been professedly transferred at full length into the pages of *Les Mondes*. We have great reason, however, to complain of the translation, which in very many places is very far indeed from conveying the real sense of the original. For example, in the last part of *Les Mondes* (for 27th June, 1867, p. 387) we read,—

"Nous croyons que ces produits défient toute rivalité—sans excepter celle de Whithworth, en supposant même que Whithworth n'eût pas degénéré. Pouvous—nous nous défendre de tristes réflexions, en voyant un exposant Français pendre le titre de fournisseur de la flotte Britannique!"

Who would imagine that this is meant for a translation of the following, which are the words of our article of June 14, p. 529:—

"There is a case of tools &c. .... which for finish and form may boldly challenge anything we can show, even were Whitworth to have come forward in his full force, which he has not done. It is not unsuggestive, too, though we do not know upon what basis the claim to the title is founded, that an exhibitor in France close by here of like tools styles himself *supplier to the English fleet*."

Take another example, p. 387, "Nous avons encore á faire une pénible déclaration." Who could have credited that this professes to be a translation of "Let us glance at fine ironwork of a totally different sort," p. 529.

Again, certain paragraphs which might not fit French trade notions, or the national vanity which *Les Mondes* seems to consider insatiable on the part of its countrymen, are omitted without the slightest notice, and the professed translation runs glibly on, as if it had quite fully and truly transferred the original English thoughts into French for Gallic readers only.

As the matter stands and for the present, we beg to warn Frenchmen that the professed translations from THE ENGINEER as they find them in *Les Mondes* require verification with the original.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending June 29th, 1867. On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., 9476; on Wednesday, Thursday, and Friday (admission 6d.), from 10 a.m. till 6 p.m., 1928. National Portrait Exhibition, by payment, 2998. Total 14,402. Average of corresponding week in former years, 11,464. Total from the opening of the museum, 6,805,488.

COAL SHIPMENT AT BIRKENHEAD.—The Welsh colliery proprietors are now adopting such measures as will enable shippers of coal to take cargoes on board at Birkenhead on as advantageous terms as those offered at Cardiff and other South Wales ports. The Powell Duffryn Colliery proprietors are offering advantages which it is believed will for the future prevent vessels being taken from the Mersey to load at Cardiff, if the risk of Channel voyage, the double port charges, and other expenses are taken into consideration, it would appear that vessels will sustain a loss by being taken from the Mersey to be laden at the pits in South Wales.

CONVERSAZIONE INSTITUTE OF ARCHITECTS.—The Conversazione of the Royal Institute of British Architects on Monday evening last was well managed, and passed off agreeably and successfully. Mr. William Tite, M.P., the president, received the guests, and there was a very large attendance, including many ladies. Pictures, carvings, photographs, and glass, afforded matter for conversation up-stairs; and the band of the Coldstream Guards downstairs very pleasantly stopped it at intervals. Decorative and industrial art were represented by some specimens of Salviati's mural mosaics and Venetian table glass, as well as by examples of furniture and cabinet work, some designed by Mr. Seddon, and other specimens by Mr. Charles L. Eastlake.—*Builder.*

MACHINERY, &C., TENDERS ACCEPTED BY THE LIVERPOOL TOWN COUNCIL.—The Town Council has agreed to accept the tender of Messrs. Richmond and Norton, for the providing and fixing the machinery, boilers, tanks, piping, troughs, and stable fittings, in accordance with a plan submitted by the borough engineer, at a cost of £440. It was further agreed to accept the tenders of Messrs. Prulington and Hutton for the supply of a large clock for the municipal offices, at a cost of £495, and of Mr. Warner for the supply of bells required in connection with the clock, at a cost of £49 10s. The whole of the salaries of the officials and assistants in the borough engineer department, are, it is believed, to be increased, and a recommendation to this effect will be considered at the next quarterly council. The increases involve a considerable sum.

THE SILKWORM DISEASE.—The French Corps Legislatif have lately been discussing this question. The disease, the *gattine* of the French, first appeared about twenty years ago in Vaucluse, and then propagated itself into all the silk growing districts of Europe except the lofty mountains of northern Portugal, and having traversed Greece, Asia Minor, and Persia, has reached China, and at present Japan is the only country which has escaped. M. Fabre has discovered its cause in what he calls vibrating corpuscles existing in the eggs and the insects of all ages. Properly qualified inspection of all imported eggs at the custom-houses has been proposed as a remedy. The cause has been sought for in the overcrowding of the insects in the modern extensive concerns, as typhus and other diseases are engendered among men and cattle when collected in large numbers. This view is supported by experience.

PHOTOGRAPHIC IMPROVEMENTS.—The collodion used in ordinary wet plate photography has always hitherto contained a soluble iodide salt, or a mixed iodide and bromide salt, but never a bromide alone. Iodides give very intense pictures, but do not render great contrasts of light and shade in a picture faithfully, so that with iodides alone it is next to impossible to get a good picture of a white statue surrounded with dark objects. With bromoiodised collodion greater harmony is secured, but there is a loss in intensity, and by neither of the methods in use can natural clouds be photographed, except by the briefest exposures of the plate in the camera. This is the reason that natural clouds are so rarely seen in photographs. Bromides alone in collodion have always been found to give thin, weak, unsatisfactory pictures, by the wet process, and have never been practically used in it. A process has, however, just been published by Mr. W. H. Harrison, whereby collodion containing a bromide only is made to give dense pictures by the wet process, so that brilliantly lighted objects can be taken together with dark ones more truthfully than hitherto, and natural clouds secured with very lengthy exposures. The collodion contains ten grains of bromide of cadmium to the ounce, and after mixing is kept for about three weeks before use. The nitrate bath is made of sixty grains of pure recrystallised nitrate of silver to each ounce of distilled water. To each ten ounces of this bath two grains of acetate of soda and three drops of acetic acid are added, the acetate being added to secure freedom from nitric acid, which would otherwise decompose the glycerine afterwards used. The plate, when coated with collodion, is dipped for ten minutes in this bath, and then dipped in another one. The latter is composed of the foregoing bath solution two ounces, pure glycerine two ounces, honey one ounce, water six ounces, and kaolin quarter of an ounce. This sticky liquid is exposed to light for two or three days; it will first blacken, then throw down a deposit, leaving the greater part of the solution clear and bright. The clear upper portion has then to be filtered into the second bath for use; in fact it is nearly the same as the glycerine preservative published some years ago by Mr. Valentine Blanchard, noted for his instantaneous views of London. The plate having rested for ten minutes in the first bath is next immersed for about five minutes in the second, the latter being a convenient method of giving it a coating of organic matter and weak free nitrate of silver. The plate is then placed on end for ten or fifteen minutes, on clean white blotting paper, in a dark box free from dust, to drain, after which it is placed in the camera slides, where it will keep in good condition for the rest of the day. For pictures of badly lighted objects a developer containing one and a-half grains of pyrogallic acid to one ounce of water and enough formic acid to restrain its too rapid action is employed. For views very brilliantly lighted by the mid-day sun, a developer, consisting of two grains pyrogallic acid and one grain of citric acid, to each ounce of water is used. For general views a mixture of four parts of the formic acid developer, with one of the citric developer, is the best. The developing solution is poured on the plate directly the latter is taken from the slide, and allowed to remain on till the picture is fully out and finished. No after-intensification is ever needed. The picture has only to be washed and fixed with cyanide of potassium as usual. The process is of value to tourists since the plates are well suited for views presenting strong lights or deep shadows, the range in both respects being greater than with iodides, so as to place a greater power at command. Ordinary iron development can be used with the plates, in which case the exposure must be very short, as the plates are then excessively rapid in action. With iron development after-intensification is necessary, and the publisher of the process recommends the use of pyrogallic acid rather than protosulphate of iron, unless the operator desires all other considerations to give way to secure the greatest possible rapidity.

PARIS EXHIBITION—COMPOUND ENGINE.

BY M. NORBERT DE LANDTSHEER, BRUSSELS.

FIG. 1

SECTION THRO CENTRE OF LARGE CYLINDER

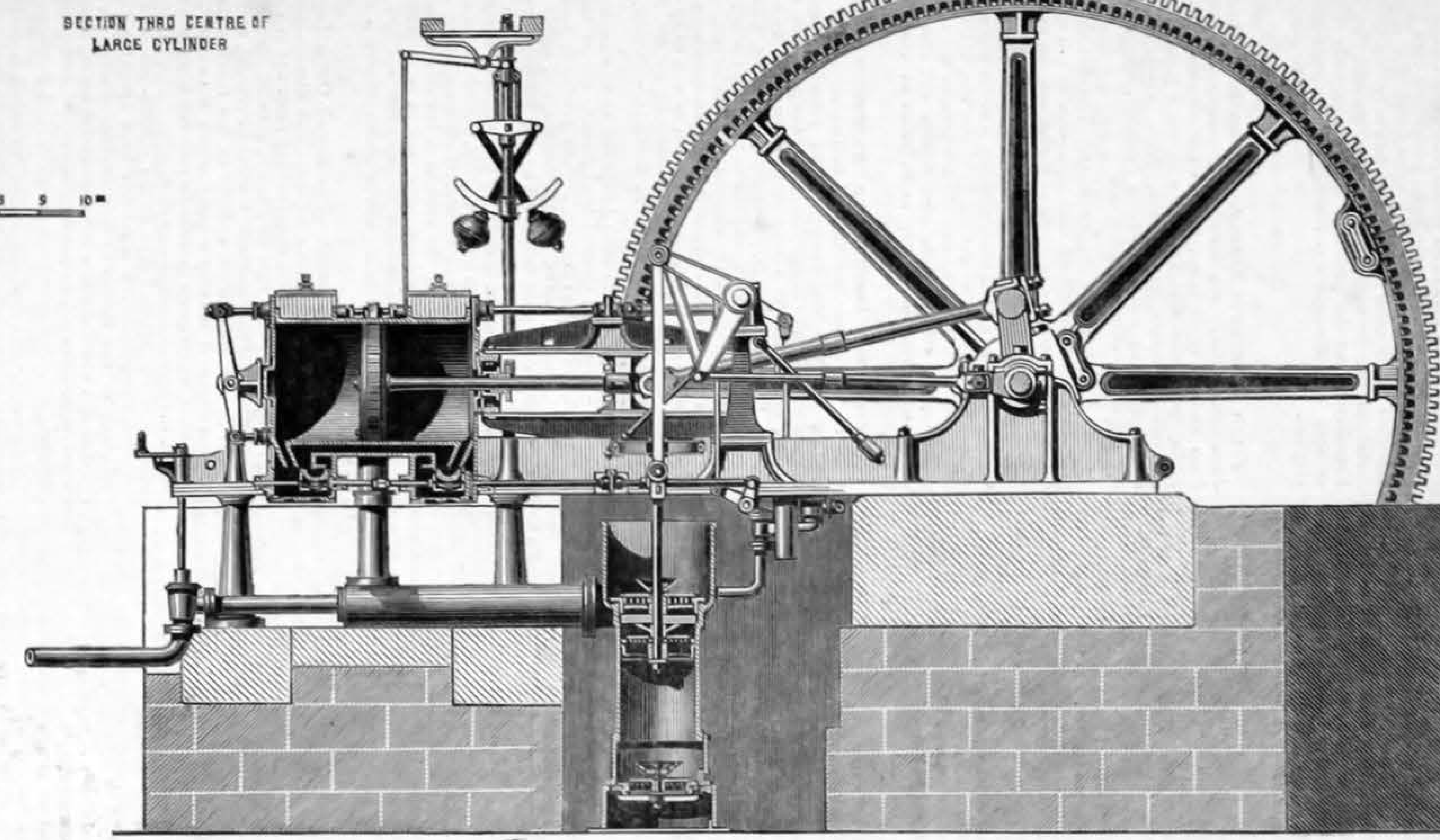


FIG. 3

SECTION THRO CENTRE OF SMALL CYLINDER

SCALE.

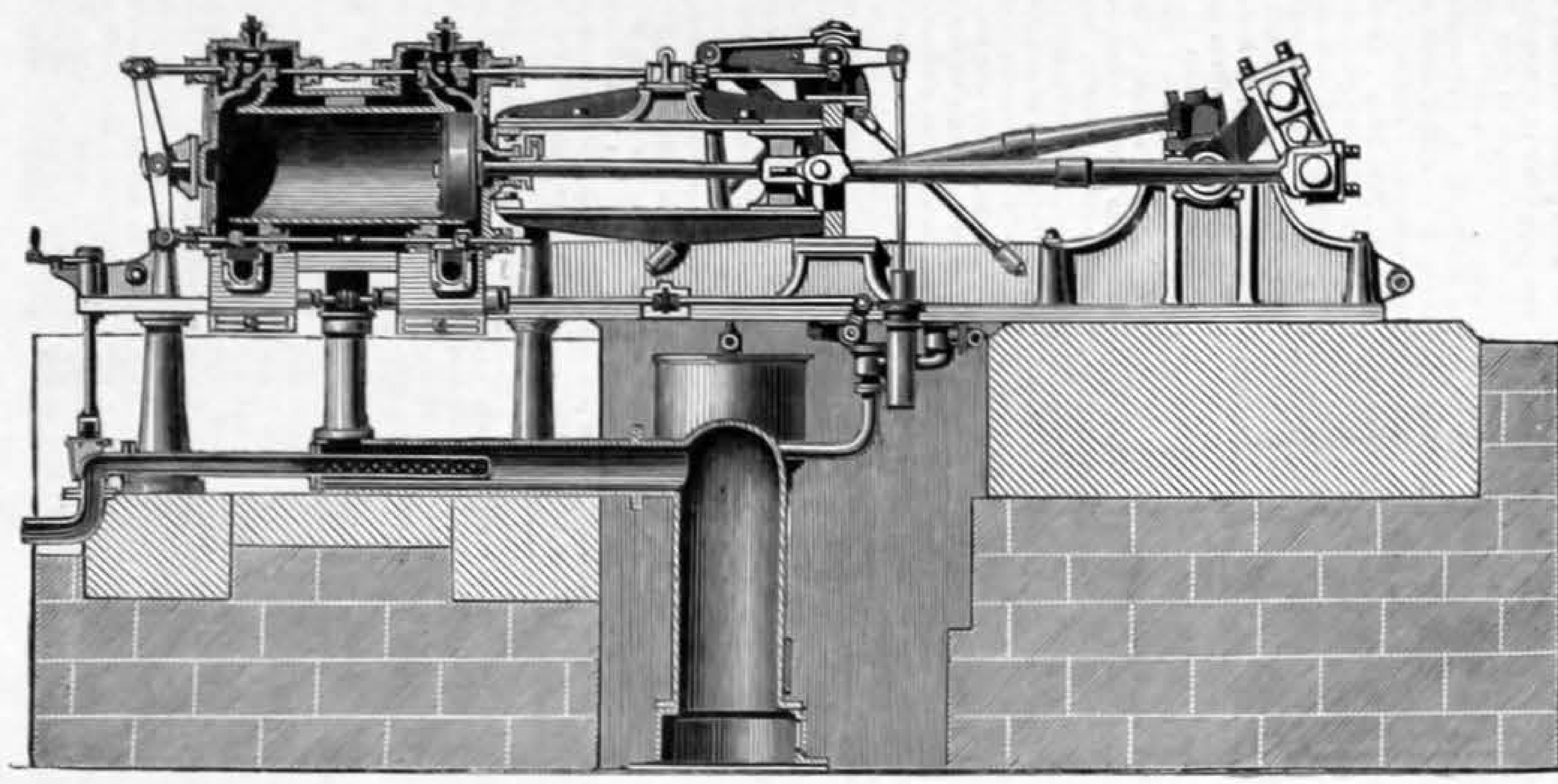


FIG. 4

TRANSVERSE SECTION

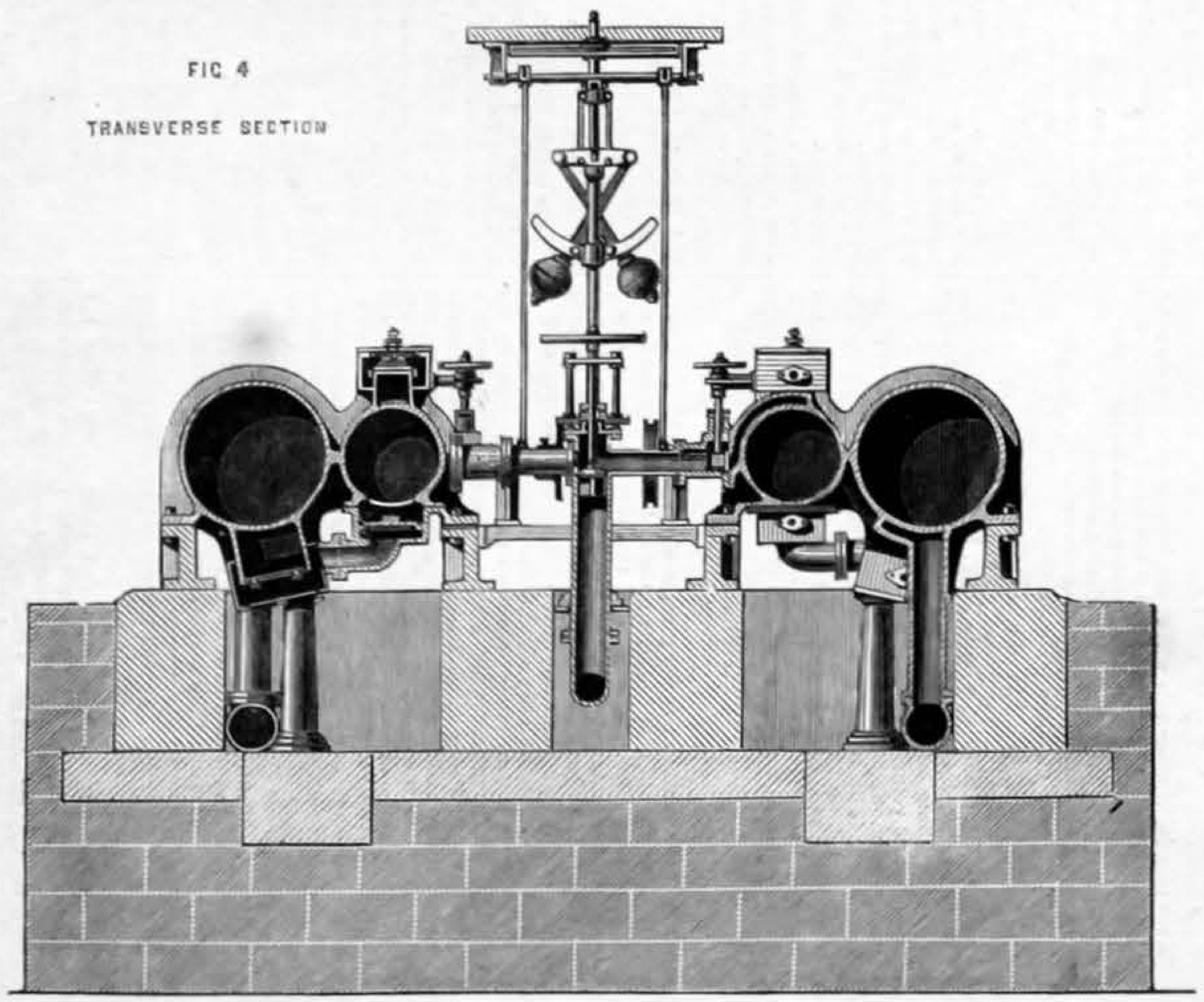
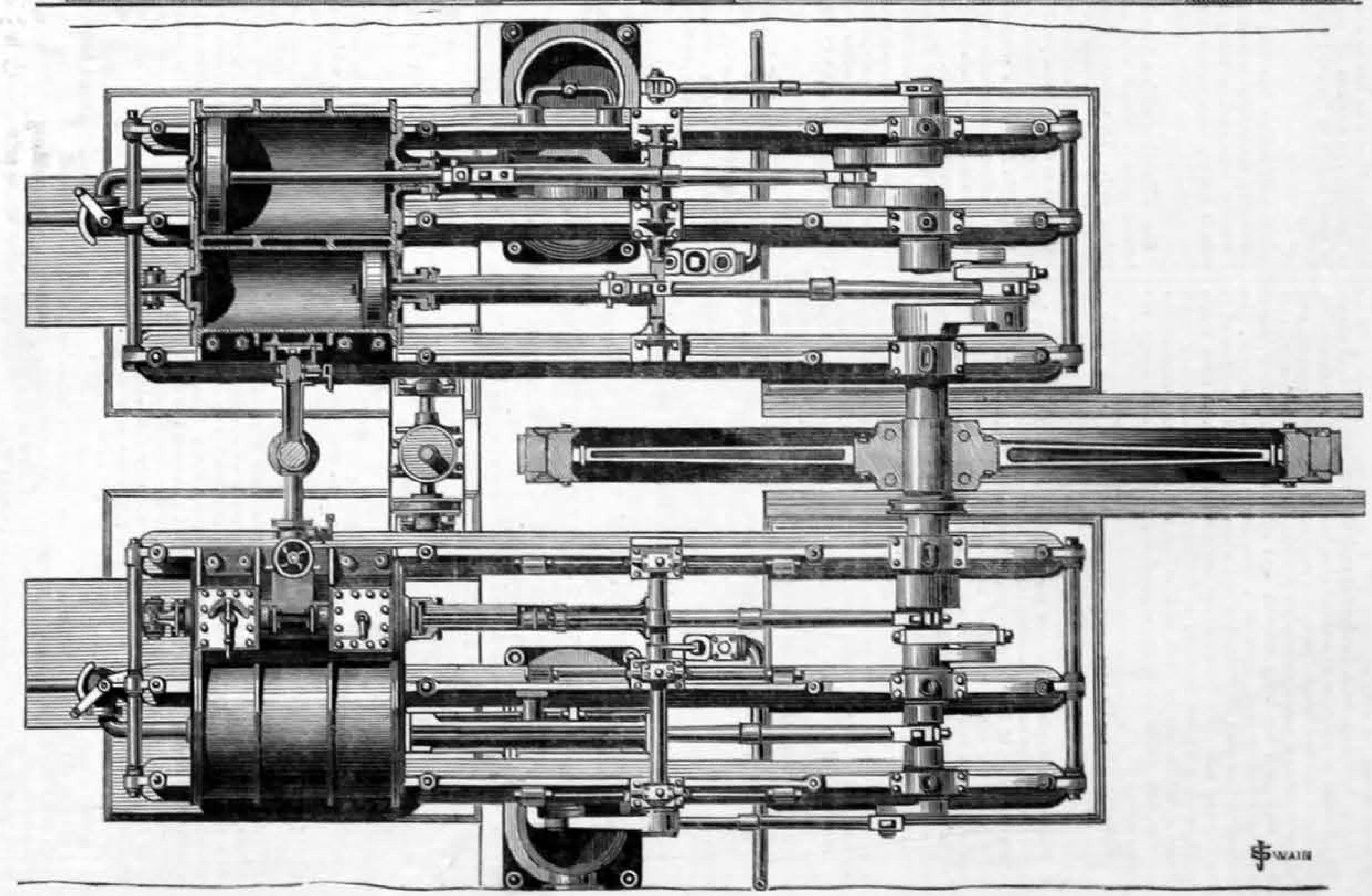


FIG. 2

PLAN



TO CORRESPONDENTS.

*** *We beg to call the attention of our Advertisers to the notice below, and to state that the large circulation of* THE ENGINEER *compels us to go to press at an early hour on the morning of publication. Advertisements, to ensure insertion, must be delivered at the Engineer Office before seven o'clock on the Thursday evening of each week.*

*** *Letters intended for publication must be accompanied by the names and addresses of the writers, not necessarily for insertion, but as an evidence of good faith.*

*** *We cannot undertake to return drawings or manuscripts, and must therefore request our correspondents to keep copies.*

J. F.—*We shall be happy to forward any letter intended for the gentleman whose address you require.*

G. R (Highland Railway).—*Certainly not forgotten, but crowded out by matter from the Paris Exhibition.*

AN OLD SUBSCRIBER.—*We have called the attention of one of our Paris correspondents to the furnace. If good it will appear in our columns.*

T. R.—*We have no recollection of the paragraph to which you refer. If you will state in what way you wish to use a cement we shall be happy to supply you with all the information in our power.*

A. B., A CONSTANT SUBSCRIBER, *and several other correspondents, write to ask questions or to make statements without sending their name and address. We beg to call their attention to the notice at the top of this column, and to state that we can take no notice whatever of anonymous communications, which are invariably consigned to our waste basket.*

R. S. W.—*Write to the secretary of the Aeronautical Society, W. H. Breary, Esq., Society of Arts, John street, Adelphi. We are unable to say where you can obtain a small quantity of Gale's protected gunpowder. We presume you are aware that the "protection" consists in mixing the gunpowder with three or four times its bulk of powdered glass.*

A. A. (Drammen, Norway)—*Dr. Hermann Sprengel has published a long article, with engravings, on different forms of his air-pump, in the Journal of the Chemical Society, January,* 1865, *printed by Harrison and Sons, St. Martin's-lane, London. A few practical particulars, sufficient, probably, for your purpose, are given in another column. We are not aware that the instrument is yet manufactured by anybody for sale.*

FORCER.—*The frictional resistance in mains of the diameter stated will be very moderate, and a small addition to the weight over and above that required to balance the water will suffice to overcome it. But by the nature of the problem you have a gross weight, including fifty tons of water in the pipes and fifty tons of balance weight, besides the weight of the beam, &c., to set rapidly into motion on the outdoor stroke. The vis inertia of this mass is to be overcome solely by increasing the weight of the balance bob over and above that necessary to sustain the column of water in the mains at rest. The amount of the excess weight will depend on the velocity to be imparted, of which you do not say one word. State length of stroke, and time in which you wish stroke to be made.*

DE G. AND CO.—*For all flanged girders, whether of cast or wrought iron, there are theoretically two methods of estimating the strength, and it depends altogether upon the thickness of the web whether that element enters into the calculation or not. On the supposition that it is only of sufficient thickness to keep the flanges apart—and there is always a loss of metal incurred in making it any thicker—the formula* $\frac{a\,d\,c}{e}$ *given in our article upon "The Flanges of Girders" will apply. As the web is continuous and perfectly rigid the value of the constant* c *may be taken equal to* 80. *As an example, the breaking weight at the centre of the largest beam shown in the sheet you sent us would by this rule be in tons equal to* $\frac{477 \cdot 5}{e}$; *the value of* e *being in feet. Thus if* e *equals* 20*ft. the breaking weight is* 23·87 *tons. Proceeding upon the other assumption, and including the web in the strength of the beam, we might use the same formula, provided the sectional area of the flange or the value of* a *is increased by one-sixth of that of the web, and, at the same time, taking the value of the constant at about* 75 *instead of* 80. *By this method the breaking weight will be much greater. In the absence of all experiments, and the uncertainty of the real value of the thickness of the web upon the strength of the beam, we should, when practicable, keep the web as thin as is consistent with its duty, and leave out all consideration of it in the calculation. It should never be forgotten that there is no economy in putting an excess of metal in the web, since the same quantity would do a great deal more work if placed in the flanges.*

MACKWORTH'S PATENT COAL PURIFIER.

(To the Editor of The Engineer.)

SIR,—Pray say where I can obtain information respecting Mr. Mackworth's purifier.

B. G. AND CO.

Liverpool, July 1st, 1867.

SHOP VENTILATION.

(To the Editor of The Engineer.)

SIR,—I beg to inform your correspondent "T. G." that an apparatus likely to answer the required purpose has, at the suggestion of J. S. Fraser, Esq., been recently erected in the coach-building shops of the Great Western Railway, Paddington. It consists of a board 15ft. long, 9in. by 2in., suspended vertically from the roof by pivots at the top edge; at the bottom part of the board is fixed stout navy canvas, 27in. wide, stretched on thin 3in. batons, one at each end and one in the centre. The parts of the canvas between the batons is left slightly loose, to prevent the resistance being too great, the whole giving a surface of 45ft. superficial. This is made to oscillate eighty times per minute (describing an arc of about 75 deg.) by a ¾in. connecting rod attached to a 12in. horizontal stud pulley driven off the adjacent shaft. The size of the pulley required will depend on the available speed; the contrivance is inexpensive and highly effective, dispelling foul air, keeping up a current of fresh, and during hot weather lowering the temperature many degrees. It may be observed that a double-joint is necessary at the end of the connecting rod attached to the board to give the two motions. In long buildings a series of these fans may be worked by small connecting rods from the same source.

W. CROSS, Foreman.

Carriage Department, Great Western Railway, 2nd July, 1867.

Advertisements cannot be inserted unless delivered before seven o'clock on Thursday evening in each week. The charge for four lines and under is three shillings; each line afterwards, eightpence. The line averages eight words; blocks are charged the same rate for the space they fill. All single advertisements from the country must be accompanied by stamps in payment.

THE ENGINEER *can be had, by order, from any newsagent in town or country, and at the various railway stations; or it can, if preferred, be supplied direct from the office on the following terms (paid in advance):—*

Half-yearly (including double number) 15*s.* 9*d.*
Yearly (including two double numbers) £1 11*s.* 6*d.*

If credit be taken, an extra charge of two shillings and sixpence per annum will be made. THE ENGINEER *is registered for transmission abroad.*

Letters relating to the advertisements and publishing department of this paper are to be addressed to the publisher, MR. GEORGE LEOPOLD RICHE; *all other letters and communications to be addressed to the Editor of* THE ENGINEER, 163, *Strand, London, W.C.*

DEATHS.

On Sunday, the 30th June, at her residence, Woodlands Cottage, Wanstead, SARAH PEARSE, widow of the late Geddie Pearse, C.E., aged 61. Friends will please accept this intimation.

On June 26th, ROBERT HAWTHORN, Esq., C.E., senior partner in the firm of Randon Hawthorn, Newcastle, aged 71 years.

NOTICE.

*** *The office of* THE ENGINEER *at the Paris Exhibition is situated close to the promenade round the building, and opposite to the English boiler-house. Our correspondents in Paris will be happy to be of use to any of our English or continental subscribers visiting the Exhibition.*

Messrs. Kirklands have undertaken the agency of this journal at the Exhibition, and it will always be found on sale at their English newspaper office, Gallery VII.

THE ENGINEER.

FRIDAY, JULY 5, 1867.

COMPOUND ENGINES.

COMPOUND engines have been quite long enough before the world to enable engineers, manufacturers, and shipowners to become acquainted with the merits or defects peculiar to the system. Whether it be adopted or rejected, nothing is done of necessity in ignorance, and it may be very safely assumed that the principle of, what we may term, separate expansion is when adopted at all by able men, so adopted with a full conviction, founded on a competent knowledge of the subject, that the principle is correct; and that by using two cylinders instead of one certain advantages may be gained which cannot be realised if but one cylinder is employed. Very bitter controversies have been fought out to no satisfactory end over the compound engine. It has been advocated with a pertinacity and a talent only equalled by the skill and power with which it has been denounced. Opinions are still pretty equally divided on the subject, and therefore the compound engine has not completely driven the single cylinder engine out of the market. Nor on the other hand has the single cylinder engine been favoured with anything like the exclusive goodwill of employers of steam power.

It can be demonstrated theoretically that whether one, two, or three cylinders are employed the advantage in point of economy of fuel to be derived from working steam expansively is the same, provided only that the cylinders are kept hot. It is therefore clear that the compound engine cannot be liked because it is theoretically capable of realising more power—in other words, of working more economically than an engine with but one cylinder. We shall probably be told that it is not liked for any reason by those who possess knowledge enough to know a good engine from a bad one. Such a statement, however, merely embodies a fallacy prevalent among a certain class of engineers—men who for the most part do not travel, or take pains to inquire what others are doing. It is a matter of fact that the compound system instead of receding is actually advancing in favour, especially on the Continent. No one who has visited Paris can fail to have noted how largely the compound engine is represented in the Exhibition. The types vary, but the principle is continually turning up in all sorts of forms. In Glasgow, again—we had almost said throughout Scotland—the compound engine is very largely used, and it is, in many instances, now taking the place of single-cylinder engines previously employed. Even in London, the head-quarters of the single-cylinder system, one of the most influential engineering firms in the kingdom have in course of construction a pair of compound marine engines of great size and the principle has in this case been adopted in the full conviction that the compound engine held out advantages presented by no other form of engine, not even by that of which they were the originators, and on which they have to a certain extent founded a great reputation.

We have repeatedly stated that we, for ourselves, regarded that form of engine in which steam began and ended its work in a single cylinder as the best. Our opinions on the subject have undergone no change. It is, however, no part of our duty as journalists to attempt to deny facts as regards the liking evinced for the compound engine, or to denounce all who differ from us in opinion as ignorant. We have a fact before us, and instead of raking up all the threadbare arguments which can be urged against the compound engine and repeating them here, we prefer to assume that every one of these arguments is perfectly valid, and to consider how it comes to pass that notwithstanding their validity, men who perfectly comprehend what they are about, use these engines, and do not use single engines. It would be unwise to assume that the engineers of France and Belgium patronise the compound engine because they fail to comprehend its defects. It would be simple idiotcy to fancy that Scotch engineers of all men in the world, would go on building, or Scotch manufacturers would go on buying engines, costing a good deal more than the single engine, simply for an idea, a whim, a fancy, a conviction founded on no sure basis. The truth is that the compound engine has given satisfaction to manufacturers who have tried it, and therefore it is bought now. It is not a thing of yesterday as we have already said; all that it can and cannot do has been very fairly learned. Through much evil report and no small opposition the system has acquired a good character by its own merits, and therefore it enjoys favour, and for no other reason that we can see. It remains to be considered in what way this character has been acquired.

When expansion is carried to a considerable extent it is necessary to use steam of a high pressure; we need not stop to explain why. Now, in single cylinder engines running at the ordinary pace, say 300ft. to 320ft. per minute, a large piston must be used in order to realise the required power from a moderate average pressure. But the shock of high pressure steam entering on a large piston is highly objectionable, tending to induce serious breakdowns which can only be avoided by making the engine very heavy, and consequently expensive; while slow-running engines working expansively invariably run irregularly unless they are fitted with fly-wheels out of all reason large and heavy, or drive two cranks at right angles. Numerous attempts have been made to adapt large measures of expansion in single cylinders, but they have invariably resulted in failures. Where the engine was large and the piston speed was moderate either the engines directly broke down, or the irregularity of their motion was incompatible with the purposes they were intended to serve. The compound engine supplies a way out of both difficulties. The impelling force can be very nearly equalised throughout the stroke, even when the steam is expanded twelve or fifteen fold; and owing to the small size of the high-pressure piston the machinery is spared from severe and sudden strains, and therefore it can be made light. The weight of a compound engine need not indeed greatly exceed that of a single engine in which steam is expanded six or eight times; the cut-off taking place in the compound engine at such a point that the steam is expanded twelve or fifteen times. The cubical space occupied by the compound engine is greater than the space occupied by its rival. That it is true that this fact tells heavily against the system as applied to marine purposes is generally admitted, but it has little force on land. Owing to the equalisation of the strains transmitted through not the engine alone but the machinery driven by it, The expenses of repairs are usually less in the case of a compound engine than in that of its rival, provided expansion is carried out pretty fully in the latter, and that the workmanship and material are equally good in both. In one word, by compounding our engines, although we do not theoretically advance one step nearer to securing economy, we render a high measure of expansion and a moderate piston speed compatible. Men understand more fully day by day the benefits to be derived from working expansively, but they have not yet learned to adopt or to like high piston speed, and therefore the compound engine will be used more and more extensively, for manufacturing purposes at least, and will grow in favour as expansion grows, until some engineer teaches the world how to build high-speed engines with a moderate length of stroke which will not break down; then the compound system will probably be superseded, but not till then.

It may be worth while to put our meaning in a clearer light. It very commonly happens that the power developed is the same, or very nearly the same, in both cylinders of a compound engine. Let us assume that the piston speed in the small cylinder is 400ft. per minute—a velocity often attained in modern Glasgow practice. If we attempt to compare this engine with a single cylinder engine intended to work up to the same power, we shall find that in order to equalise the *strains* in both, the pressures and ratios of expansion being the same, the single cylinder must not be much larger than the small cylinder of the compound engine; and from this it follows that in order to equalise the *power*, a velocity nearly double that of the compound engine must be adopted. We are not of those who hold that piston speeds of 800ft. or 1000ft. per minute will never be satisfactorily attained on a large scale. We shall probably have pistons running at such speed as an ordinary, instead of as an exceptional thing, in a few years to come. But meanwhile the compound engine supplies a want very satisfactorily; and although not so theoretically perfect as the high-speed single-cylinder expansive engine, it possesses practical perfections which fully entitle it to all the favour it enjoys, and it really has no theoretical deficiencies which can seriously militate against it. The worst, perhaps, is that a large surface of metal is exposed to the steam, but this is in great measure compensated for by the fact that the high-pressure cylinder is never exposed to the cooling influence of the condenser. There are, of course, bad combined engines—machines deficient both in design, workmanship, and material, but their existence does not affect a principle. For ourselves we accept the compound system as the best, if not the only way, in which a large measure of expansion can be practically adopted in the present position of mechanical science. No doubt many engineers will differ from us. We beg such of our readers to observe that we have conceded that in theory the single-cylinder high-speed system is the better of the two. The opponents of the compound engine hold similar opinions, carried much further than we are prepared to follow. It remains for them, as they will not recognise with us the good qualities of the compound engine, to convince the world that they can reduce theory to practice. Until they have succeeded in doing this by building a great many single-cylinder engines expanding twelve or fourteen fold, and running very fast and very regularly for long periods without breaking down or getting out of order, the compound engine will hold its own. The moment they have accomplished all that they say is possible—and we do not deny that they speak truth—we shall join with them in putting down the compound system, but not before.

RAILWAY LEGISLATION.

To draw the line where the enterprise, capital, and self-interest of private parties should stop, and the influence and authority of Government commence, is a task requiring the utmost skill, delicacy, and tact, worthy alike of the highest efforts of the experienced diplomatist and the most serious consideration of the profound political economist. Although the question has baffled the wisdom of our statesmen and the sagacity of our legislators for centuries, yet we still halt between two opinions, neither accepting the one nor rejecting the other. Relying upon the truth of the old motto, "*in medio tutissimus ibis,*" it might be anticipated that we are pursuing the most judicious course in leaving things very much to themselves. Unfortunately, however, we have not hit the true mean. While on the one hand private parties are not permitted to push their own interests *à l'outrance* completely in defiance of all extraneous considerations, on the other Government steps in but very tardily, and frequently very ineffectually. It scarcely makes any attempt to arrest the ruinous litigation entered into by public companies, and the promoters of private bills ostensibly sought for the welfare of the community at large, notwithstanding that it is perfectly patent that the result of its apathy and indifference will tend to the disadvantage and injury, not of those presenting the bills, but of those in whose behalf they are apparently submitted to the House. Looking at the manner in which our railway legislation is conducted one is inclined to believe that the views of the Government towards the petitioners and promoters seeking its assistance, protection, and sanction are founded upon the principle of "giving a man rope enough to hang himself." If we take the case of the promoters of rival lines who have each secured a *locus standi*, it oftentimes is not until the funds are at the last gasp—until the sinews of war are utterly *épuisé*—that the fate of the bills is decided. Both may be passed; one or other, or both rejected. In many instances indeed it is known beforehand that both bills cannot be passed, the comparative identity of the rival lines rendering one or other superfluous. The various Acts, standing orders, and other regulations of Parliament confirm the fact that a line of railway is a public desideratum. Without this assumption the laws for the compulsory purchase of land, houses, property, we may say of everything, human life alone excepted, would be a distinct violation of national rights and privileges. Regarding a railway in this extended light, what a paradox, what an absurdity, it appears that enormous sums must be expended not only in order to gain, but frequently in the bare attempt to obtain, from Government, a public boon which ought to be conceded gratuitously. It is lamentable to think of the frightful waste of money incurred in the early days of steam locomotion in promoting and opposing the various claims of belligerent railway companies. We are at present reaping the fruits of a system most injurious to the true interests and welfare of a nation, and the harvest is only just commenced. Disastrous to ourselves, disgraceful to the companies and their management; a source of stagnation to trade, commerce, and enterprise, and onerous and troublesome to Government, it promises, judging from the small quantity gathered in, to be peculiarly prolific for the gentlemen of the long robe.

Crossing the Channel we find a different *régime* in operation, and comparisons have been frequently instituted between it and that prevailing among ourselves. These obviously tend so much to the disparagement of the latter that it would be humiliating, and at the same time unnecessary, to enter into them in detail. It must not, however, be supposed that the French Government denies parties interested in a proposed line a right of hearing; or that they summarily decide upon any particular route without regard to the claims or merits of those lying in a different direction. That it has a far more energetic and vigorous method of proceeding than ourselves is as undeniable as commendable; but it is a mistake to imagine that it arbitrarily assumes the supreme authority and has no ear for fair propositions put forward against the selection of one especial route. Not always even in that paternally governed country are the officers of the different branches of the State departments *d'accord* upon every projected railway. At the present time a difference of opinion exists between the Admiralty officials and those of the Ponts et Chaussées respecting the particular line to be chosen for a proposed railway uniting the important maritime towns of Cherbourg and Brest. Similarly to ourselves, France appears to have been backward in connecting her principal ports with her railway system, and is now endeavouring to rectify the omission. Most of our early lines were constructed in the interests of commerce, and it was not until irreparable blunders were perpetrated, in the laying out of our main arteries of communication, that it was discovered how imperfect and deficient they would prove in the event of any foreign war or intestinal disturbance.

Latterly attempts have been made to remedy the glaring deficiencies, but their success is very partial, as we have pointed out in a previous article. The placing of Cherbourg and Brest in locomotive "rapport," is unquestionably a most important undertaking—considered strategically, and may be said primarily to have greater claims upon the consideration of the Ministre de l'Interieur than upon the public generally. Upon the side of the Admiralty are ranged the officers of the *génie* and the Council for marine works, and they prefer the route from Sottevast to Coutances. On the opposite side are the engineers of Les Ponts et Chaussées, backed up by the municipal council and inhabitants of Dinan. The latter have presented a petition to the Emperor soliciting that he would make it a *sine quâ non* that the proposed line should pass through their town. The interests of another town are also indirectly concerned, so that, as the time for the decision draws near, a lively anxiety is displayed by all parties. We are inclined, for the reasons already adduced, to award the victory to the Admiralty, and bearing in mind how fast the warlike accommodation and size of Cherbourg are developing, that department is justly entitled to preference in determining the ultimate line of communication.

THE RODMAN GUN AT SHOEBURYNESS.

THE American 15in. gun purchased by the English Government has been tried at Shoeburyness. It so happens that just at present there is not a target there sufficiently sound to test its powers of penetration or of racking; the gun was therefore fired out to sea, solely with the object of ascertaining the initial velocity of its projectiles, but some useful information has been obtained nevertheless. The relative strengths of English and American powder need be no longer disputed, at least as regards the powders used in the United States for large bore guns. We have always maintained that English powder was the strongest in the world—a deduction drawn not alone from the results of experiment, but from a consideration of the pains which are taken in the Government mills at Waltham Abbey, to purify all the ingredients, to combine them in just the proportions most conducive to strength, and to give the grains just those dimensions tending most forcibly to secure the same end. But we confess we were not prepared for the enormous disparity which the trials of last Thursday week have proved to exist. We shall not give the particulars of all the fifteen rounds fired in detail. It will answer every purpose to give a summary of the results obtained.

The American powder used was sent over as that expressly made for the gun. It is known as "Mammoth powder," from the size of the grains, each of which measures at least one-fourth of a cubic inch in extent. The weights of the powder charges used were 35 lb., 50 lb., and 60 lb. The use of the last charge is limited, we may add, by official instructions from the United States Ordnance department to 20 rounds only. In a word, it is only to be employed in emergencies. The weight of the spherical shot varied between 451 lb. and 455 lb., averaging about 453½ lb. A 35 lb. charge in the second round gave an initial velocity of 917ft. per second; in the third round, 926ft. In the fourth round, the powder charge being raised to 50 lb., the velocity was 1110 ft.; in the fifth round, with the same charge, the velocity was 1120ft.; in the sixth round, same charge, 1133ft.; and in the seventh round, with a 60 lb. charge, the velocity rose to 1210ft. per second.

Six rounds were next fired with English Government powder, which has a very much smaller grain. In round No. 8, fired with 35 pounds, the velocity was 1037ft. In round No. 9, same charge, velocity 1044ft. Round No. 10, same charge, velocity 1010ft. The next three rounds were fired with 50 lb. charges, and the velocities were respectively 1191ft., 1211ft., and 1214ft. The experiments were concluded by firing two rounds with 60 lb. charges of American powder, the velocities being 1194ft. and 1210ft. per second. The elevation of the gun throughout was 2 deg. It is fairly accurate, but its range is moderate, as was to have been expected from the shape of the projectile.

It will be seen from the foregoing that the average velocity imparted to the projectiles by 35 lb. charges of American powder was 921·5ft. per second, while with similar weights of English powder the velocity was 1030·33ft. With 50 lb. charges of American powder the average velocity was 1121ft., while with similar charges of English powder the average velocity rose, we find, to 1205·33ft The average velocity with 60 lb. charges of American powder was 1201·33ft. From this it appears that a little less than 50 lb. of English powder is equivalent to 60 lb. of American powder, or, in other words, our Government powder is stronger than that used in the States by at least one-fifth.

It is only when we come to calculate the work stored up in the shot as the effect of various charges, that we are enabled to realise the full importance of the preceding facts. Using the well-known formula $\frac{W v^2}{2 g}$, and taking first the case of a 454 lb. shot, fired with a charge of 35 lb. of American powder, and attaining an initial velocity of, in round numbers, 922 ft., we find that its *vis viva* or stored up work amounts to approximately, 2691·8 foot-tons. But the work stored up in the same shot, by 35 lb. of English powder, amounts to 3360 foot-tons. Again, a 454 lb. shot, fired, with 50 lb. of American powder, stores up 3979·5 foot-tons with an initial velocity of 1121ft., while 50 lb. of English powder brought the velocity up to 1205ft., and the work to 4598·5 foot-tons. It must be borne in mind that these figures do not represent the actual power of the gun acting against armour plates, as the striking velocity of a round shot of such large dimensions would be greatly reduced by a flight of even 200 or 300 yards; but they answer admirably as a means of comparing the qualities of English and of American powder.

It may also be deduced from the Shoeburyness experiments that the 15in. American gun is in no sense a more formidable gun than it has been supposed to be. The experiments, imperfect as they are, have gone far enough to show that it is inferior to our own 12-ton gun, the projectiles from which, fired with full charges, have a *vis viva* of 2472 foot-tons at 200 yards range with but 35 lb. charges, while with a 40 lb. charge the work amounts to 2898 foot-tons, the projectile (elongated) weighing 300 lb. It is satisfactory to learn even this much, and we have no doubt that when the American gun comes to be tried at a target in competition with the English gun, the superiority of the latter will be fully demonstrated. It is to be borne in mind, too, that while the American gun weighs nearly 20 tons, the English gun weighs little over 12 tons; if, therefore, we regard the ease with which the two guns can be carried and worked on board ship, the English gun has an enormous advantage.

SUBAQUEOUS PROJECTILES.

SINCE the æra of armour-plated ships of war it is plain that more has been thought of subaqueous explosions than heretofore. Torpedoes and other devices whereby gunpowder and other explosive bodies, enclosed in waterproof cases and fired by electrical or percussive expedients, have come to be regarded as of great avail in modern naval warfare. Much admits of being stated in favour of subaqueous explosions as a means of marine attack. The bottom of an iron ship of war is, and ever must remain, her weakest part. Naval architects are too much puzzled to reconcile the sea-going qualities of ships with the enormous weight armour ships have now to bear to permit the belief that the armour system will ever be extended along the bottom under water. For this reason, as well as others to be presently adduced, the bottom and the deck of an iron ship of war must remain the most vulnerable part, always assuming the proper means of vulnerability to be at command. With respect to attacking a ship through her decks, a plunging fire is indicated, either by firing down upon the deck from an elevated battery, or by dropping shells upon the deck under some system of vertical fire. We are well aware of the chances against the hitting of a ship's deck under the circumstances specified, quite as well as of the correlated fact that the hit if delivered would be most fatal. It is not, however, with the disabling or destroying a ship of war through the effect of projectiles delivered through her deck that we now purpose to concern ourselves, but with a system of submarine attack communicated to our Admiralty in the year 1862, on or about the 20th of November, by a gentleman not the inventor, but with the inventor's permission. Equally with the inventor's permission we now communicate the particulars of this mode of attack, not any more than himself seeing any cause for keeping the method secret.

It is somewhat extraordinary that, amongst the number of schemes of subaqueous explosion for warlike purposes, there is hardly any record beyond what we are now to make of subaqueous projectiles. The ingenuity of engineers seemed to restrict itself to the proposition of establishing a mine at some fixed point in a channel, and then allowing it to stay at rest until an enemy's vessel might happen to pass over it, when by some sufficient device the mine should explode. Yet it would seem more desirable, if it could be effectuated, to launch a subaqueous projectile against a ship than to await the contingency of a ship passing over a stationary mine. The only sort of subaqueous projectile that comprises the conditions of prolonged flight—if flight be the appropriate word for such a medium as water—is the rocket; and granting the rocket's competence to take effect in a watery medium, then the use of this missile demonstrably presents enormous advantages over every other projectile that could be launched against a ship. Long before 1862 it had been known that a rocket would propel itself through water, and therein generate considerable projectile force; but the specific novelty of the proposition laid before the British Admiralty in November, 1862, was that of regulating the subaqueous flight of an iron rocket by a system of flotation and pilotage, which, when explained, cannot fail to manifest its own advantages. An ordinary iron rocket being slung at a definite depth below the water-line by means of two metal stays from any convenient float, has pendent from it a rudder. Obviously the depth of the rocket below the water-line will be regulated and determined by the length of the stays, and the dimensions of the rudder would be regulated by experience. A rocket thus arranged when ignited, as might readily be accomplished by electricity, would obviously tend to go straightforward until the exhaustion of its propulsive force. Unlike an aërial projectile, which may incur deflection in any plane, a subaqueous rocket, arranged as here described, could only experience deflection laterally, vertical aberration being prevented by the float and regulating stays. A rocket, however used, is endowed with certain advantages an ordnance projectile has not. To the dimensions of a rocket there are hardly any imaginable limits; then, again, its first moment of flight being attended with no initial shock, many explosive bodies may, if desired, be used for charging rocket heads, though wholly incapable of employment by ordinary artillery. To fire a slung rocket, like the one just described, from a ship against a ship would not be very difficult, but the special service indicated to the War-office and Admiralty, as falling within the province of these slung rockets, was that of establishing a perpetual protection at harbour mouths. It is easy to understand that an entire coast line might be converted into a battery of such slung rockets at convenient distances apart, and converging, if desired, towards one or more points whereat a hostile fleet might be expected to pass. Equally easy is it to understand that any number of these slung rockets might be kept in perpetual communication with an electric reserve, whereby they might be discharged when necessary.

AN ASSISTANT ENGINEERS' AND DRAUGHTSMEN'S BENEVOLENT SOCIETY.

THERE are at this moment many thousands of draughtsmen and assistant engineers doing a large proportion of the hard engineering work of the day, absolutely dependent on the continuance of bodily health for the means of subsistence. Underpaid as these gentlemen are as a rule, they cannot save money in the ordinary acceptance of the term even while single; they marry, too, and have families as well as wives to support now and then; or they are compelled by circumstances or duty to subscribe to the maintenance it may be of a mother, a father helpless in his old age, or a younger brother or sister without money or the means of earning it. Is it remarkable that under such circumstances the draughtsman however steady and skilful and talented, comes to bitter grief now and then; that succumbing to the unhealthy influences of a profession notoriously inimical to longevity, he dies and leaves behind him a widow, and possibly two or three little ones as well, without friends able or willing to aid them in their distress. The draughtsman's pay is so small that he cannot afford to be idle, and yet sickness will come and enforce idleness; or he may lose one berth and seek in vain for another for months; need we dwell on the painful consequences. Misery and death seize their victims and hasten things on to a direful end, on which we do not like to think. Are such evils unavoidable? Are there no means of providing aid and assistance for those who stand in sore need of it? Can nothing be done to soothe the last moments of a dying man with the conviction that his wife and family are not left to utter penury? A satisfactory answer can, we believe, be given to all these questions. It rests with the assistant engineers and draughtsmen of England to say whether they will or not undertake the task of ameliorating their own condition, and relieving themselves from some of the cares to which every thoughtful man in their ranks must now and then fall a prey under existing circumstances.

Some months since a correspondent—himself a draughtsman—suggested the formation of a benevolent society of draughtsmen, by the aid of which funds might be obtained for the relief of those thrown out of work through sickness or other causes, and for the widows and children of members of the profession. The suggestion was admirable, but it did not receive all the attention it deserved from those most interested. It is unnecessary at present to consider why. Since the publication of Mr. Bancroft's letter we have received several others, but not half so many as we could wish. Published as they came to hand, these would have made little impression,—certainly not that impression which we cordially wish them to make. This week we give them all in another page, just as they were received. We commend them to the attention of our readers. It will be seen that but one writer suggests any scheme for carrying into practice the wishes expressed independently by each. This is not quite as it should be. It is useless to ask whether it is or is not desirable that all the assistant engineers and draughtsmen in the kingdom should subscribe to a fund for the relief of members in sickness or distress. It would, in our opinion, be mere waste of time to discuss such a question. But it is absolutely indispensable to settle upon a satisfactory method of embodying the principle of mutual aid in practice. Our correspondent "A. B.'s" proposal may constitute a good groundwork for discussion. For the present we shall refrain from making any suggestions on this subject, but we shall be happy to see the matter fully considered in our pages by those who are most interested. At a future time we shall, if need be, speak. For the present we shall leave our correspondents to themselves, contenting ourselves by assuring the assistant engineers and draughtsmen of Great Britain that they shall not lack such assistance in maturing their plans as we can afford them. But we must impress on the minds of our readers that this thing, to be done well, must be begun and ended by engineers and draughtsmen themselves. If they have not sufficient energy and enterprise to establish a benefit society for themselves they will not have the good sense and resolution to maintain it if established by others. We feel no doubt that employers will co-operate heartily, but those for whose benefit we write must rely in the first instance only on themselves. It is but an effort and the task is accomplished. We have launched the proposal—Mr. Bancroft and his fellows have our best wishes for their success; our aid shall not be wanting in future. For the present our part is done. It rests with the draughtsmen of England to prove that they really wish to heartily co-operate in providing for the evil days to the advent of which every professional man is liable.

M. LANDTSHEER'S COMPOUND ENGINE.

ON page 12 we illustrate an engine exhibited by M. Norbert de Landtsheer, the inventor and patentee. The engine is on the combined, or Woolf system, the pistons moving in opposite directions; and it will be seen that the entire machine is sufficiently remarkable in its arrangements, a drag link being used to unite the cranks. The valve gear is worked by the same crank as that driving the air and feed pumps, in a way which will be readily understood without further description.

As regards the advantages of the design we must leave M. Landtsheer to speak for himself. There is no doubt much which is objectionable to English eyes, but no hesitation is felt on the Continent in sacrificing simplicity to secure any particular object.

The inventor states that the object which he has sought to obtain in designing this engine has been to unite all the qualities recognised as indispensable in a perfect steam engine. These qualities are:—1st, Economy of fuel. 2nd, Perfect regularity of rotation. 3rd, Solidity. 4th, Simplicity. 5th, Absence of danger. 6th, Economy in cost price and in setting up. 7th, Facility of working and of keeping in repair.

Economy of Fuel.—The economy of consumption of fuel in steam engines depends principally upon five points:—*a.* To work at the highest pressure possible. *b.* To work with the greatest expansion possible. *c.* To work on the condensing principle. *d.* To have the least prejudicial space. *e.* To have little weight or bodies in motion. *a.* For the first condition it is evident that an engine may be worked with much less danger at a *very high* pressure of steam, by using Woolf's system, than with a single cylinder, because the cylinder in which the high pressure steam acts is of small diameter. *b.* It is also evident that in an engine on Woolf's principle the expansion of the steam may be greater than in single cylinder engines; because if the expansion is too great in engines of one cylinder the irregularity of movement becomes very great and in addition the diameter of the cylinder must become so large that the admission of the steam produces concussions which are not without danger. *c.* The engine is on the condensing system, and it is well known that these engines are the most economical in working. *d.* The prejudicial spaces are those which have to be filled with steam which does not produce any effect; in other terms, without displacing the piston, such are the conducts between the side valve and the ends of the cylinders; it is evident that in my machine these conduits or passages are as short as possible, which proceeds from the reverse working of the pistons; steam which has worked in the small cylinder enters directly into the large cylinder at the same end at which it issues from the small cylinder, whereas in all other engines on Woolf's system the steam which has acted in the small cylinder has to enter the large cylinder at the opposite end to that by which this steam leaves the small cylinder into a conduit, which has to be filled uselessly and prejudicially; this volume of steam is saved at each stroke of the piston in my engine. A mere glance will show that a smaller number of, and less weighty pieces, could not be used to obtain the changes and the transmissions of movement, therefore little weight or bulk to keep in motion producing a saving of steam. It will therefore be seen that this engine unites all the conditions for obtaining the greatest economy in the consumption of fuel.

Perfectly Regular Rotation.—In steam engines there are two regularities of movement to notice; the first consists in making the same number of revolutions in the same time—this regularity depends upon the governor applied to the engine, and this exists now in those which are perfect; it is not this regularity which I denominate perfectly regular rotation; the regularity of movement to which I allude is that where the speed of the engine does not vary during a revolution of the engine, in other words that the pressure exerted upon the stud of the crank varies in the least possible degree for the different positions of the crank in a revolution of the engine; it is evident that in all engines on Woolf's system the variation is very much less than in engines on the expansion principle with one cylinder; this requires no proof, and in my machine it must also be added that the pistons working in reverse directions, the two rods of the small and large pistons, as well as the cranks, counterbalance each other in all the positions of the crank.

Solidity.—The inspection of the drawing shows at once that the cylinders and the axle of the cranks being upon one and the same casting the foundations do not suffer, and have not to resist the effort of the working of the engine; the foundations have only to bear the weight of the engine so as to keep it in its horizontal position, whereas in beam engines it is the foundations which by their weight have to resist the efforts of the working of the engine. In my engine the crank axle is composed of three pieces: the axle of the fly wheel, and on each side an elbowed axle; each axle is placed in two bearings; this arrangement allows of the engine being easily set up, for it is sufficient if two of the bearings are in a parallel position to the other two, and it is not necessary for the line of the centres of the three axles to form rigorously a sole and only straight line; this gives not only a great facility in putting up the engine, but what is of more importance, if in working one of the bearings should be more worn than another, that will cause no impediment to the proper working of the engine. The axle of the fly wheel is connected with the other two elbowed axles by means of a stirrup movement (drag link); the elbowed axle is behind the crank of the axle of the fly wheel, therefore the elbowed axle serves to push the other crank, and the stirrup does not suffer in the least degree. The bearings of the axle of the driving wheels may be upon the same cast iron base as the bearings of the axle of the fly wheel, or more simply, the bearings of the driving wheels may be upon separate castings bolted to the principal bases, which causes mutual support between these axles and consequently impossibility of their being displaced; the foundations of the building do not suffer in the least from the working of the engine. An engine upon my system does not weigh one half what a beam engine of the same power weighs, and the foundations, which suffer less, may be reduced to one half of those necessary for a beam engine; in addition no special building is required, a light roof above the machine is sufficient. As there is a much less number of pieces in motion than in the beam engines there are fewer pieces exposed to breakage; and further, the arrangement and dimensions of all the pieces allow of their being made of wrought iron, therefore these pieces are much less liable to be broken. The inventor goes on to show that the ports being placed beneath the cylinder, water cannot accumulate in them and lead to a break down; and he gives the cost at one-half that of a beam engine of the same power. He concludes with the following observations:—Referring to the engine existing in the mill of the Société linière of Brussells, it has been working now two years and four months without offering the least trouble. The foundations although very small do not vibrate at all, and it is the same with respect to the axle of the driving wheel, which does not suffer in the least although transmitting 180-horse power; this engine uses less steam than any other engine of the same power. I have compared it by diagrams with different engines of Woolf's system with beams, and also several engines with onecylinder, and the comparison has always been in favour of my engine.

MICROSCOPES IN THE PARIS EXHIBITION.

EVERYONE knows that the microscope is an instrument specially contrived to enable the eye to examine objects or parts of objects too minute to be made out by unassisted vision. This result is effected in refracting instruments by interposing between the eye and the object a transparent body usually of glass, so shaped as to enlarge the angle with which the rays of light reflected from or transmitted by the object impinge upon the retina, and the larger the angle the higher is the magnifying power of the interposed body. The effect is as if the eye were brought nearer to the object, an approximation which cannot be made directly in consequence of the structure of the eye, which does not permit the rays of light to be brought to a focus upon the retina unless it is removed to a certain distance. When a single piece of glass is used a limit is soon found to its profitable employment in consequence of the aberrations and dispersions caused by the form and material of the glass. The difficulties thus arising have, however, been in great part overcome by combining lenses of different forms and materials so that the faults of one correct those of another.

Microscopes are usually classed as simple or compound. In the first the lens or combined lenses transmit at once to the eye the rays of light reflected from or transmitted by the object, whilst in the second the image produced by one set of lenses is again magnified by another. In the latter class of microscopes the lenses which are nearest the objects are termed objectives, whilst that whose office is to enlarge the image formed by the first set of glasses is termed the eyepiece, from being placed next the eye. A series of six eyepieces can be obtained from opticians, gradually increasing in magnifying power, whilst a complete series of objectives would number fourteen or fifteen. Of these the greatest magnifiers, though wonderful triumphs of skill, require so much nicety in their manipulation that only very accomplished microscopists can make advantageous use of them, and besides they are only needed in very special and therefore limited researches. For high powers, that is where great enlargement is contemplated, the objectives must be constructed with extreme attention to mathematical accuracy, and then when success has been obtained, we are met by another difficulty, that of obtaining the required amount of light. It is evident that if the light reflected from the object remains the same the more we magnify it, in other words the smaller the bit of it which fills the field of view the less light is derived from it and the darker it becomes. The attention of opticians has consequently been directed to the contriving, as an essential part of a good microscope, of means whereby an increased amount of light may be thrown upon or through the object under investigation.

After these preliminary explanations we will turn to an English compound microscope of ordinary construction, and we shall see that its leading feature consists of a metal tube, at the lower end of which are placed the objectives, and at the upper end the eyepiece. This tube is supported by the stand, and worked up or down, so as to obtain the proper focus in modes that vary with different makers, but the bar to which it is attached, is invariably made to move on a stiff joint, so that the eyepiece may be brought in the most convenient manner to the observer's eye. This power of swinging on a centre, immensely convenient as it is, does not seem to be much valued on the Continent, where large numbers of microscopes are made with the tube fixed in a vertical position, which entails great fatigue on the observer, and is, besides, a bad one for the due observation of the object. The object to be observed is placed upon a stage, which is fixed in the commoner microscopes, and then the object when required to be moved during the investigation, must be shifted by the fingers; or it is capable of being moved by some sort of mechanism (*e. g.*, screws with large milled heads, levers, &c.) A stage with a mechanical adjustable movement is by far the most convenient, especially when high magnifying powers are employed. Here again the continental microscopes as commonly made are defective, for the stage is in them usually fixed. As to the illuminating apparatus, if the object under examination is opaque the light must be thrown from above, and for this purpose, bull's eye condensers, lieber kuhns, &c., are brought into play. If, on the other hand, the object is transparent, and we desire to examine its internal structure, the light is thrown from below, and reaches the eye after passing through the object. To effect this a mirror is attached by means of an arm to the lower part of the bar which carries the optical tube. In microscopes which have any pretensions to completeness, there is an apparatus for concentrating or condensing the light interposed between the mirror and the object, such as the achromatic condenser, the parabolic condenser, &c. It is frequently desirable to throw the light into the object at an angle more oblique than can be obtained from the mirror, and this has given rise to the application of prisms, such as Amici's prism, and other contrivances, which are usually borne by separate stands so as to be at once brought into use or removed as the case may require.

Of late years the binocular form of microscope has come extensively into use. In this form there are two tubes, up which distinct images of the object are sent simultaneously to the eyes of the observer, who therefore sees the object in relief; various contrivances have been suggested for effecting this, but that which has been universally adopted in this country was the invention of Mr. Wenham. This contrivance consists in slipping a glass prism into the lower part of the optical tube above the combination of objectives, and this causes half the rays of light to ascend the lateral tube to the eye placed at the upper extremity. On withdrawing the prism the main tube can be employed in the ordinary manner, and the instrument becomes monocular. The great beauty of many objects when viewed binocularly has largely increased the popularity of the microscope. It does not form any part of our purpose to enter into the details of many adjuncts to the microscope, such as the polariscope, an apparatus for examining objects with polarised light; the camera lucida, for throwing the magnified image of it upon paper, and enabling the observer to draw it; or the micrometer, a contrivance for ascertaining the number of times the image exceeds in size the object; and we only allude to them for the purpose of remarking that a microscope, with all its accessories, is an elaborate apparatus which must necessarily require great skill on the part of the maker, and if it is to be brought within the reach of persons of moderate means must be produced in large numbers by the aid of machinery. One at least of our London firms has a considerable manufactory where steam power is employed to actuate the machinery. This will show that the demand for microscopes amongst us cannot be small. It may be observed in passing that microscopists have a literature of their own, for, in addition to numerous excellent treatises on the structure of the instrument, and those that instruct students how to employ the apparatus to the best advantage, there is a quarterly microscopical journal, in the pages of which the world is made acquainted with what observers are doing in their different lines of research.

Coming at length to the display of microscopes in the Paris Exhibition, we are glad to state that the honour of England has been worthily sustained in this respect, for we have no hesitation in saying that the two best instruments to be found there have been contributed by Mr. Thomas Ross and Messrs. Beck, of London. Both are binoculars, and both are accompanied by a host of accessory apparatus and a complete battery of object glasses that must make their cost amount to a considerable sum. Which of the two is really the better instrument it would be hard to say, without a closer testing, by actual work, than could be allowed in the case of articles which must always be kept *en grande tenue* before the public, and perhaps, after all, a decision in favour of one or the other would be given rather by one's prepossessions than by the comparative merits of the two. Everyone who has worked with the microscope well knows how apt he is to pronounce a particular contrivance to be inconvenient if he has been previously unaccustomed to use it. Mr. Ross's fine instrument has the tube that carries the eyepiece and object glass screwed into a transverse bar, which is attached to another bar that swings between uprights so as to be capable of affording the observer any degree of obliquity he requires, and there is a contrivance for fixing the instrument securely at the desired angle. The optical part has a rack and fine screw movements, and the graduated concentric rotating stage has one inch of motion in rectangular directions by means of a screw mechanism. There is a graduated sub-stage for holding and adjusting by universal motions all the illuminating and polarising apparatus placed beneath the object, and the mirrors, which are flat and concave, are capable, by jointed arms, of assuming any position the observer may desire to give them. In short, the instrument is as perfect in all its details as a microscope can be made in the present state of science. We are glad to perceive that the instruments of this maker are lighter and less cumbersome than those he formerly made. Messrs. Beck's large microscope has a longer optical tube than Ross's, and this tube is made to slide by means of a rack and pinion in a groove cut in the metal bar which is made to swing between the supporting pillars. This arrangement is different from Ross's, and it is a form that we ourselves prefer. In addition to their large microscopes, Messrs. Beck exhibit nine others, including a specimen of their "universal microscope" and two dissecting microscopes, one on Mr. Darwin's model. The "universal" is of a peculiar form, and is sold at a low price for the use of students. The optical part is at one side of the single upright, and the foot is circular. The workmanship of all the instruments, both large and small, is excellent.

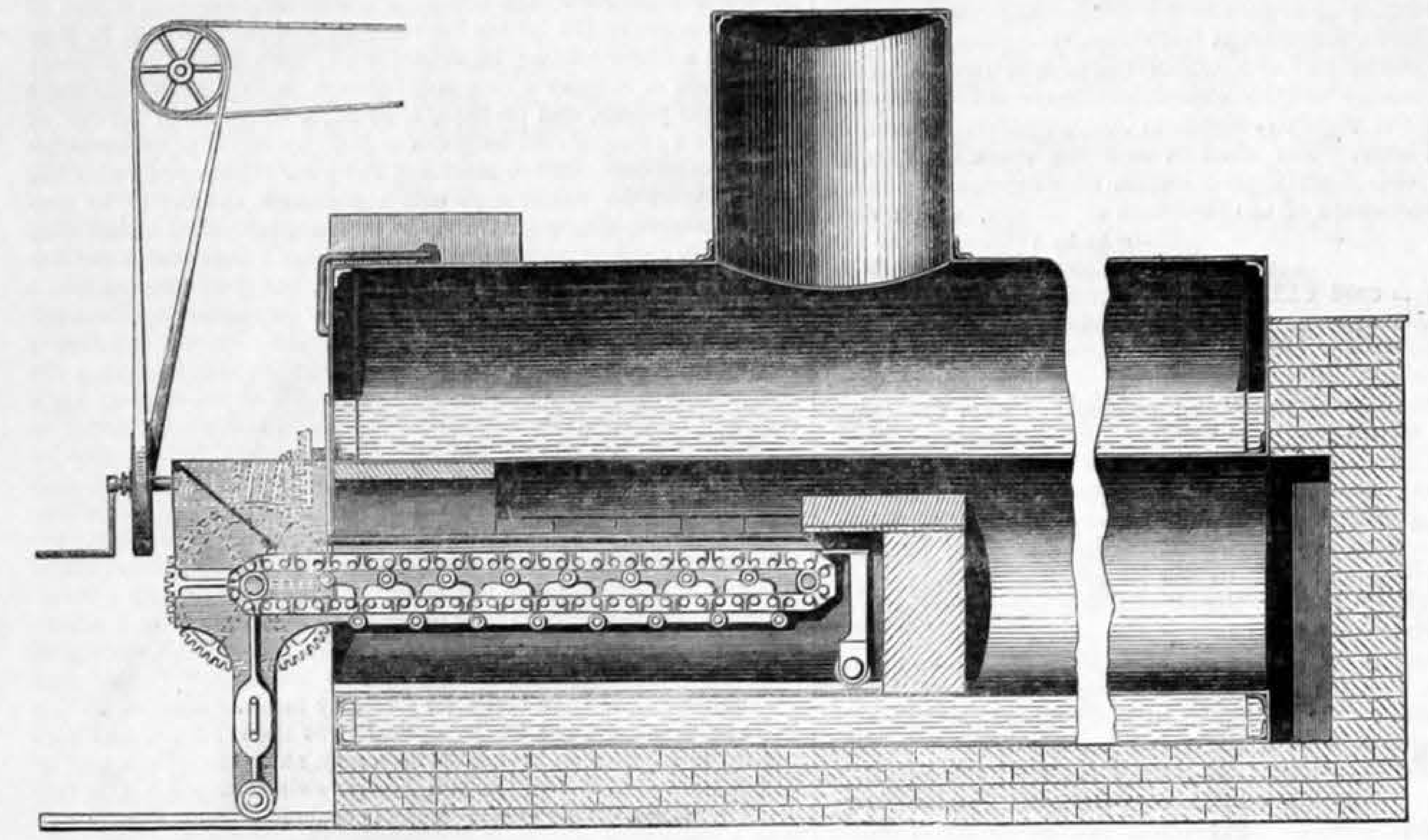
Mr. Dallmeyer exhibits four microscopes, all well finished; and some of them are elaborate instruments, differing somewhat in their arrangements both from Ross's and Beck's. Messrs. Powell and Lealand have not put in an appearance. Their reputation as makers of microscopes stands as high as that of any firm in London, and they probably think they could gain nothing by sending examples of their work to Paris.

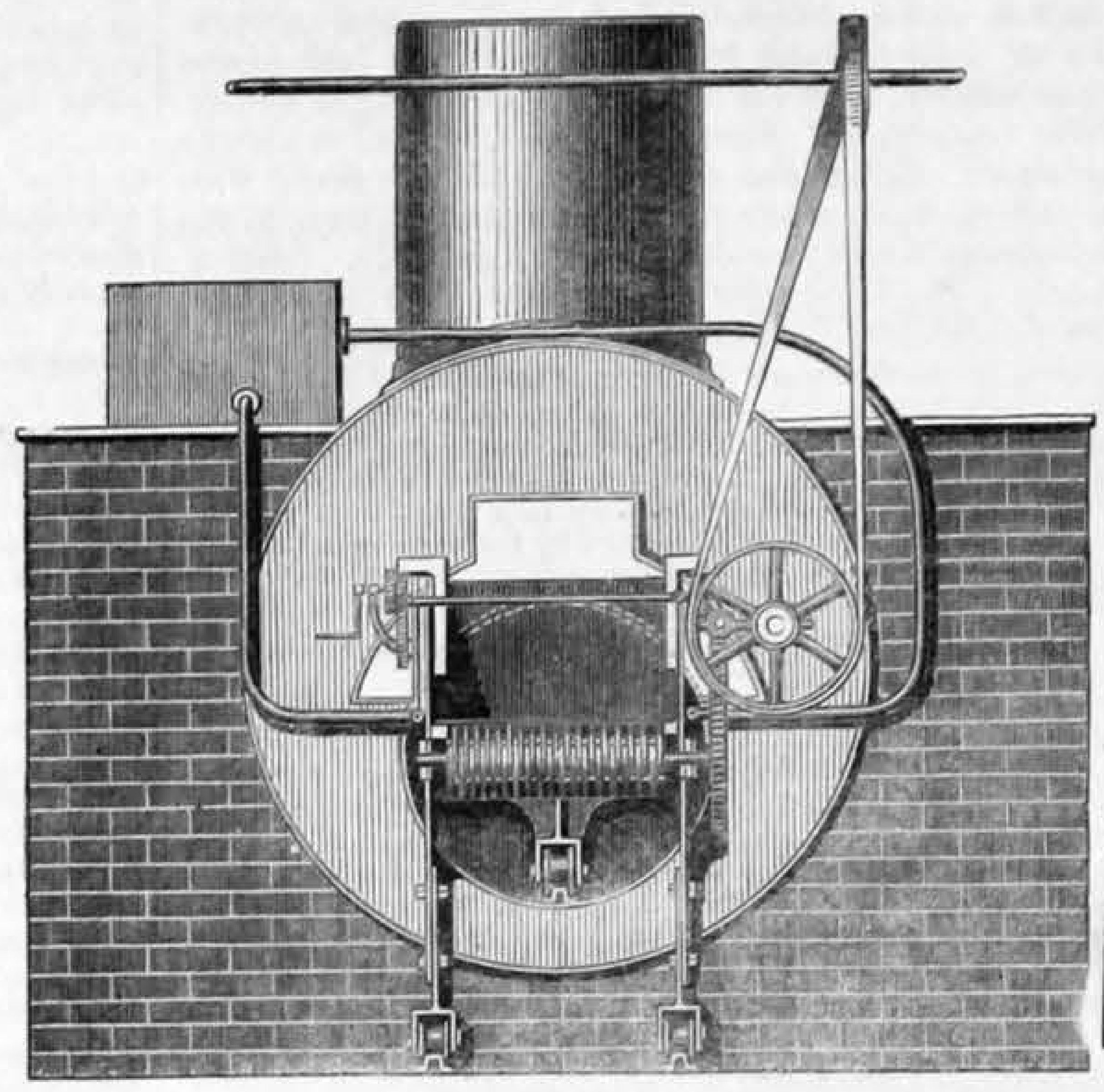
On looking round for the microscopes made by the Prussian and German opticians, we confess we were disappointed with the result of our search. The best instrument we could find is many degrees below the English microscopes we have described. Among the French makers, Chevalier sends instruments that are unnecessarily heavy, and they have a poor, under-bred look when contrasted with the handsome forms to which our English opticians have accustomed us. Harnack's style of stand is better than Chevalier's, though still we see a needless amount of metal employed. He exhibits a series of objectives to be used *à immersion*, that is, with a drop of water interposed between the lowest glass and the object to be observed. This contrivance is thought to correct some of the chromatic aberration, and to present a clearer image. Miraud and Son make the largest display of microscopes in the Exhibition, contributing upwards of twenty instruments. They range in price from 28f. to 600f., including eye-pieces and objectives. Some of them are solar microscopes, and one is termed a universal microscope, as it is intended to serve either as an ordinary compound microscope, a solar microscope, or a polariscope. The largest of the ordinary microscopes is much in the style of Beck's larger instruments. Nachet and Son also make a considerable display, for they exhibit nearly twenty instruments, which vary a good deal in form and purpose. Some are for the use of two or three observers simultaneously. One is fitted with Mortessier's arrangement for photographing the magnified image; another is a binocular dissecting miscroscope. Their large binocular is a well finished instrument, but the contrivance by which the image is seen in relief is inferior to Wenham's form, which has become so common in England. The microscope which they term their grand model is a smaller instrument than Ross's and Beck's chief exhibits, and we venture to think altogether inferior. The last of theirs which we need refer to is a microscope furnished with a goniometer, and intended for chemical researches after Professor Lawrence Smith's design. Hofmann has sent a fine polari microscope with goniometer, but none of ordinary construction. Dubosq, the well known philosophical instrument maker, contributes a still finer photo-electric and solar microscope. Amongst the other French contributors we could find nothing to attract notice.

The Genevese Company for the construction of philosophical instruments exhibit a simple dissecting microscope and two compound microscopes, the larger of which is styled their grand model. Its price, without eye-pieces and objectives, is 350f. whilst the series of three eyepieces and four objectives is priced at 317f. The body of this microscope, which is monocular, swings between uprights, moving on a platinum joint, and it possesses both coarse and fine adjustment, but the stage is incapable of movement and the object is retained in its place simply by spring clips. The light-condensing or other apparatus for transparent objects fits into a tube working by means of a rack in another tube attached to the under side of the stage. There is nothing remarkable about the workmanship or structure of this microscope except that the objective is not screwed into the lower end of the optical tube, but is retained in its place by a forked spring clip. Such a mode of attaching the objective is no doubt attended with a saving of time when the observer has need to change his objectives frequently, and does not employ a nose-piece or some similar contrivance; moreover, the makers assert that on their plan the centering of the entire objective is better than in the case of a screw, and that any defect of centering is at once perceived, and in part capable of rectification; lastly, that the side of the objective which gives the best image in oblique light can be more easily selected.

Prussia does not make a great figure in regard to microscopes. Grundlach of Berlin has several instruments in his case, ranging in price from 33 to 300f., with eye-pieces and objectives, so that it will be seen that his instruments are not of an elaborate construction. All of them are of that objectionable upright form without power of swinging, which tasks so much the muscles of the observer's neck. A solitary microscope, d t hat of a small ordinary form, was all that we could discover in the Austrian department, and this is placed along with Professor Hyrtl's truly admirable preparations of injected objects. Russia contributes absolutely nothing. Having thus reviewed all the microscopes contained in the exhibition, we must repeat what we have previously said, that, beyond all controversy, there are no instruments which can be compared with those in the cases of Mr. Ross and Messrs. Beck.

MESSRS. HART'S MODIFICATION OF THE JUCKES' FURNACE.





THE Messrs. Hart and Sons, of Wenlock-road, City-road, already known as manufacturers of the Juckes' smoke-preventing furnace, have recently patented a modification of the contrivance which promises to be of importance, and to promote its extended application. It has been hitherto supposed that the travelling fire-bars, which form the distinctive feature of the Juckes' furnace, prevented its application to any but externally fired boilers. This idea has, however, given way under the pressure of a practical demonstration of its fallaciousness. The Messrs. Hart have constructed a furnace and very successfully applied it to an internally-fired boiler in their Wenlock-road factory. We recently saw the apparatus at work, and found that steam was generated rapidly, and that the general action of the apparatus was satisfactory. The flue into which the travelling bars were inserted, in the case just mentioned, was only 24in. in diameter, and therefore the space was unusually limited. In spite of this disadvantage, which necessarily caused the furnace to be of comparatively miniature dimensions, its action was good. The bars extended within the tube to a distance of 5ft. from the face of the boiler, and at their inner end were supported by a leg or bracket of cast iron, at the foot of which was a roller, resting on a longitudinal rail, passed along the base of the tube. Exteriorly to the boiler the barrel carrying the furnace bars rests on two iron supports, also fitted with rollers, and these were sustained upon a pair of rails laid along the floor of the stokehole. By means of this arrangement it will be seen that the apparatus is portable, and capable of ready adaptation to any internally-fired boiler. The shifting apron of iron for regulating the thickness of feed, the worm and screw wheel for propelling the bars, and the cistern and water bilge, are in all respects analogous, except in size, to those in use for externally fired boilers. The distance between the surface of the advancing and that of the receding bars is, in the Wenlock-road boiler, 7½in., whilst the width of the whole is 20in. These dimensions would of course be varied in accordance with the differing sizes of tubes in other boilers to which it might be intended to apply the internal furnace. The bars travel at the rate of 6ft. per hour, and as on their return journey they become cool, their durability should be greatly enhanced as compared with that of fixed fire-bars. The coal used is that known as "slack," which has the advantages of being much better adapted for the purpose than ordinary steam coal, and one-half cheaper. The furnace is self-feeding, and thus the labour of the engineman is minimised, and he is free to perform other duties once the supply hopper is charged and until it needs re-filling. The Messrs. Hart purpose applying the internal furnace to double as well as single-tube boilers, and are sanguine of succeeding eventually in introducing them into steam vessels, at least so far as river traffic is concerned. In order to render this description yet more complete we have given above longitudinal and end elevations of the boiler and furnace, which no doubt will make the whole arrangement perfectly clear to our readers.

PARSONS' PATENT BOLTS.

To find a simple and efficient method of preventing the loosening of the nuts of the fish bolts used on railways is a problem that many have attempted to solve, but we are not aware that as yet any of the various devices for that purpose have come into use, and railway engineers are fain to rely upon a daily examination and tightening up of the loose nuts by the platelayers on the line. No doubt this examination would in any case have to be made, however secure the fastenings, but there is a great difference in the time expended in simply walking over a line and observing if any of the nuts are loose, which is at once revealed by their position, and stopping, perhaps at every other joint, to tighten some of them up; this coupled with the greater safety and ease in travelling, the reduction in the wear and tear of the rolling stock, and the cost of maintenance of the line generally when the nuts are always tight and the joints in good order, instead of a considerable portion of the time loose, is sufficient to account for the desire evinced by railway engineers to find a sure and simple method of effecting the object as well as the numerous attempts made to obtain so great a desideratum.

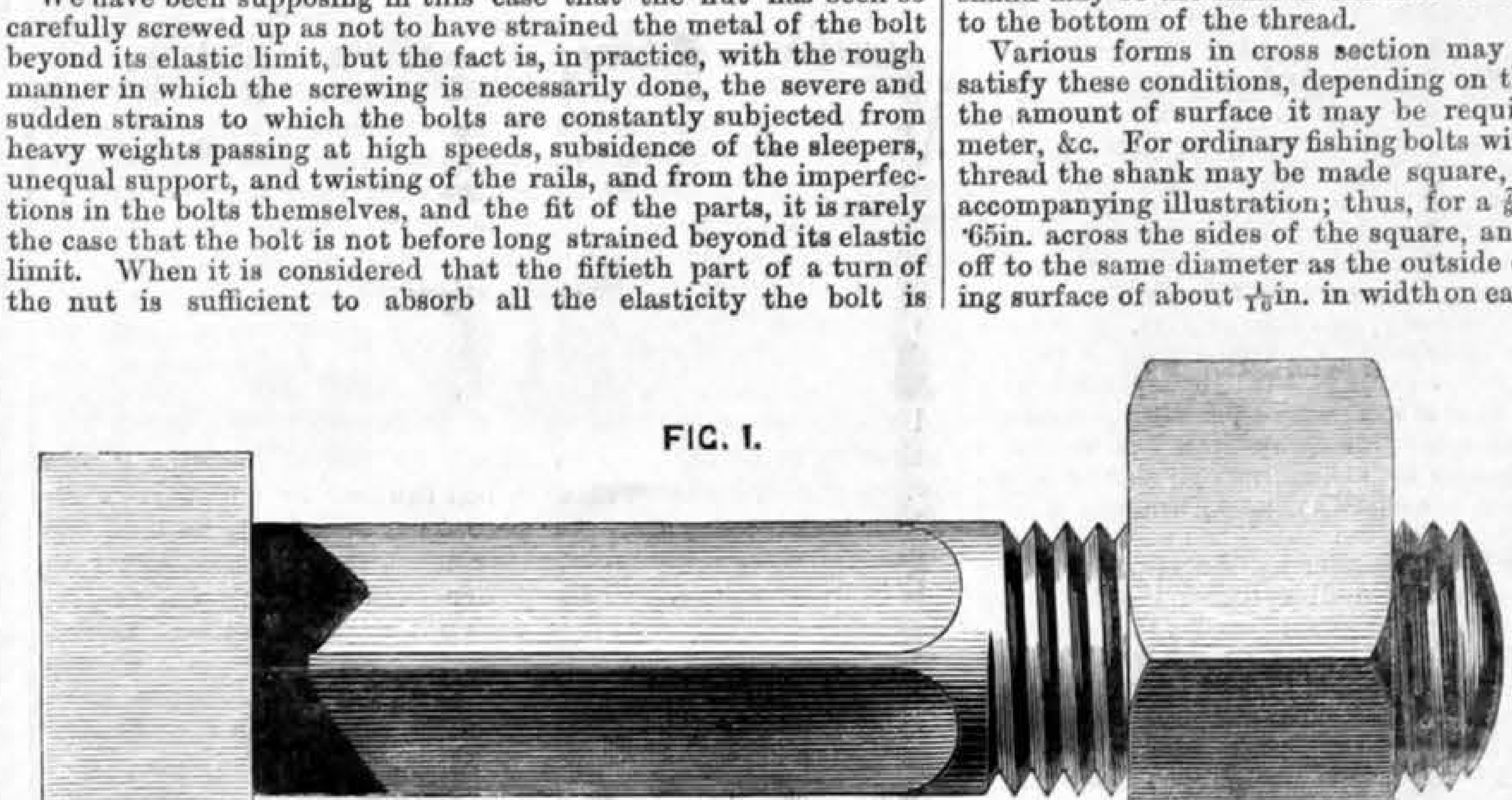
All the plans that have hitherto been proposed resemble each other in principle in that they seek to avoid the defect by some mechanical contrivance applied directly to the nut to arrest its turning; none of them are directed to the root of the evil, and attempt to obviate the tendency itself of the nut to unscrew. The plan which we now present to our readers differs from previous ones in this respect, its object being to remove the cause instead of attempting to oppose the effect, so that when the nut is once fairly tightened up it will remain so without extraneous aid.

If we take an ordinary fishing bolt, say, of ⅞in. diameter tapped with a Whitworth thread, we shall find that the cross sectional area through the shank is just half as much again as the area through the screwed part to the bottom of the thread. When a bolt thus made is subjected to strain, so long as that strain is confined well within the elastic limit of the metal, the shank and screwed part each stretch nearly in the inverse proportion of their respective areas and in direct proportions to their lengths, but the smaller area through the two or three threads of the screw left inside the nut for clearance where the greatest elongation occurs, having no appreciable length, the amount of elasticity given out by the bolt is very small, in an ordinary bolt, 3in. between the head and face of the nut, with a strain of 10 tons per square inch through the screwed part, it would not exceed ·0015 of an inch with iron of the best quality; it can easily be understood then that as so small a variation in the space between the head and nut makes the difference between a loose nut and a tension 10 tons per square inch on the bolt, how likely it is for the nuts of fishing bolts to be overscrewed, or to become loose; for a layer of rust, the scale of the iron, the necessary imperfection in the fit of the parts, would any of them absorb more than this amount, so that although a bolt may at first be fairly screwed up, after the passage of a few trains, having so small a range of elasticity it soon becomes loose.

We have been supposing in this case that the nut has been so carefully screwed up as not to have strained the metal of the bolt beyond its elastic limit, but the fact is, in practice, with the rough manner in which the screwing is necessarily done, the severe and sudden strains to which the bolts are constantly subjected from heavy weights passing at high speeds, subsidence of the sleepers, unequal support, and twisting of the rails, and from the imperfections in the bolts themselves, and the fit of the parts, it is rarely the case that the bolt is not before long strained beyond its elastic limit. When it is considered that the fiftieth part of a turn of the nut is sufficient to absorb all the elasticity the bolt is capable of giving out, it would seem that such must ordinarily be the case, and to this we believe may be attributed the chief cause of the loosening of the nuts; and it is when this is about to occur that the inability of the ordinary bolts to prevent it becomes apparent. Suppose, for instance, that the screwed part of the bolt has, from overscrewing up, or any of the before named causes, a tension of 20 tons per square inch put on it, this will strain the shank to about 13 tons per square inch, but then the relative stretch of the parts will no longer be in the inverse proportion of their respective areas, for the screwed part, being strained considerably beyond its elastic limit, will stretch nearly twenty times as much as the shank, take a permanent set, and thus distort the thread of the screw in front of the nut, where the stretch takes place, so that the nut can only be screwed on further by its thread cutting into that of the bolt; thus the fit between the two is destroyed, a kind of shoulder is formed in the thread making a seat for the nut at the position the nut occupied when the bolt was first strained beyond its elastic limit, and to this position the nut will always have a tendency to return, however frequently and tightly it may be forced up; such at least is the solution of the problem offered by Mr. Parsons, and to remedy these defects he proposes to make the shank of the bolt of a different form in cross section from the screwed part, so that while a sufficient portion of the perimeter of the shank may be of the same diameter as the screwed portion of the bolt measured to the top or outside of the thread, and thus fit fairly into a hole that the screwed part of the bolt can pass through, the area of the cross section through the shank may be the same as the area of the screwed part measured to the bottom of the thread.

Various forms in cross section may be given to the shank to satisfy these conditions, depending on the depth of the thread and the amount of surface it may be requisite to retain on the perimeter, &c. For ordinary fishing bolts with the standard Whitworth thread the shank may be made square, as shown in Fig. 1 of the accompanying illustration; thus, for a ⅞in. bolt the shank is made ·65in. across the sides of the square, and the angles being taken off to the same diameter as the outside of the screw, leaves a bearing surface of about $\frac{1}{16}$in. in width on each corner, which will generally be sufficient to maintain the true position of the bolt and fishing plates; but if more surface is required, or the thread is deeper, the form shown in Fig. 2 may be employed.

FIG. 1.



SECTION THRO' SHANK.

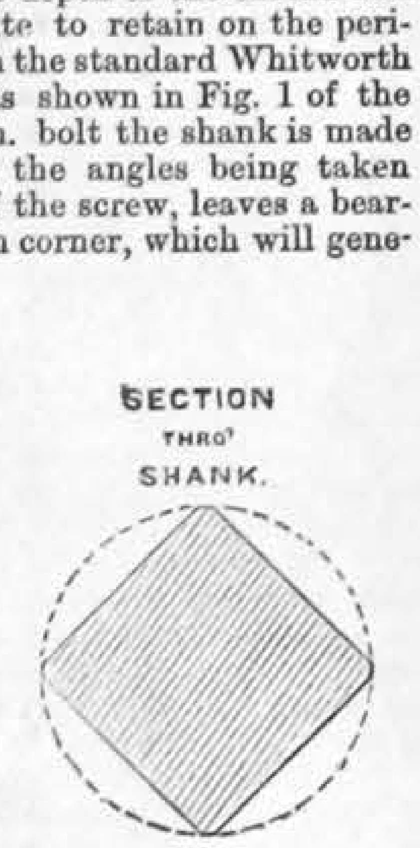
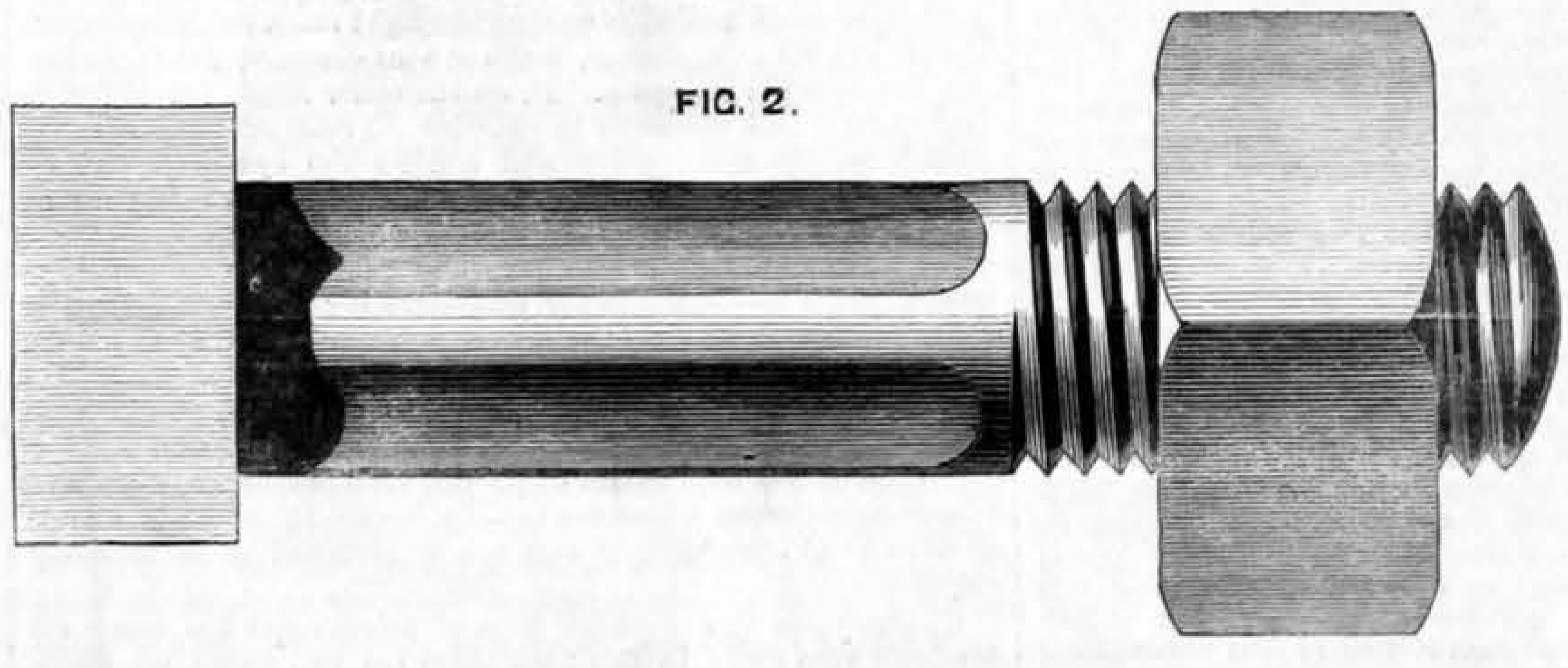


FIG. 2.



SECTION THRO' SHANK.

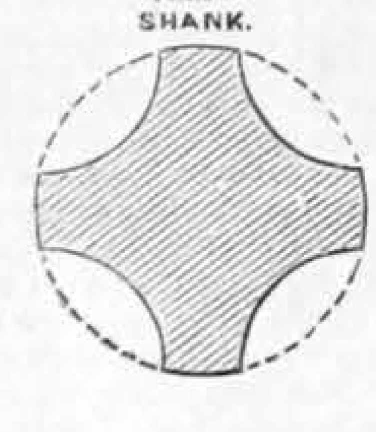
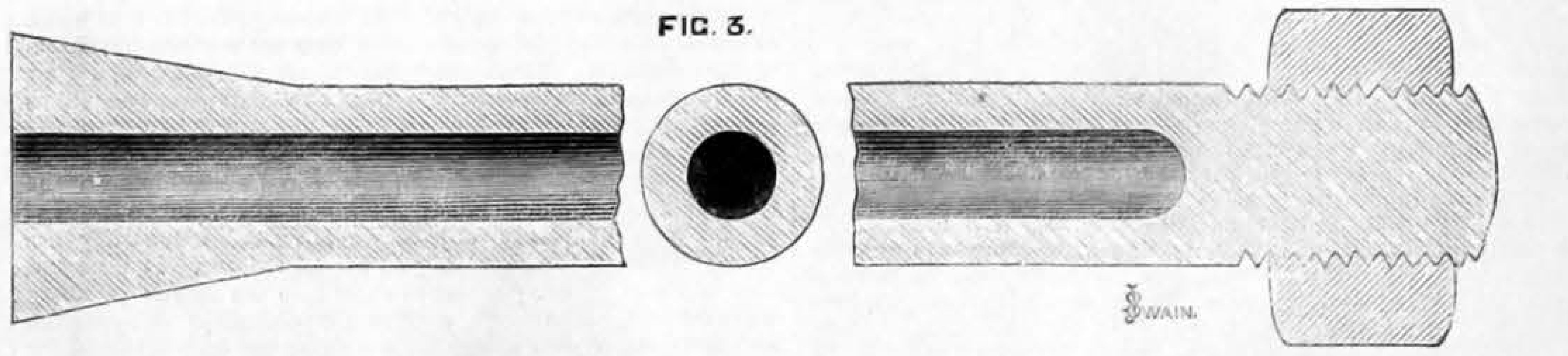


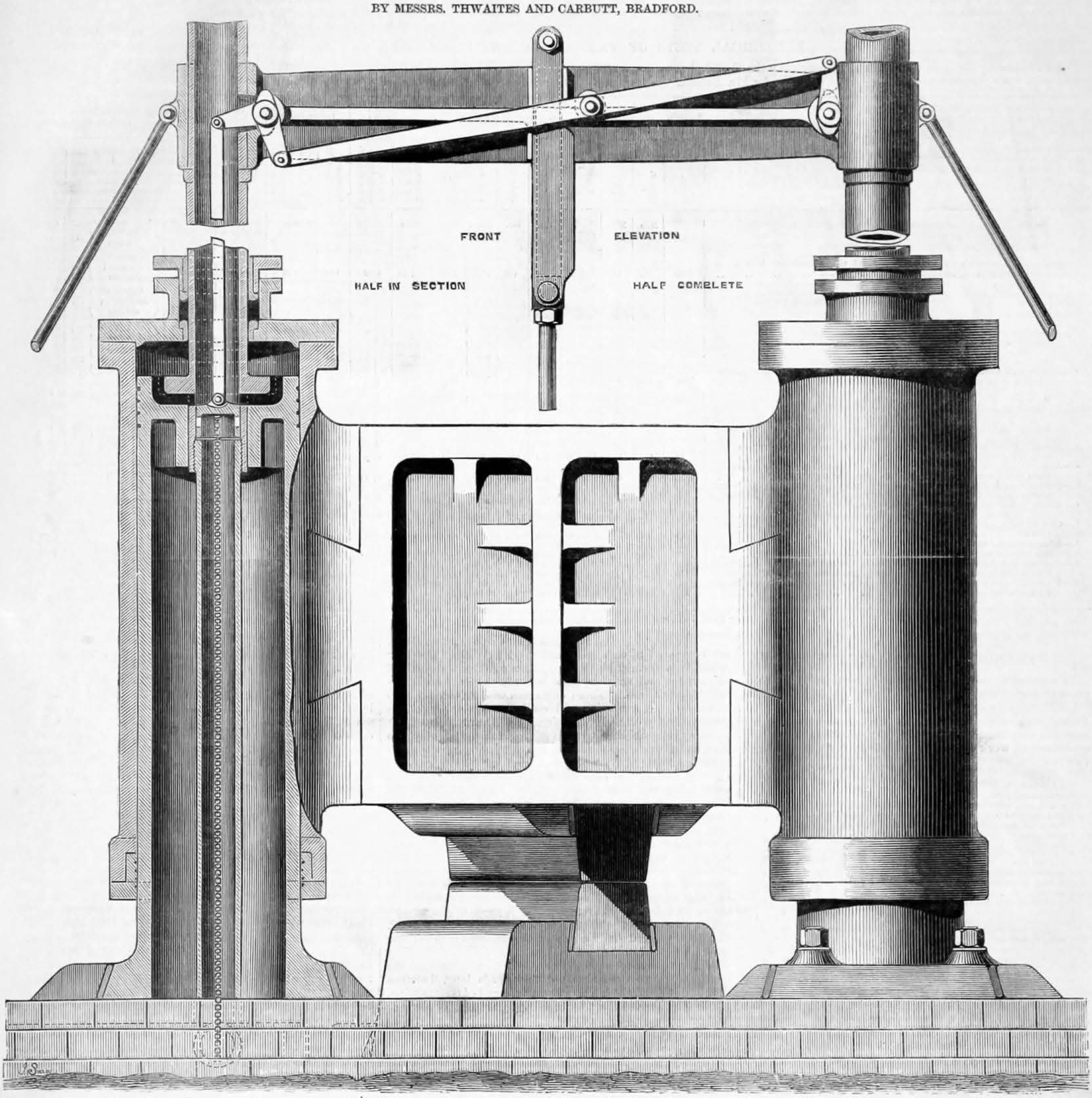
FIG. 3.

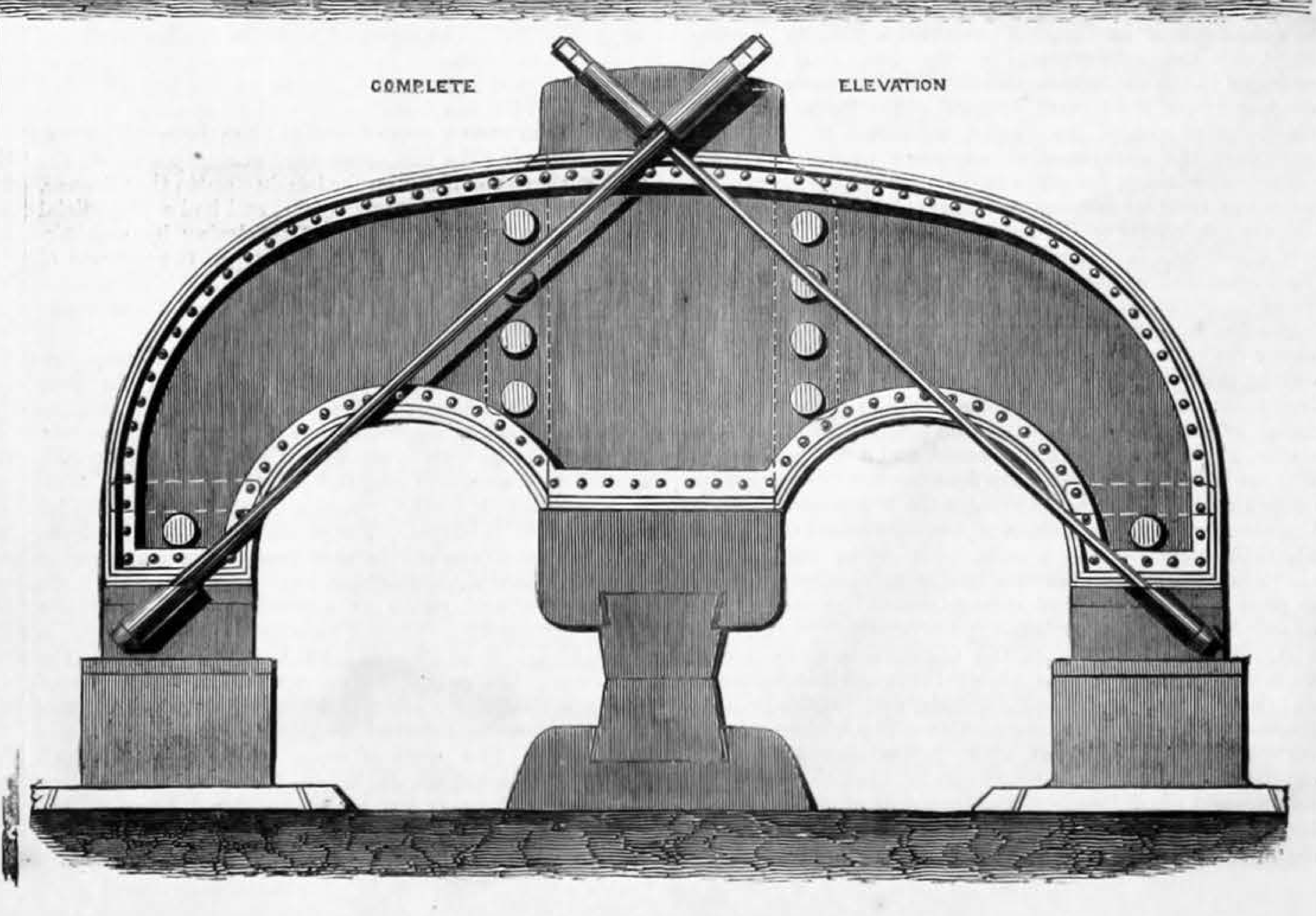


It is claimed by Mr. Parsons that bolts thus made, while they possess all the requisite properties of ordinary bolts in maintaining the parts of a structure in their true position sideways, are entirely free from the defects inherent to ordinary bolts before explained; thus, as the cross sectional area of the metal is the same through the whole length of the shank as through the smallest area of the screwed part, the bolt is of equal strength and stretches equally throughout its whole length, so that not only has the bolt a greater useful range of elasticity, but the probability of the elastic limit being exceeded and the thread being distorted by overscrewing up or any sudden strain is avoided. This may be thus exemplified: If we take an ordinary bolt and interpose a perfectly unyielding substance between the head and nut, only just touching them, the surfaces being perfectly flat and true, it will be found that about the twentieth part of a turn of the nut will be sufficient to put on a strain of 20 tons to the square inch through the bottom of the thread, and the metal at that part will then be strained beyond its elastic limit, and will take a permanent set, whereas with Mr. Parsons' bolts it will require about six-tenths of a turn, or from ten to twelve times as much, to

PARIS EXIBITION—DOUBLE CYLINDER STEAM HAMMER.

BY MESSRS. THWAITES AND CARBUTT, BRADFORD.





produce a like effect. Of course in practice the parts held together yield to the pressure of the bolt at first, and are not perfectly flat and true, and therefore the actual amount of turn necessary to tighten up the nut considerably exceeds the amount; but supposing the nut in both cases fairly screwed up to its bearing, then the nut of the Parsons' bolt would require ten times as much turning as that of the ordinary bolt, or any sudden strain brought upon it would have to be exerted through ten times the distance to strain it beyond its elastic limit. Thus by reason of the greater range of elasticity in the Parsons' bolt a steady pressure is always maintained against the force of the nut, and so long as this exists the adhesion between the surfaces is—it is claimed by the inventor—sufficient to prevent its getting loose, while the fit of the nut not being destroyed by a distortion of the thread, there will be no tendency of the nut to resume its old position, when from the unavoidable wear and abrasion of the surfaces tightening becomes necessary.

These bolts are now under trial on several of the principal railways, we understand, with every indication of confirming in practice the views held by the inventor.

Although these bolts are peculiarly adapted for securing fishing plates Mr. Parsons also contemplates their employment for various other purposes, particularly when sudden strains and vibrations occur; when experiment has demonstrated that he is right in his conclusions they will no doubt be found superior to ordinary bolts for connecting the parts of iron bridges, roofs, and other similar structures, as well as for fastening armour plates to forts and vessels. For this purpose as the weights to be sustained by the bolt sideways is great, if more surface is required than afforded by the form shown at Fig. 2, it may be obtained by adopting the plan shown at Fig. 3 In this the full external diameter of the bolt is retained throughout, and it is made tubular up to within a short distance of the thread of the screw, the inner diameter being so regulated with reference to the depth of the thread as to make the area of the cross section at this part the same as the area of the screwed part to the bottom of the thread.

DOUBLE-CYLINDER STEAM HAMMER.

In our last number we illustrated a double-cylinder steam hammer, by Messrs. Thwaites and Carbutt, in which the pistons moved. We give on the opposite page an engraving of one in which the cylinders move. The steam admitted from below rises through the internal tube, its influx and exit being regulated by the cylindrical-ported valve in the piston. This valve is worked by the cross rod and links shown. These rods are put in motion by a species of plug frame connected with the tup, seen in the centre of the engraving. The steam wastes through what may be termed the upper portions of the piston rods, which are, of course, fixed, and being braced together by a frame at the top, as shown, act the part of guides. The second illustration shows another mode of forming the cross-head. The pistons are down in the position shown in the engraving; in rising they carry up the feet of the arch with them, and of course the tup. The idea of combining the frame with the tup is very ingenious.

ELECTRICAL TESTS OF VARIOUS RECENT SUBMARINE CABLES.

The following Table of valuable data, illustrating the electrical condition and supplyin; every essential particular the most important Submarine Cables yet laid, has been compiled by Mr. Latimer Clarke, and may therefore be regarded as perfectly trustworthy.

Description of Cable.	Length.	Diameter.		Logarithm of $\frac{D^1}{D}$	Weight per Knot.				Resistance of Conductor at 24° Cent.		Resistance of Dielectric at 24° Cent.		Inductive Capacity Compared to Persian Gulf Cable = 100.		Approximate Resistance per Knot when laid.	
	Knots.	Copper. D	Core. D^1		Copper.	Dielectric.	Iron Wires.	Completed Cable.	Resistance per Knot.	Per Centage compared to Pure Copper.	Resistance per Knot.	Calculated Resistance reduced to Dimensions of Persian Gulf.	Capacity per Knot. Persian Gulf = 100.	Calculated Capacity if of same Material as Persian Gulf.	Dielectric.	Conductor.
		Mils. *	Mils. *		lbs.	lbs.	Tons.	Tons.	Ohms.		Mils. of Ohms.	Millions of Ohms.			Millions of Ohms.	Ohms.
1.—Malta and Alexandria Cable. Conductor a 7 wire strand. 18 Iron Wires 0·120in. diameter. (Laid 1861.)	1330	153	463	0·48089	400	400	1·68	2·13	3·49	85·2	115	129	—	106·7	Malta Tripoli Section 242 Tripoli Benghazi Section 192 Benghazi Alexandria Section 151	3·59 3·56 3·54
2.—Persian Gulf Cable. Segmental Conductor. 12 Iron Wires 0·192in. diameter. Exterior Covering of Asphalte Compound. (Laid 1864.)	1245	110	380	0·53839	225	275	3·06	3·73	6·25	85·1	190	190	100	100	Fao-Bushire Section 495 Bushire Mussendom Section 326 Mussendom Gwader Section 342 Gwader Kurrachee Section 239	6·46 6·21 6·40 6·30
3.—Hooper's Cable for River Crossing in India. Conductor a 7 wire strand. 12 Iron Wires 0·2in. diameter. (Laid 1865)	46	110	380	0·53839	180	330	3·3	3·8	6·98	94·9	8064	8064	78	96	—	—
4.—Atlantic Cable. Conductor a 7 wire strand. 10 Steel Wires 0·095in. diameter. Each wire covered with tarred Manilla hemp. (Laid 1865.)	1896	147	467	0·50200	300	400	0·632	1·75	4·522	87·7	365	391	101·4	101·9	3128	4·202
5.—Persian Gulf Cable. (Additional length.) Solid Conductor. 12 Iron Wires similar to No. 2. Exterior Covering of Asphalte Compound. (Laid 1866.)	160	110	380	0·53839	225	275	3·06	3·73	6·01	87·2	395	395	95	100	—	—
6.—Ceylon Cable. (Hooper's Core.) Conductor a 7 wire strand. 12 Iron Wires 0·2in. diameter. Exterior Covering of Asphalte Compound. (Laid 1866.)	35	110	380	0·53839	180	330	3·3	3·8	7·52	88·1	7949	7949	79·6	96	7000	—
7.—Core for India. (Hooper's.) Core similar to No. 6. No Iron covering. (Laid 1866)	40	110	380	0·53839	180	330	—	—	7·59	87·4	8526	8526	79·8	96	—	—
8.—Atlantic Cable. Conductor a 7 wire strand. 10 Steel Wires similar to No. 4, each covered with white Manilla hemp. (Laid 1866.)	1852	147	467	0·50200	300	400	0·632	1·50	4·371	90·9	374	401	101·4	101·9	2385	4·0616
9.—England and Hanover Cable. Conductor a 7 wire strand. 12 Iron Wires 0·305in. diameter. Exterior Covering of Asphalte Compound. (Laid 1866.)	240	87	280	0·50763	107	150	8·003	10·94	12·070	92·3	272	272	92·3	100·9	1010	11·71
10.—Placentia Bay and Sydney Cable. Conductor a 7 wire strand. 12 Iron Wires 0·148in. diameter. (Laid 1867.)	320	102	348	0·53298	150	230	2·15	2·5	8·958	88·8	455	465	102·3	97·8	—	—

* Note.—The "mil" is the one-thousandth part of an inch.

Latimer Clark, *April*, 1867.

FRENCH INLAND NAVIGATION.

In concluding our last article on this subject, with reference to the improvement of the Lower Seine navigation, we inadvertently omitted the table of costs given by the French engineers. We now insert it, and although unfortunately it only treats of generalities, without specifying the quantities of work done, it is to a certain extent instructive:—

Works.	£	s.	d.
Towing-paths between Rouen and Duclair	59,736	10	0
Embankment between Villequier and Quillebeuf ..	11,6550	8	6
Embankment between La Meillerale and Villequier..	26,711	16	0
Banks between Quillebeuf and Tankerville, and banks between Quillebeuf and La Roque ..	173,610	0	0
Prolongation of northern embankment below Tankerville	43,621	10	0
Prolongation of embankments between La Roque and Berville	39,309	13	6
Protective embankment of Villequier	3,199	0	0
Northern embankment between Rétival and Villequier	3,956	0	0
Protective embankment below Caudebec	2,000	0	0
Protective embankment above Caudebec	1,912	14	0
Subsequent filling in of the above embankments and repair of breaches made by the sea from 1859 to 1866, inclusive	73,237	16	0
	543,845	8	0

The next work of importance in improving the inland navigation of France was the improvement of the Garonne below the bridge of Bordeaux. The navigation to that important commercial city remained in a very imperfect state up to the year 1850, since which time extensive works have been undertaken for its improvement, which, though still in progress, have already effected considerable amelioration in the navigation. In 1823, alarmed by the loss of two fine vessels in the lower part of the Garonne, the engineers of La Gironde presented a plan to Government for the improvement of the two most difficult passages of the navigation, and the subject was extensively discussed; but the Council General of the Ponts et Chaussées disapproved of the project submitted to them, and requested the departmental engineers to send in fresh plans, but nothing definite was done for several years. At length in 1840 a fund was voted for taking soundings and drawing up charts of the locality, making observations on the tides, &c. These preliminaries, however, appear to have extended over a period of nine years. In fact, like a great many other works talked of during the reign of Louis Philippe, the actual execution was only commenced under the present emperor. Amongst the data obtained during the long investigation which the subject received the following statistics may be quoted:—The Garonne, from the bridge of Bordeaux to its position with the Dordonne, has a length of 27,500 yards, and a width of about 600 yards at high-water at Bordeaux. But this width increases considerably, so that where the two rivers meet the Garonne is 900 yards wide, and the total width of both is about three-quarters of a mile. The mean rises of tide above low-water mark on the bridge at Bordeaux is 13ft. in neap tides and 16¼ft. at spring tides. The smallest rise of any neap tide observed during ten consecutive years was 11ft. When the water of the Garonne is at its lowest there is no sensible difference in level between it at Bordeaux and at the mouth of the Gironde, and in the greatest freshes the rise does not exceed 3¼ft. The highest tide observed since 1835 rose 21ft. above low-water mark at Bordeaux. The ebb tide is much quicker than the flood, and its duration much longer. The long flow of the ebb, aided by the water of the river itself, forms deep and intricate channels in the estuary, the bottom and shores of which are composed of soft sand and mud cut into gulleys or raised into formidable bars. There are five well-defined anchorages and as many bars between the bridge of Bordeaux and the sea. Those engineers who have had experience in such estuaries will easily understand that the great difficulty of the navigation lay in the shifting of the passages intermediate between these anchorages, and also that, as in common with all such sand harbours when left to themselves, the average depth of the water was gradually diminishing; in fact Bordeaux, when these works were undertaken, ran considerable risk of being left high and dry. The first project of 1849 had for its principle the alteration of the run of the river banks, for the purpose, first, of easing the rapid transverse currents from one side to the other of the estuary; secondly, to re-unite the main waters at any points where they had divided into two channels; thirdly, to contract any exceptional enlargements of the river bed; and, fourthly, to direct the flood and ebb waters into the same channel, as in many cases they each followed different tracks.

The necessary expenditure was estimated at £140,000. The first work undertaken was the improvement of the bar of Montferraud, about halfway down the navigation, which was commenced in January, 1854, and included the formation of an embankment 2,500 yards long, between the left bank and the lower end of the island of Grattequina, which here divides the river into two arms, and of another transverse bank 300 yards long, uniting the island to the shore. The effect of these works was thoroughly satisfactory, as the waters were confined in a much narrower channel, and the tide, which had previously flowed by the left bank and ebbed by the right, was forced to confine itself to a single channel. These works were executed in 1854-5, at a total cost of £16,700. The depth of water on the bar previous to their commencement, *i.e.*, in 1853, was 5ft. 6in.; it had at one time been known to fall as low as 2ft., but the mean depth since 1855 has been maintained at upwards of 13ft. From 1853 to 1860 a sum of £18,614 has been employed, first in removing the numerous encroaching points on the banks of the Garonne and on the Isle du Nord in the Gironde, which were obstacles to navigation, and had a prejudicial effect on the currents; secondly, in closing by embankments three channels occurring between the islands of Mocan, Gazeau, Ile du Nord and Ile Virte, which divided the Garonne at its mouth into two parts. These works had the effect of throwing a much greater volume of water into the main passage of Bec d'Ambeò, but the effect produced was insufficient, and in 1860 further works were undertaken at a cost of £75,000. These operations resulted in altogether changing the passage across the Bec, and consisted, first, in the partial closing of the entrance of the Mocan arm by means of a longitudinal embankment of 3000 yards, in which, however, a passage of 800 yards was left for the navigation of barges. The entire depth of water, however, was not preserved in this passage, as a submarine dyke was formed, connecting the points of the main embankment, and rising to a level of 10ft. below low water mark; secondly, in the construction in prolongation of the Bee, a spur of about 1600 yards in length. The latter work has only been completed for a distance of 800 yards, the desired effect in deepening the main channel having been so far attained as to render its continuance unnecessary. The depth of water across this bar, which had never exceeded 6ft. during the fifteen years preceding 1850, and had been as low as 4ft. in 1848-9, has since the execution of these works attained a mean depth of 10ft. by soundings taken down the centre of the channel, a line which does not always correspond with the deepest water.

The third principal operation undertaken was at the Bar of Bassino, a place at which the ebb tide is widely diverted by the Point de Lormont, forming no defined channel, whilst the flood, following the right bank, scooped out a deep but very narrow passage. Here, from 1860 to 1863, was constructed a longitudinal embankment of 5000 yards in order to divert this passage of the flood tide from the bank, and at the same time the embankment previously mentioned between the island of Gratuquina and the left bank was raised to a height of 16¼ft., the result of which was that the channel of the ebb became defined and approached the left bank of the river, and was further regulated by a bank of upwards of a mile in length starting from the upper end of the island. The depth of water on the Bar of Bassino for the seven years preceding 1860 was on an average 6ft. 8in. The result of the works undertaken upon it has been less marked than that of any of the other operations undertaken on the Garonne, the mean depth of water, low water spring tides, having only been increased to 8ft.; however, with the 13ft. rise of a neap tide added, the available depths over this bar, which is the limiting entrance of the Garonne, is 21ft. The cost of the two last operations, extending from 1860 to 1866, has been £69,000. The total expenditure on the Garonne since 1864 up to the present day has amounted to £105,142 3s. 4d. There remain still two rather formidable shallows to be dealt with, those of Bacalan and Cailloux; the first is situated just below the port of Bordeaux at the point where the channel passes from the right to the left bank of the river. Previous to 1860 the depth has generally been about 8ft. (low water spring tide), except in 1820 and 1858, when it was a foot shallower, but since 1861 it has constantly diminished, and last January had become less than 6ft., in consequence of which great care is necessary in taking the transatlantic steamers and other large vessels through this passage at the highest point of the tide. On the bar of Cailloux the difficulty is not so much felt, as vessels, after passing Bacalan, always arrive at it almost at high water, but its depth has considerably diminished—so much so, indeed, that in the last ten years the water in the channel has decreased from 9ft. to 5ft. The French engineers, however, are of opinion that the works already executed can have had no effect, either prejudicial or otherwise, on the water of these two bars, the expense for the improvement of which they estimate at about £50,000. As will be seen, from the alarming diminution of water which we have mentioned on some of the bars, these works have not been undertaken a day too soon for the safety of the port of Bordeaux. As, however, they have so far only consisted in the embanking and judicious management of the currents, and it has not yet been necessary to resort to dredging, by which means only so many of our own harbours are kept open. A *resumé* of the works executed for the improvement of the Clyde during the last fifty years would give material for an interesting comparison between French and English works of this nature. The channel of that river has been deepened for a considerable length from an average of 18in. to, we believe, 8ft. or 9ft. at low water.

It is worthy of remark that although fears for the regularity of the service of the Brazil line of steamers were entertained when Bordeaux was chosen as their port of departure at an early period of the progress of those works, yet no vessel of that line has ever been delayed in its passage down the Garonne. The engineers who have had the direction of these works are MM. Deschamps, engineer-in-chief, and Pairier, second engineer, from 1840 to 1852; MM. Dreling, engineer-in-chief, and Pairier and Joly, second engineers, till 1856, and in 1865 and 1866 M. Pairier returned as engineer-in-chief, with M. Joly as his assistant. The plans exhibited by the Ponts et Chaussées show the condition of the Garonne in 1842 previous to the commencement of these works and its state as at present improved.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants and Dates of Provisional Protection for Six Months.

439. WILLIAM HILL and HENRY CHARLES WILBERFORCE, Yorkshire, "Improvements in gas-cooking apparatus, and in steaming, baking, boiling, and roasting apparatus."—*18th February*, 1867.

466. MICHAEL HENRY, Fleet-street, London, "Improvements in balloons and in arrangements relating thereto."—A communication from Henry Giffard, Boulevart St. Martin, Paris.—*20th February*, 1867.

539. HENRI ADRIEN BONNEVILLE, Porchester-terrace, Bayswater, Middlesex, "An improved apparatus to deepen, excavate, scour, and remove the mud, slime, stones, and other foul matters from the bed of rivers, streams, and other watercourses."—A communication from Joseph Grosley and Louis Albert Merckens, Kremlin, Seine, France.—*27th February*, 1867.

1035. JULES DE LA COUX DES ROSEAUX, Boulevart de Strasbourg, Paris, "An improved lubricator for oiling axles and other moving pieces of machinery."—*6th April*, 1867.

1114. SAMUEL HARRISON, West-street, Warwick, "Improvements in watches."—*13th April*, 1867.

1212. EMILE GUENIN, Henrietta-street, Covent Garden, London, "Improvements in the preparation and application of mustard for curative purposes."—A communication from Paul Rigollot, Paris.—*26th April*, 1867.

1427. ALEXANDER MELVILLE CLARK, Chancery-lane, Middlesex, "Improvements in the means of raising liquids, and in apparatus for the same."—A communication from Pierre Leon Margot, Boulevart St. Martin, Paris.—*14th May*, 1867.

1483. GEORGE HAYNES, Ellesmere, Salop, "An improved apparatus for cleaning or brushing boots and shoes."—*18th May*, 1867.

1493. EDWARD HENRY CRADDOCK MONCKTON, Oriental Bank Corporation, Threadneedle-street, London, "Improvements in preserving meat, fruit, and vegetables."—*20th May*, 1867.

1503. EDWARD HENRY CRADDOCK MONCKTON, Oriental Bank Corporation, Threadneedle-street, London, "Improvements in the construction of a steam vessel suitable for ferrying laden trains across the ocean complete, together with its landing-places, breakwaters, and modes of protection from marine insects and fouling, which improvements are also generally applicable to other vessels, and to the protection of iron and wood exposed to the action of the sea water."—*21st May*, 1867.

1569. HENRY PETHER, Trigon-road, Clapham-road, Surrey, "A new or improved method for producing ornamental bricks for building purposes, and in apparatus therefor."

1571. EDWARD THOMAS HUGHES, Chancery-lane, London, "A combined seeder, cultivator, and roller."—A communication from James Page Long and Peter Low, Cherry Valley, Otsego, New York, U.S.

1579. THOMAS FREDERICK CASHIN, Sheffield, "An improved compound lever for working railway points and signals, applicable also to other purposes."—*28th May*, 1867.

1631. ENOCH TAYLER, Acorn-court, Fetter-lane, London, "The facilitating the composition or arranging of type of various founts, for displaying jobs or other works usually required to be done in printing offices."—*1st June*, 1867.

1657. ISAAC EVANS, Birmingham, "Improvements in spring hooks."—Partly a communication from Samuel Lagwitz, New Jersey, U.S.—*5th June*, 1867.

1659. JAMES ADAMS, St. John's-terrace, Sadler's Wells, London, "Improvements in machines for dating or printing of railway and other tickets."

1661. EDWARD BLAND, Bury, Lancashire, "Improvements in steam engines."

1663. THOMAS BROWN, Newgate-street, London, "Improvements in artificial limbs."—A communication from Amasa A. Marks, New York, U.S.

1665. ROBERT MAYNARD, Whittlesford, Cambridge, "Improvements in portable chaff-cutting machinery."

1667. GEORGE RICH TURNER and WILLIAM THOMAS ALLEN, Upper Thames-street, London, "Improvements in the manufacture or construction of gates and fences, part of which invention is applicable to straining wires and to other straining purposes."—*6th June*, 1867.

1669. CHARLES EMILE GIOJOLA, JAMES HOPFFE GRAY, and PHILIP MARTINENGO, Birmingham, "Improvements in inkstands."

1671. AUGUSTUS LEA BRICKNELL, Stratford-on-Avon, Warwick, "Improvements in rotary pumps."

1673. HENRY CROWE, Manchester, "Improvements in hot-water apparatus for heating and warming purposes."

1675. DAVID RORISON, Glasgow, Lanarkshire, N.B., "An improved arrangement of reeds to be used in looms for weaving."

1677. EDWARD THOMAS HUGHES, Chancery-lane, London, "Improvements in sewing machines."—A communication from Nathan Adolphus Baldwin, Milford, New Haven, Connecticut, U.S.

1678. WILLIAM WILSON WOOD and JOHN WOOD, Don Boiler Works, Sheffield, "Improvements in the mode of fitting the tubes in the flues of Cornish and other steam boilers."

1679. JOSEPH SHELDON, Rue Scribe, Paris, "Improvements in brushes, and in apparatus for manufacturing the same."—A communication from Barnard Lavery, New York, U.S.

1680. ALFRED BARRY, Bromley Grove, Shortlands, Kent, "An improved mode of and means for communicating motion to cranes, and regulating and controlling the operation of the same."

1681. JOSEPH OFFORD, Wells-street, Oxford-street, London, "Improvements in wheel carriages and other vehicles."

1683. ROBERT SCOTT, jun., JOSEPH NIXON, and JOHN BEAUMONT, Dumfries, Scotland, "Improvements in the manufacture of certain descriptions of woollen cloths."

1684. JAMES WARBURTON, Hythe, Kent, "Improvements in apparatus for registering and recording the quality of gas."—A communication from Christopher Friedleben, Offenbach, Germany.—*7th June*, 1867.

1686. HENRY PARKER, Robinson's-terrace, Stratford New Town, Essex, "Improve ments in the construction of tobacco pipes."

1687. FRANCESCO GLISENTI, Brescia, Italy, "Improvements in the manufacture o gun-barrels."

1688. JAMES COLLIER, RALPH HOWARTH, and WILLIAM CRYER, Bolton-le-Moors, Lancashire, "Improvements in machinery for knitting healds."

1689. JOHN CLEMENTS RALSTON, Newry, Armagh, Ireland, "Improvements in machinery or apparatus for making candles by dipping, and in the self-feeding of the tallow vessel or mould thereof."

1690. HENRY WILLIS and GEORGE RICE, Worcester, and ARTHUR MAXFIELD, Birmingham, "Improvements in sewing machines and in apparatus connected therewith."

1691. JAMES HARGREAVES, Appleton-within-Widnes, Lancashire, "Improvements in obtaining motive power."

1692. JOHN TURNER and ROBERT BUCHANAN DUNNETT, Liverpool, "An improved stamping machine."

1693. OBADIAH BARRETT and HENRY LEGGOTT, Bradford, Yorkshire, "An improved knife cleaner."

1694. NATHAN THOMPSON, Abbey Gardens, St. John's Wood, Middlesex, "Improvem ents in unions or apparatus for connecting together pipes or tubes, and for stopping the ends thereof."

1695. ALEXANDER PARKES, Birmingham, "Improvements in ornamenting surfaces of paper, woven fabric, and other material to render them suitable for bookbinding and other similar uses."

1696. ROBERT HENRY PEPYS, Poultry, London, and JAMES WARBURTON, Hythe, Kent, "Improvements in apparatus for securing cords and straps, such as are used for raising and lowering window blinds, ventilators, carriage windows, and for other similar purposes."—*8th June*, 1867.

1699. WILLIAM FRENCH, Keppel Mews North, Russell-square, London, "Improvements in roughing horses and other animals."

1700. JOHN MACINTOSH, North Bank, Regent's Park, London, "Improvements in the application of plastic and fibrous materials to the manufacture of moulded or formed art icles."

1701. THOMAS ROBINSON, Widnes, and JONN PIERCE, Warrington, Lancashire, "Improvements in apparatus employed in the manufacture of zinc."

1702. ANDREW LINMERE DOWIE and ROBERT MCINTYRE, Glasgow, Lanarkshire, N.B., "Improvements in apparatus for punching, cutting and embossing."

1703. JOHN HAMPDEN KERLY, Percival-street, Clerkenwell, London, "Improvements in fastenings for brooches."

1704. FREDERICK BERNARD DŒRING, Duke-street, Westminster, "Improvements in engines for boring rock, cutting coal, and boring, cutting, or working in other material, and in stands or frames for such engines, the improvements in engines being partly applicable to other purposes."—*10th June*, 1867.

1709. RICHARD HORNSBY, JOHN BONNAL, and HENRY SHIELD, Spittlegate Ironworks, Lincoln, "Improvements in thrashing machines and other machines for dressing and separating grain, and in rotary screens to be used therein, and for other purposes."

1711. CHARLES TOFT, Handsworth, Staffordshire, "Improvements in cruet frames, liquor frames, pickle frames, and other frames for holding bottles and vessels, and in the bottles and vessels to be held in the said frames."

1719. WILLIAM ROWAN, Belfast, Antrim, "Improvements in machinery for heckling or cleaning flax, hemp, and other fibrous material, and for preparing the same for spinning."—*11th June*, 1867.

1721. JOHN MILLWARD, Birmingham, "A combined step cover and wheel fender for carriages and other vehicles."—A communication from John Wood Gosling, Cincinnati, Ohio, U.S.

1723. JOHN COCHRANE, Grange, Stourbridge, Worcester, "An improved pontoon bridge, also applicable as a life raft and lighter."—A communication from John Wright, New York, U.S.

1725. DAVID CRIGHTON, WILLIAM DONBAVAND, and DUNCAN CRIGHTON, Manchester, "Improvements in looms for weaving."

1727. JOSEPH HALFORD SNELSON, Ashby-de-la-Zouch, Leicester, "Improvements in axles and boxes, and in securing wheels thereto."—*12th June*, 1867.

1731. AUGUSTUS CAHEN LION, Paris, "Improvements in the manufacture of chains, bracelets, necklaces, and other similar articles of jewellery."

1735. JOHN GLOVER, Seckford-street, Clerkenwell, London, "Improvements in furnaces for steam boilers and other uses."—*13th June*, 1867.

Inventions Protected for Six Months by the Deposit of Complete Specifications.

1810. HENRY ORAM, Lark-hill, Bury, Lancashire, "Improvements in machines for sewing and stitching."—*21st June*, 1867.

1825. ROBERT WILSON MORRELL, Bradford, Yorkshire, "Improvements in dyeing black upon certain mixed textile fabrics made of worsted, alpaca, or mohair, woven in combination with cotton, and known generally in the trade as 'Bradford goods.'"—*22nd June*, 1867.

1832. JOHN HENRY KEARNS, Bennet's-hill, St. Paul's, London, "A diary blotting pad."—*24th June*, 1867.

Patents on which the Stamp Duty of £50 has been Paid.

1609. WILLIAM FREDERICK THOMAS, Newgate-street, London, "Sewing machines."—*27th June*, 1864.

1616. THOMAS THOMSON and JOHN MURRAY, Newcastle-on-Tyne, "Supplying water to water-closets, &c."—*28th June*, 1864.

1620. WILLIAM CLARK, Chancery-lane, London, "Furnaces and boilers."—*28th June*, 1864.

1623. HENRI ADRIEN BONNEVILLE, Porchester-terrace, Bayswater, Middlesex, "Litho-chromolitho-typographic press."—*29th June*, 1864.

1680. FREDERICK JOHN BUGG, Tacket-street, Ipswich, Suffolk, "Pressed leather."—*6th July*, 1864.

1614. CHARLES JAMES TINKER, Pontefract, Yorkshire, "Lozenges, &c."—*28th June*, 1864.

1635. JAMES COMBE, Belfast, Ireland, "Machines for making cops."—*30th June*, 1864.

Notices of Intention to Proceed with Patents.

439. WILLIAM HILL and HENRY CHARLES WILBERFORCE, Yorkshire, "Improvements in gas-cooking apparatus, and in steaming, baking, boiling, and roasting apparatus."—*18th February*, 1867.

450. EDWARD BRASIER, New Cross, Surrey, "Improvements in machinery for scutching flax or other fibrous materials, and also for opening and straightening fibrous materials (which have been previously made up into yarns and threads), in order to prepare the same for spinning or other purposes."

451. EDWARD BRASIER, New Cross, Surrey, "Improvements in machinery for the manufacture of oakum from old ropes, cordage, or other fibrous materials."—*19th February*, 1867.

461. CHARLES WEIGAND, Cambridge-street, Pimlico, London, "Improvements in the construction and manufacture of umbrellas and parasols."

466. MICHAEL HENRY, Fleet-street, London, "Improvements in balloons and in arrangements relating thereto."—A communication from Henry Giffard, Boulevart St. Martin, Paris.—*20th February*, 1867.

467. WILLIAM SUTTON GAMBLE, Idmiston-road, Forest-lane, Stratford, Essex, "Improvements in lubricating apparatus."

473. JOSEPH MEYERS KAUFMANN, Glasgow, Lanarkshire, N.B., "An improved means or apparatus to be used for travelling through the atmosphere and on land and water."

475. JOHN SAINTY, Burnham, Westgate, Norfolk, "Improvements in hurdles, lifts, and fencing for agricultural and other purposes."

478. JOHN ROBINSON and JOHN SMITH, Rochdale, Lancashire, "Improvements in applying motive power to saw frames."—*21st February*, 1867.

483. MOWBRAY WALKER, Essex-street, Strand, GEORGE HENRY MONEY, Jermyn-street, St. James's, and FRANCIS LITTLE, Junior Carlton Club, Regent-street, London, "Improvements in the construction of breech-loading fire-arms, and in cartridges to be used therewith."

484. JOHN HARRISON, Liverpool, "Improvements in apparatus for removing sea-weed, shell-fish, and other foreign matters from the bottoms of submerged parts of ships and other floating structures."

486. CHARLES COLWELL, Gorleston-cum-Southtown, Suffolk, "Improvements in apparatus for obtaining motive power."

495. WILLIAM EDWIN HEATH, Pembroke-terrace, Chalk Farm, Middlesex, "Improvements in gas pressure governors."—*22nd February*, 1867.

499. ARTHUR KINDER and WILLIAM BARNS KINSEY, Cannon-street, London, "Improvements in gas engines."

503. HENRY JAMES COLE, Kennington Cross, and WILLIAM CHISHOLM HORTON, Kennington-road, Surrey, "Improved apparatus and mechanism to be used for awnings or coverings for omnibuses and other vehicles."—*23rd February*, 1867.

513. JOHN CASH and JOSEPH CASH, jun., Coventry, "An improvement in the manufacture of towels."

515. WILLIAM BARRATT, Earl-street, Bristol, Gloucestershire, "Improvements in apparatus for boiling fats, oils, and bones, whereby to neutralise and avoid the escape of noxious gases."—*25th February*, 1867.

518. GEORGE DAWS, Penge, Surrey, "Improvements in signalling on railways and in apparatus connected therewith."

519. JAMES SYME, Glasgow, Lanarkshire, N.B., "Improvements in central fire cartridges."

527. CLEMENT MARTIN, Hammersmith, Middlesex, "Improvements in steam engines."

529. JOHN TATHAM, Rochdale, Lancashire, "Improvements in machinery for preparing cotton, wool, and other fibrous materials for spinning."—*26th February*, 1867.

535. ANDREW HOWATT, Farnworth, near Bolton, Lancashire, "Improvements in machinery for mining, cutting, or working coal and other minerals, and for hammering metals and crushing minerals."

539. HENRI ADRIEN BONNEVILLE, Porchester-terrace, Bayswater, Middlesex, "An improved apparatus to deepen, excavate, scour, and remove the mud, slime, stones, and other foul matters from the bed of rivers, streams, and other watercourses."—A communication from Joseph Grosley and Louis Albert Merckens, Kremlin, Seine, France.

543. JOHN MCLINTOCK, Barnsley, Yorkshire, "An improved packing for piston rods, pump rods, and valve spindles."

547. JAMES LIVESEY and JOHN EDWARDS, Victoria Chambers, Westminster, and WILLIAM JEFFREYS, Cooper's-road, Old Kent-road, Surrey, "Improvements in signal and switch apparatus for railways."—*27th February*, 1867.

556. ADOLPHE GILBERT CHALUS, Rue Sainte-Appoline, Paris, "Improvements in apparatus for producing artificial light from gas, air, and liquids."

557. JOHN PIDDINGTON, Gracechurch-street, London, "Improvements in inkstands."—A communication from George Marie Stoltz, Rue Fontaine, St. George's, Paris.

558. ANDREW MCCALLUM, Greenock, Renfrewshire, N.B., "An improved mode or means for actuating motive power engines, and improvements in the apparatus employed therefor."

559. ANDREW BETTS BROWN, Vauxhall Ironworks, Wandsworth-road, Surrey, "Improvements in steering apparatus, and in machinery for stopping, starting, and reversing heavy steam engines."

563. ALEXANDER ANGUS CROLL, Coleman-street, London, "Improvements in the treatment of liquid hydrocarbons for the purpose of obtaining a permanent gas."

565. JAMES HARBERT and FREDERICK GOODMAN, Kidderminster, Worcester, "Improvements in destroying explosive gases in coal and other mines, in order to render them safe for the miners to enter."

569. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improved apparatus to be used as spinal, abdominal, and pelvic truss supports."—A communication from Edmund Prior Banning, New York, U.S.—*28th February*, 1867.

574. JOHN HENRY JOHNSON, Lincoln's-inn-fields, London, "Improvements in machinery or apparatus for sewing or ornamenting textile fabrics and other like goods, and in the appliances connected therewith."—A communication from George Joseph Richardson, Philadelphia, Pennsylvania, U.S.

575. THEOPHILUS BERRENS, Tarbes, Boulevart de Strasbourg, Paris, "Improvements in the process and apparatus for perforating tunnels and galleries of mines of great length through rocks much quicker than by the process hitherto employed."—*1st March*, 1867.

59?. ANN CATHERINE LAURYS, Louvain, Belgium, "A new and useful fabric for elastic stockings, stays, or corsets, bandages, and other similar and analogous articles."—*2nd March*, 1867.

603. JAMES WILLIAM LEWIS, Birmingham, and GEORGE ARCHBOLD, Handsworth, Staffordshire, "Improvements in needle cases."—*4th March*, 1867.

652. WILLIAM YOUNG, Straiton, and PETER BRASH, Leith, Midlothian, "Improvements in the distillation of bituminous substances."—*7th March*, 1867.

663. MICHAEL HENRY, Fleet-street, London, "Improvements in apparatus for measuring the speed of ships and other vessels and the velocity of running or flowing water."—A communication from Louis Alfred Anfonso, Boulevart St. Martin, Paris.—*8th March*, 1867.

707. JOHN FREDERICK BRINJES, Fieldgate-street, Whitechapel, London, "Improvements in machinery or apparatus for the manufacture and reburning of animal charcoal, and for distilling shale and other like substances."—*12th March*, 1867.

790. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in spinning machinery."—A communication from Constant Peugeot, Rue St. Sebastien, Paris.—*15th March*, 1867.

882. WILLIAM EDWARD NEWTON, Chancery-lane, London, "Improvements in the valve gear of steam engines."—A communication from William Wright, New York, U.S.—*26th March*, U.S.

929. MICHAEL HENRY, Fleet-street, London, "Improvements in wind musical instruments."—A communication from Jules Legendre, Boulevart St. Martin, Paris.—*29th March*, 1867.

1256. WILLIAM SNELL, Clement's-inn, Strand, London, "An improvement in the manufacture of boots and shoes, and other articles of leather or kindred substances."—A communication from Thomas Briggs Smith, Boston, Massachusetts, U.S.—*1st May* 1867.

1407. WILLIAM ROBERT LAKE, Southampton-buildings, Chancery-lane, London, "An improved mode of constructing metal cocks, faucets, and other similar articles."—A communication from William Westlake, New York, U.S.—*11th May*, 1867.

1440. ALFRED VINCENT NEWTON, Chancery-lane, London, "Improvements in billiard tables."—A communication from Hugh W. Collender, New York, U.S.—*15th May*, 1867.

1454. JOHN MARTIN STANLEY, Chancery-lane, London, "Improvements in producing and increasing combustion in blast and other furnaces, also for generating steam, and for other similar or analogous purposes."—*16th May*, 1867.

1566. WILLIAM SNELL, Clement's-inn, Strand, London, "Improvements in mining, tunnelling, and stone-dressing machines, and valve motion therefor."—A communication from Richard Channing More Lovell, Covington, Kenton Kentucky, U.S.—*27th May*, 1867.

1576. HENRI ADRIEN BONNEVILLE, Porchester-terrace, Bayswater, Middlesex, "Improvements in machinery for carding wool and other fibrous materials."—A communication from Celestin Martin, Pepinster-Verviers, Belgium.

1577. HENRI ADRIEN BONNEVILLE, Porchester-terrace, Bayswater, Middlesex, "Improvements in machinery for weaving wool and other fibrous substances."—A communication from Célestin Martin, Pepinster-Verviers, Belgium.—*28th May*, 1867.

1590. JOSEPH ROCK COOPER, Birmingham, "Improvements in cartridges for breech-loading fire-arms."—Partly a communication from Charles Francois Galand, Liége, Belgium.—*29th May*, 1867.

1642. MICHAEL CAVANAGH, Kensington, Middlesex, "Improvements in adjustable lock spindles."—*4th June*, 1867.

1665. ROBERT MAYNARD, Whittlesford, Cambridge, "Improvements in portable chaff-cutting machinery."—*6th June*, 1867.

1684. JAMES WARBURTON, Hythe, Kent, "Improvements in apparatus for registering and recording the quality of gas."—A communication from Christopher Friedleben, Offenbach, Germany.—*7th June*, 1867.

1686. HENRY PARKER, Robinson's-terrace, Stratford New Town, Essex, "Improvements in the construction of tobacco pipes."—*8th June*, 1867.

1717. STEPHEN WELLS WOOD, Cornwall, Orange, New York, U.S., "Improvements in apparatus for elevating or moving grain, and for weighing and moving grain."—*11th June*, 1867.

1741. HEZEKIAH HAZARD BRYANT, Boston, Massachusetts, U.S., "A new and useful fire-proof safe."—*14th June*, 1867.

1764. WILLIAM ROBERT LAKE, Southampton-buildings, Chancery-lane, London, "Improvements in railway carriages and in brakes for the same."—A communication from Samuel Augustus Chase, Boston, Massachusetts, U.S.—*17th June*, 1867.

All persons having an interest in opposing any one of such applications should leave particulars in writing of their objections to such application at the office of the Commisioners of Patents, within fourteen days of its date.

List of Specifications Published during the week ending 29th June, 1867.

2722, 4d.; 3010, 1s. 2d.; 3037, 4d.; 3041, 1s.; 3042, 8d.; 3043, 8d.; 3044 4d.; 3045, 6d.; 3046, 4d.; 3047, 4d.; 3050, 1s. 2d.; 3052, 1s. 2d.; 3053, 8d.; 3054, 8d.; 3055, 4d.; 3056, 8d.; 3057, 8d.; 3058, 10d.; 3059, 6d.; 3060, 4d.; 3061, 1s. 4d.; 3062, 1s. 6d.; 3063, 2s.; 3064, 6d.; 3065, 1s.; 3067, 4d.; 3068, 4d.; 3069, 1s. 2d.; 3070, 4d.; 3071, 8d.; 3072, 8d.; 3073, 8d.; 3074, 10d.; 3075, 4d.; 3076, 8d.; 3078, 4d.; 3079, 1s. 4d.; 3080, 4d.; 3081, 4d.; 3082, 4d.; 3083, 4d.; 3084, 10d.; 3085, 6d.; 3086, 4d.; 3087, 4d.; 3088, 8d.; 3089, 6d.; 3090, 4d.; 3091, 4d.; 3092, 4d.; 3093, 4d.; 3094, 10d.; 1095, 1s. 10d.; 3096, 10d.; 3097, 4d.; 3098, 1s. 4d.; 3099, 10d.; 3100, 1s. 4d.; 3101, 4d.; 3102, 4d.; 3103, 10d.; 3104, 10d.; 3105, 1s. 4d.; 3106, 4d.; 3107, 4d.; 3108, 4d.; 3109, 1s. 4d.; 3110, 4d.; 3111, 4d.; 3112, 8d.; 3113, 4d.; 3114, 4d.; 3116, 10d.; 3128, 1s. 10d.; 3129, 1s. 4d.; 3157, 8d.; 3187, 8d.

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ABSTRACTS OF SPECIFICATIONS.

The following descriptions are made from Abstracts prepared expressly for THE ENGINEER, *at the office of her Majesty's Commissioners of Patents.*

Class 1.—PRIME MOVERS.

Including Fixed Steam and other Engines, Horse, Wind, and Water Mills, Gearing, Boilers, Fittings, &c.

3082. J. ROBINSON, *Greenfield, York*, "*Apparatus for economising fuel by retaining and applying heat to the heating of water in locomotive boilers.*"—*Dated 23rd November*, 1866.

This invention relates more particularly to that class of high-pressure boilers known as the locomotive boiler, and is designed for the purpose of heating the water supplying the boiler during its circulation or passage through the feed pipes of such steam boilers before such water is injected into the same. The improvements consist in the novel adaptation, construction, and arrangement of a box or boxes containing a series of pipes through which the water is caused to pass on its passage to the boiler; this box is situated in the smoke box of the locomotive engine, and is so arranged and constructed that it will allow the exhaust steam as it escapes from the cylinder to pass between and constantly envelope the aforesaid pipe through which the water passes; by this means the water as it circulates becomes heated before entering the boiler. If two boxes are employed they are to be placed in such a position that each separate cylinder will exhaust its steam into its own box, from whence the steam is injected through suitable openings into and out of the blast pipe. These boxes containing the pipes through which the water circulates on its passage to the boiler may, if desirable, be supplied with a jet of steam from the boiler which will assist, in conjunction with the exhaust steam, to heat the circulating water in the said pipes, as before described, or such jet of steam may be employed separately and independently for the said purpose.—*Not proceeded with.*

Class 2.—TRANSPORT.

Including Railways and Plant, Road-Making, Steam Vessels, Machinery and Fittings, Sailing Vessels, Boats, Carriages, Carts, Harness, &c.

3077. J. *and* W. KITCHEN *and* S. SAMUELS, *Accrington*, "*An improved railway brake, a portion of the apparatus of which can also be employed as a means of communication between the guard and driver of a railway train.*"—*Dated 23rd November*, 1866.

The patentees claim, First, the novel construction and adaptation to the tenders or other convenient place of locomotive engine of a steam clyinder solely under the control of the engineer, the piston rod of which is in connection with the brakes of the carriages composing the train, by the arrangement of gearing and mechanism shown in the drawings, or any modification thereof. Secondly, the peculiar and novel construction of valves as applied to the brake cylinder shown in the drawings, whereby the pressure and power of the "brake" is governed, as described. Thirdly, the novel and peculiar construction of coupling pin and spring as described and shown in the drawings, and also the novel application, arrangement, and adaptation of a bell or other alarm in the guard's van, or on the engine, which can be actuated through the medium of the brake shaft for the purpose of communication between the guard and driver, or *vice versa*; and lastly, the novel employment and use of friction bowls for applying the brakes, together with their arrangement, construction, and adaptation to the guard's van, as described and shown in the drawings, whereby the guard is enabled to apply the brake in case the locomotive becomes disconnected from the engine when the steam brakes are not coupled up with the brake cylinder.

Class 3.—FABRICS.

Including Machinery and Mechanical Operations connected with Preparing, Manufacturing, Printing, Dyeing, and Dressing Fabrics, &c.

3087. T. R. *and* T. W. HARDING, *Leeds*, "*Machinery for drilling combs and hackles.*"—*Dated 23rd November*, 1866.

These improvements consist in using two drills working opposite to each other, so that the holes drilled from contrary sides of the brass coincide in the middle and form one straight hole. The drilling heads are such as are commonly used, and are so fitted on to the slide which carries them that their drills are exactly opposite to each other. These may be made to enter the brass or stock simultaneously or alternately in opposite directions, as may be most convenient, the distance of penetration being regulated by the class of work to be done. The improvements further consist in an arrangement by which the inventors make the above-described apparatus self-acting. They effect this by connecting together the two drilling heads or their spindles by a rod or bar furnished with suitable adjusting screws for varying the distance of the heads or spindles from one another.—*Not proceeded with.*

3093. J. MITCHELL, *Musselburgh, and* W. C. LAIRD, *Leith*, "*Detergent material applicable to the cleansing of wool, &c.*"—*Dated 24th November*, 1866.

The patentee claims, First, the application and use as a detergent material of the ley obtained by boiling rags, esparto grass, straw, or other similar materials employed in the manufacture of paper pulp, whether such ley be used in the state it comes from the boilers or be concentrated either by itself or compounded with the hereinbefore-mentioned materials, substantially as described. Secondly, the application and use to and in the cleansing of wool and other fibrous substances, and for other purposes where coarse soap has hitherto been employed, of the peculiar detergent material described.

3096. W. B. JOHNSON, *Altrincham, Cheshire, "Arranging and driving the shafting of loom sheds."—Dated 24th November,* 1866.

This invention consists in an arrangement for loom sheds whereby the patentee is enabled readily to apply the motive power to any desired "bay" or "bays" or sections, and to combine steadiness of driving with simplicity of arrangement. To accomplish these objects he divides the looms into sections, and uses a separate steam or other motive power engine for each of such bays or sections. He proposes to dispense with the usual shaft which extends along the end of the shed, and from which the cross shafts are driven, and to place the motive power engines in a line corresponding to such end, each crank shaft being connected direct to a cross-line shaft, from which a section or bay of looms is driven.

Class 4.—AGRICULTURE.

Including Agricultural Engines, Windlasses, Implements, Flour Mills, &c.

3083. R. POTTER, M.A., *Balkington, Warwick, "Cleansing, purifying, and bleaching various kinds of grain."—Dated 23rd November,* 1866.

The patentee claims, First, the application and adaptation of chloride of lime (bleaching powder) with or without sulphuric acid to the purpose of cleansing, purifying and bleaching barley and other grain, as set forth and described. Secondly, the application and adaptation of sulphuric acid and common salt to the purpose of cleansing, purifying, and bleaching oats and other grain, as set forth and described. Thirdly, the application and adaptation of sulphuric acid alone to the purpose of cleansing, purifying, and bleaching various kinds of grain, as set forth and described. Fourthly, the applications and adaptations of the chlorines of potash and soda, and also of gaseous chloride as substitutes for the purpose of cleansing, purifying, and bleaching various kinds of grain, as set forth and described. Fifthly, the application, adaptation, and combination of the above ingredients and processes with the ordinary processes for making malt, as set forth and described.

Class 5.—BUILDING.

Including Brick and Tile Machines, Bricks, Tiles, Drain Pipes, and House Fittings, Warming, Ventilating, &c.

3120. J. H. ATTERBURY, *Castleford, and* S. WOOLF, *Knottingley, York, "Manufacture of earthenware and other articles made from plastic materials."—Dated 27th November,* 1866.

Among the features of this invention are the following:—To one end of a suitable foundation plate or table the patentees secure a pugging mill in a vertical position, having its pugging shaft actuated by suitable gearing from the main driving shaft. This latter is supported by brackets at the upper end of the mill, and runs horizontally over the same. From a convenient part of the side of the pugging mill they project a bracket, the outer end of which is adapted to receive a vertical spindle free to move in a vertical direction. To the upper end of this spindle they connect a lever of the first order, having its fulcrum from the carrying bracket. Between the end of the lever and its fulcrum they place a loose grooved pulley, which is impinged upon by an eccentric keyed upon the driving shaft immediately over it. The effect of such impinging is to depress the vertical spindle, and cause an adjustable die affixed to its lower end to descend and impress the clay or other plastic material under operation, which has been previously placed underneath the die. The pressure of the before-named eccentric upon the pulley placed upon the lever being removed, balance-weights on the shorter arm or arms restore the vertical spindle to its previous position. A roller covered with flannel, and placed in proximity to the die, and receiving a horizontal motion by means of levers and eccentric from the main shaft, is now brought into play and passed over the face of the die to remove impurities. In front of the die spindle there is a shaft geared from the main shaft, and having on its lower extremity an arm so arranged as to strike the mould away when the die descends, a "loosing" or vertical motion being simultaneously applied to the bottom of the mould. A prominent feature in this invention is the heating of the metal die, for which purpose gas may be used issuing from any desired number of jets, the result being that the die leaves the clay or other plastic material more readily. The arrangement for feeding and traversing the moulds from the pugging mill to the die forms an important feature of this invention. The patentees effect this by a species of turntable having its centre equidistant from the pugging mill and the die. This turntable is adapted to receive four moulds—by preference one at each quarter of its periphery—and is actuated by suitable lever and ratchet apparatus underneath the foundation plate or table, being so arranged that it revolves one-fourth of a circle at each stroke, so that whilst the material for operation is being discharged from the pugging mill to the mould under it another is under the die receiving the impress, one intermediate waiting for impress and one waiting for a fresh mould. A wire knife actuated by bell crank and levers from the main shaft passes reciprocally under the pugging mill and cuts off the required amount of clay, or other plastic material, which is forced through dies—round or other required shape—secured to the bottom of the pugging mill. The above machinery may be actuated by hand or other motive power than steam if desired.

3170. H. A. DUFRENE, *Finsbury, "Fireplaces."—A communication.—Dated 1st December,* 1866.

According to this invention the grate containing the fire is placed in a hollow metallic casing which is filled with water. This casing is of a cylindrical form leaving the front of the fire open, and the upper part is open for the passage of the smoke. This kind of jacket may be placed in a fireplace with a marble mantelpiece, or may be isolated; it is filled and emptied by means of taps. The place under the grate where the ashes fall is cased with sheet iron and closes like the lower part of the grate. A door made in the ash box allows of the ashes being removed, and openings give access to the air, which after entering is heated by the lost heat of the ashes and small coal falling therein. —*Not proceeded with.*

3188. D. S. CHATER, *Blackorton Vicarage, Devon, "Chimney tops for the prevention of smoky chimneys."—Dated 4th December,* 1866.

This invention relates to the application of a double coned surface to the tops of chimneys, whereby to prevent down draughts, and at all times maintain a free escape for the smoke from the chimney top. The inventor applies this double coned surface to revolving cowls in which the smoke emerges in a vertical or horizontal direction. The escape openings of chimney tops are usually circular, and he makes the addition to be applied thereto according to this invention also circular in accordance therewith, and somewhat larger in diameter, it is, as before indicated, in the form of a double cone of metal or other material, the apex of the one cone pointing towards the centre of and just entering the orifice of the chimney top, while the other points in the opposite direction; it is fixed in position by three stays more or less, near the periphery, each of three or four inches in length which will be somewhat varied according to the incline of the cone, leaving a little distance between it and the mouth of the cowl or chimney pot. In whichever direction the wind strikes this top, it is thrown off and prevented entering the chimney; this top at the same time provides a free escape for the smoke.—*Not proceeded with.*

3199. V. VANDROY, *Paris, "Cast iron sash windows to be adapted to purlin tile or slate roofing."—Dated 5th December,* 1866.

This invention consists of an improved system of cast iron sash for sky-lights or roof windows of the styles known as the "tabatierè" and the "belle voitine," for pantile, slate, tile, lead, and zinc roofing, and generally for all the forms of material used to cover roofs. This system is essentially based on the various forms to be given to the contours of sashes, such forms or shapes being similar to the covering of the roof on which they are to be placed. The result of the identity of form of sash and roof is an equal multiplicity of points of contact, and an equal security against leakage. For pantile roofs the sashes are composed of cast iron pantiles cast together to accord with the fitting and arrangement of those of the roof. They are in fact parts of roofs, in the middle of each of which is made an opening, and a sky-light or tabatiere is raised. It is the result of a casting of pantiles in a mould taken in plaster from the pantiles themselves. For slate, tile, lead, and every other form of roof, the inventor proceeds in the same manner, following the same principle of opening and adopting the same means.

3200. J. TOWARD, *Newcastle-upon-Tyne, "Machinery for the manufacture of bricks."—Dated 5th December,* 1866.

The patentee claims the improved arrangement of machinery described and shown in the drawings, wherein a hollow rotating moulding wheel is employed, formed with an even number of moulds, recesses, or matrices, the movable bottoms of each opposite pairs of moulds being connected together and actuated by an eccentric shaft or bearing in the manner described.

Class 6.—FIRE-ARMS.

Including Guns, Swords, Cannon, Shots, Shells, Gunpowder, Implements of War or for Defence, Gun Carriages, &c.

3198. C. M. FONTENOY *and* J. N. DOFFELD, *Paris, "Fastenings of covers for powder flasks or cases used in naval gunnery."—Dated 5th December,* 1866.

In the naval marine the powder is placed in such part of the ship that, in case of necessity, the said part may be filled with water; it is, however, advantageous to remove the water after the danger has passed, and to recover the powder in as perfect a state as it was before the immersion, and according to this invention this desideratum is obtained. The fastenings, forming the subject of the present invention, are perfectly hermetical, and can at the same time be opened and closed with great facility. According to one arrangement the fastening is composed of a metal ring, made by preference of bronze, rivetted and soldered to the top of the copper vessel for containing the powder. The ring is fitted with, by preference, three projecting pieces of metal hollowed out on the under side to receive the ends of a cross-piece having arms in number corresponding with those of the projecting pieces; the ring is also provided with a projecting ring, whereby an hermetically closed joint is obtained. There is a disc or cover hollowed out on the under side of its rim or edge to receive a greased felt wad, which rests on the inside edge of the ring. The disc or cover is cast with a projecting piece, which fits into and between two corresponding pieces formed on the ring; a pin passes through the three pieces, and in this manner a hinge is formed. The aperture through which the pin passes is, in some cases, somewhat enlarged, in order that the cover may be raised and lowered by means of a screw at or about the centre of the said cover. —*Not proceeded with.*

3204. J. PALMER, *Old Derrig, Queen's County, Ireland, "Projectiles."—Dated 5th December,* 1866.

This invention has reference to a previous patent dated 15th November, 1862 (3084). The shell manufactured according to this invention retains the general characteristics of that described in the specification of the above-named patent, but the patentee so modifies the form of the internal rings as to ensure the severance of the outer rings into small fragments. The invention cannot be described without reference to the drawings.

Class 7.—FURNITURE AND CLOTHING.

Including Cooking Utensils, Upholstery, Ornaments, Musical Instruments, Lamps, Manufactured Articles of Dress, &c.

3129. H. TIMMINS, *Soho-square, London, "Furniture springs."—Dated 28th November,* 1866.

This invention relates to the springs used for giving elasticity to mattresses and seats and for other like purposes, and commonly called furniture springs. The said springs consist of spirals of wire, the coils being of smallest diameter at the middle, the diameter increasing from the middle to the summit and to the base. The coil of wire forming the top, as well as that forming the bottom of the spirals, is usually fixed to the next coil by twisting the end of the wire obliquely around the said next coil, or by binding it thereto with a clip or binding wire. The improvements in the said springs consist in connecting the end of the last coil of the springs at top and bottom to the adjacent coil by bringing the end into the same plane as the coil to which it is to be fixed, and twisting the extreme end of the wire around the said coil, so as to form as nearly as possible a continuous ring around the said coil, and at right angles to it. By this method of manufacture the base and summit of the spring have a flat bearing, and bear firmly against the surfaces between which the spring is placed. The improvements in machinery to be employed in the manufacture of furniture springs consist in the arrangements hereinafter described of the parts of a machine for forming the connecting rings or loops used to connect the ends of the spring to the adjacent coils, as hereinbefore explained. In the base of the machine is a slot through which the end of the coil is passed so as to project upwards. A lever working in a vertical plane is made to bend down the projecting end of the coil into the base of the machine, and against a cylindrical peg. Another lever turning in a horizontal plane carries on the end of its short arm a pressing roller. By turning this lever upon its centre the wire is pressed around the before-mentioned peg, and bent into the figure of a nearly complete circle. Both ends of the spring are similarly treated, and the circular ends or loops of the wire are closed upon the adjacent coils of the spring at top and bottom by means of an ordinary press.

3134. G. HASELTINE, *Southampton-buildings, Chancery-lane, London, "Regulating and registering the tension of pianoforte springs."—A communication. —Dated 28th November,* 1866.

This invention cannot be described without reference to the drawings.

3135. G. HOWARD, *Berners-street, Oxford-street, London, "Elastic seat."—Dated 28th November,* 1866.

In carrying out this invention the patentee forms, First, a spring seat or mattress in the usual way, and upon the canvas covering of this spring mattress he applies and secures a coating of horse hair, or its equivalent elastic stuffing of sufficient thickness to prevent the individual springs below from being felt through the stuffing. Over this he applies a bed or cushion of feathers, the case of which he forms with cells or transverse or longitudinal divisions. The cellular form of this bed or cushion, and the arrangement of the cells, is shown in the drawings. Within the cells or compartments thus formed he inserts feathers or down in such quantity as will make a soft, plump stuffing, and from the stuffing being confined by the small cells or narrow compartments, its even distribution will be maintained, and he thus secures at once the elasticity and softness requisite for a luxurious seat. The back cushion and the pads for the rms are also constructed in a cellular manner.

Class 8.—CHEMICAL.

Including Special Chemical and Pharmaceutical Preparations, Fuel and Lighting Materials, Preparation and Preservation of Food, Brewing, Tanning, Bleaching, Dyeing, Calico-Printing, Smelting Glass, Pottery, Cements, Paint, Paper, Manures, &c.

3111. T. J. BARRON, *New York, U.S., "Converting iron into steel by the action of certain gases, &c."—Dated 26th November,* 1866.

The patentee claims, First, the use and application for converting iron into steel of the compound gas composed of carburretted oxygen with nitrogen and cyanogen, or with nitrogen and carbonic oxide, and either with or without ammoniacal and chlorine gases applied substantially as described. Secondly, the use, in combination with the process of converting iron into steel by the application of the gases mentioned in the first claim, of chlorine as preliminary to such process for the purpose set forth. Thirdly, protecting the iron or metal after it has been steeled or converted into steel from contact with the atmosphere while being cooled or hardened, substantially as and for the purposes set forth. Fourthly, producing nitrogen, carbonic oxide, and cyanogen gases by passing atmospheric air, whether heated or not, through ignited charcoal, coke, &c., substantially as described. Fifthly, in combination with producing nitrogen, carbonic oxide, and cyanogen, as described in the last claim, the use of liquid or other hydrocarbons, substantially as described for producing carburetted hydrogen in connection with such other gases

3114. W. CLARK, *Chancery-lane, London, "Manufacture or preparation of leather and other materials."—A communication.—Dated 26th November,* 1866.

This invention consists, First, in a method of treating leather, forming a manufacturing or carrying process, as also in a mode of preserving it when in use. This method consists in introducing neutral fatty matters in solution into the pores of the leather, so as to entirely fill them should the leather be required to be completely impervious. Secondly, in improved compositions suitable for application in the manufacture and improvement of leather, as also to render it impervious. Thirdly, in applying this process for preserving and rendering fabrics, papers, and pasteboard impervious. The following is the composition employed. The inventor makes a paste of yellow or white wax, two parts; mutton suet or oil of the same, one part; neatsfoot oil one part; benzine or tar, schist, or petroleum oils, one part. The composition of this paste may be slightly modified without changing its principle.

3117. C. CROCKFORD, *Holywell, Flint, "Improvements in the reduction and treatment of zinc ores in the manufacture of spelter, and in the utilisation of the products resulting therefrom, and also in the construction of furnaces and apparatus employed for such purposes."—Dated 27th November,* 1866.

The patentee claims First, the addition of a sufficient quantity of sulphur vapour to the sulphurous acid gas generated by the calcination of sulphuret of zinc to render it economically available for the manufacture of sulphuric acid, either by causing it to pass through chambers or kilns, heated or not heated, containing sulphur, or any metallic sulphuret. Secondly, the mode of charging the sulphurous acid gas with additional sulphur vapour, by causing it to pass through a chamber containing sulphuret of zinc, which is kept stirred or agitated without the admission of atmospheric air. Thirdly, the peculiar construction of retort furnaces for the reduction of zinc ores having a succession of fire-places in advance of a succession of blocks of retorts; and lastly, the construction of the fire-place with its length parallel to the retorts, as shown in the drawings.

Class 9.—ELECTRICITY.

Including Electric, Magnetic, and Electro-magnetic Apparatus, Electrical Apparatus, Galvanic Batteries, &c.

3023. W. E. GEDGE, *Wellington-street, Strand, London, "Improvements applied to clocks and to the receiving apparatus of telegraphs."—A communication.—Dated 17th November,* 1866.

First, the mechanism of the clock or telegraphic apparatus is not changed, but as many movable dials are fitted as there are indications to be given; two, if it be desired to have only the hours and the minutes, or three or a greater number according to the indications required from the clock or chronometer. Secondly, this movable dial is placed on the axle of the wheel of the hours, minutes, and seconds, in such a way that the indication of the minute corresponds perfectly with the tooth which establishes this division of the minutes. Thirdly, the movable dials are hidden by a screen or cover, leaving visible for the hours only the hours corresponding to the twelfth of the dial; in other words, only one hour, one minute, or one second, passes at a time.

3038. J. L. CLARK, *Westminster Chambers, Victoria-street, London, "Electric telegraphs."—Dated 19th November,* 1866.

The First of these improvements consists in the construction of the iron posts or standards used for supporting telegraphs. The Second, in rolling the iron poles with two or more flanges or longitudinal wings on opposite sides of the pole, so as to give greater strength and stiffness to the pole in the direction of these flanges than in any other direction. The Third in forming the body of the pole of wrought iron plates rivetted together, and the top length, which carries the arms and insulators, of a solid wrought iron tube, either cylindrical or tapered, by which combination a maximum of strength with a minimum of weight is obtained. The Fifth improvement relates to the construction of the supports for the insulator. The patentee makes the bracket or support of the insulators of a combination of wrought iron with cast iron, or steel with cast iron. The Sixth improvement consists in the attachment of the insulators to the supports, which is effected by means of a screwed socket-piece, which is cemented into the interior of the insulator. This socket-piece may be of metal, vulcanite, or other suitable material, or of cloth, or other fibrous material, saturated with glue, or other adhesive matter; but the patentee prefers to construct the socket-piece of lead or copper. The Seventh improvement relates to the means of attaching the wire to the insulator. The Eighth improvement consists in the use of lightning conductors combined with an insulator, so that every insulator has its lightning protector. The Ninth improvement relates to the instruments employed in signalling through long submarine cables. The Tenth improvement consists in an arrangement for obviating the inconvenience caused by the wandering of the spot of light in working submarine cables too much to one side or the other of the scale, which is caused by earth currents tending to deflect the needle continuously to the right or left. The details of the invention are too voluminous to be produced here.

Class 10.—MISCELLANEOUS.

Including all Specifications not found under the preceding heads.

2857. J. PLAYER, *Morton, near Stockton-on-Tees, "Lining or felting for puddling furnaces and containing vessels in which pig or crude iron is converted into wrought iron or steel."—Dated 3rd November,* 1866.

This invention consists in lining or felting the above named furnaces or vessels with wrought iron bars or pieces cut or formed in such shapes as may be found most suitable.—*Not proceeded with.*

2867. R. A. HARDCASTLE, *Newcastle-upon-Tyne, "Apparatus for transmitting and controlling motion."—Dated 5th November,* 1866.

This invention relates to a peculiar construction and arrangement of combined coupling and break, more particularly applicable to machinery or apparatus for raising and lowering heavy bodies with a view to transmitting motion thereto when hoisting, and to regulating, controlling, or arresting such motion when lowering weights. In carrying out this invention it is proposed to employ in conjunction with other parts arranged as hereinafter described two discs, in the contiguous faces of which are respectively formed a series of annular concentric wedge-shaped projections, and a corresponding series of similarly shaped grooves, with a view to obtaining the required adhesion or friction between the two discs when pressed together. When used as a windlass break, one of these discs is keyed or otherwise secured to the pinion, and the other disc is free only to move longitudinally on the spindle; but in cases where it is required to a divided spindle, then one of the friction discs is keyed or otherwise secured on to that portion of the spindle to which motion is to be transmitted, or whose motion is to be regulated, controlled, or arrested, whilst the other disc is fitted on to the feathered or grooved square end of the other portion of the spindle which should be in the same axial line with the first, such disc being free only to move longitudinally along the spindle when subjected to end pressure. Between the last mentioned friction disc and a smooth disc or plate on the same spindle there is compressed a helical or volute spring or springs, or a spring of india-rubber or other elastic medium, the convolutions of the spring when a helical or volute spring is used being, by preference, made to gradually diminish in diameter towards the outer end, such spring being composed of a bar of a double convex section, so that when pressed home the curved outer side of one convolution will enter and press against the curved inner side of the adjoining larger convolution. The requisite degree of compression of the spring or end pressure is maintained by tie or coupling rods which connect the two last-mentioned discs, but which are free to play longitudinally through the smooth disc when end pressure is applied to the outer or smooth disc. This end pressure is applied by means of a screwed tubular collar turning freely on the spindle, and rotated by a hand wheel, such collar being screwed into the end of a clutch box or frame, which may be attached to the pinion disc, or may rotate with the spindle, or the tubular collar may be screwed on to the spindle, or the inventor may dispense with the collar and screw the spindle into the clutch box. If the clutch box rotates with the spindle, its interior should be provided with projecting ribs or recesses or projections on the last-mentioned one of the two grooved-faced friction discs, and also the smooth disc; but if it rotates with or is fixed to the pinion, then it may be made smooth inside. By exerting an end pressure on the smooth disc the increased compression of the spring thereby produced will force one of the friction discs against the other, when the parts will be coupled, and rotary motion will be transmitted.—*Not proceeded with.*

2874. J. H. JOHNSON, *Lincoln's-inn-fields, London, "Rolling metals."—A communication.—Dated 6th November,* 1866.

This invention relates to a mode of rolling T, double T, or U, shaped metal bars, and bars of a similar character, as well as bars of a flat or rectangular section, and to the means employed therein, and consists, essentially, in the employment of a pair of lateral adjustable rolls running loose on vertical axes in combination with a pair of rolls on horizontal axes, whereby the top, bottom, and side or sides of the bar may be rolled simultaneously. The upper roll may be raised or lowered by screw spindles or otherwise to give any desired thickness of metal to the rolled bar, and the two lateral rolls which revolve loosely on their axes, and which rotate by their contact with the metal passing between the horizontal rolls, may also be adjusted nearer to or further from the ends of the horizontal rolls by screw spindles worked in concert or separately, or otherwise adjusted. These several rolls will of course be shaped in accordance with the form of bar to be produced, and any convenient arrangement may be employed for giving motion to the main rolls, or if desired to the lateral rolls.

2876. E. H. BENTALL, *Heybridge, near Maldon, Essex, "Manufacturing screw nuts."—Dated 6th November,* 1866.

This invention relates to the use of a series of machines of novel construction for facilitating the manufacture of screw nuts from bar iron without the same being required to be heated. The first stage of the process of manufacture is to cut up bar iron into pieces of uniform size to constitute nut blanks. For nuts of ordinary thickness the patentee uses a novel construction of shearing machine, into which the bars arranged side by side are fed. At every descent of the cutter a series of nut blanks, corresponding in number to the bars fed into the machine, will be severed. For nuts having what is known as "one and a half thickness," or any greater thickness, he prefers, however, to employ a kind of planing machine fitted with a series of parallel cutters, which will operate upon several bars simultaneously, and cut them into nut blanks by being traversed over the bars, and fed and kept up to their work by an intermittent feed motion. The blanks thus formed are to be centered in any approved way, and they are then ready to be submitted to a novel construction of drilling machine in which the centre of the nut is bored out, the blanks being fed into the machine by hand in rapid succession. The next operation is to tap the nut, which is effected by a machine similar in construction to the drill. The thread having been cut, the nut is faced in a lathe of peculiar construction, after which the nuts are shaped in a shaping machine, and are finally submitted to a finishing facing operation. The invention cannot be described in detail without reference to the drawings.

2893 J. *and* M. DEAIN, *and* J. H. SUTTON, *Rotherhithe, "Method of closing and keeping open at any distance doors and gates in lieu of using springs, straps, &c."—Dated 7th November,* 1866.

In performing this invention the patentees propose using a series of pulleys so fixed as to be within a small compass at the bottom or top of the door, near the hinge edge, with lines passing over the said pulleys, and weights attached at the ends thereof, which so govern the door that it may be made to close or remain open at any distance required, whereby slamming is prevented. The pulleys, lines, and weights may be kept entirely out of sight, and the lines may be made of wire, rope, chains, or any other suitable material, also the door may be fastened in the ordinary manner without interfering with the above arrangements.

2894. W. GOODBRAND *and* E. T. HOLLAND, *Manchester, "Apparatus for rendering the security of safes and other depositories more effective."—Dated 7th November,* 1866.

This invention is designed for the purpose of indicating burglarious attempts to open safes, and for giving alarm or information of the same to watchmen or others, the first object being accomplished by extinguishing a certain gas light by means of a novel arrangement of mechanism, the alarm being given by electrical apparatus in combination with such mechanism, which first arrangement, either used combined with or separately from the electric apparatus, constitutes the chief feature of the invention, the extinguishing of a gas jet for such a purpose being well-known. The apparatus is secured within the safe or depository, and consists of a chamber which is supplied with gas from outside the safe, and a glass tube through which the gas passes to a lamp or jet situated outside the building, or in the street, or other conspicuous position; a metal pipe enclosing the glass tube also is connected to this chamber, the outer end of which pipe is open to the atmosphere. The gas is prevented from passing into the atmosphere through the metal pipe by means of a valve which is mounted on a spindle or rod, the upper end of which is bent and retained in its position by hooking or edging on a hinged rod secured to the opposite side of the safe, which rod is also connected with a piston and rod enclosed in a box, and as long as the apparatus is in this position the gas will burn in the lamp; if, however, any attempt be made to force open the safe by wedges, levers, or other means that will dislodge the hook or ledge and release the valve it becomes forced by a spring over the glass tube aperture and extinguishes the light, and leaves the other aperture and the gas open to the atmosphere, and at the same time the other end of the valve rod in falling completes an electrical circuit from a battery in the safe or elsewhere, and causes a bell to ring above the lamp, or elsewhere, for any duration of time, which may be determined by any well-known arrangement of spring and clockwork.

2895. P. KIRK, *Workington, Cumberland, "Apparatus for rolling metals."—Dated 7th November,* 1866.

This invention relates to that description of machinery employed in rolling metals in which three rollers are used, one above another, and acting together, and the improvements consist in raising the middle roller in combination with fixed or stationary—that is unadjustable—bearings, and in making the bearings of the top and bottom rollers movable or adjustable, so that the thickness of the metal passing between the rollers may be regulated by raising or lowering the top and bottom rollers to or from the middle roller. In order to facilitate the movement of these top and bottom rollers, the framings in which their bearings are fixed are connected together by shafting and levers, to which springs may be applied, so that they balance each other. The exact position of the top roller is regulated by a screw at each end of the rollers as usual; and another improvement consists in adapting or applying two screws beneath the bottom roller for the purpose of regulating the same, the two screws being connected together (or the nuts thereof) by means of gearing, so that both rollers may be raised or lowered simultaneously.

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

(From our own Correspondent.)

THE PRELIMINARY MEETING REVIEWED: *The Standard Prices: The Report of the Executive: The Resolutions of the Meeting*—ANOTHER AGGREGATE MEETING OF THE IRON TRADE OF ALL ENGLAND IN LONDON: *The Select Committee and the Ironmasters: Probable Effects of the Government Factories Bill*—TRADE DURING THE WEEK: *Few Orders: Stock-taking: Hay Harvesting: Low Prices for Galvanised Sheets: Improved American Demand*—PIG IRON: *Good Inquiries: Prices Firm*—IRONSTONE: *Encouraging Sales: Firm Prices: Demand for Foreign Ores*—COAL: *Unimproved: Prices Drooping*—MR. A. S. HEWITT'S EVIDENCE BEFORE THE TRADES' UNION COMMISSIONERS—THE NEW ZEALAND IRON LAND COMPANY: *Meetings Here*—HARDWARES UNCHANGED—PARIS MEDALS—THE WORCESTER AND BIRMINGHAM CANAL, AND MESSRS. McCLEAN, BRASSEY, AND ELLIOTT—TWENTY PER CENT. BANKING—COVENTRY EXHIBITION—BIRMINGHAM CHAMBER OF COMMERCE: *Proposal to Send Out Representative Workmen to Report on Paris Exhibition: The Anglo-Austrian Treaty: International Maritime Laws*—BOARD OF TRADE RETURNS: *Metals and Customers, with Proportions Specified.*

LAST WEEK we stated briefly what was the decision to which the ironmasters came at their preliminary meeting in Birmingham on the eve of our publication. It was determined that no alteration should be made in the "list" prices of iron, which will therefore remain at—for bars £7 10s., hoops £8, and sheets £9. It was then shown that the committee reported upon their efforts to induce the Government to adopt their legislation on the Factory Acts to the necessities of the trade, but that they had been unsuccessful, the select committee, which the trade suggested in the expectation that evidence of a practical character would be received, having declined to hear any such testimony. We now give the text of the committee's report. It is as follows:—"The questions which have employed the attention of your committee during the past quarter have arisen entirely from the consideration of bills before Parliament, brought in by the Government and by private members. Some of the latter have been needless, and have entailed much trouble upon the association in opposing them. The bills referred to are:—1. Law of Master and Servant, which has been nearly arranged with Lord Elcho. 2. The Valuation of Property Bill and the Mines Assessment Bills, on which evidence has been given before the select committee by Mr. Mathews. 3. The Factories Act Extension Bill has had the constant attention of your committee, who by a most influential deputation which waited on the Secretary of State for the Home Department, on April 29th, urged on the Government alterations which the iron trade of Great Britain considered necessary. It was referred to a select committee, before which it was hoped that evidence would have been taken. It was based mainly upon the false assumption contained in the third report of the Children's Employment Commission, and it will require great care on the part of members for the iron districts to prevent unfair clauses being added by the philanthropic section. The Trades Union Commission has been attended constantly by Mr. Mathews. The evidence received becomes more and more important and astonishing than the strongest opponents to trades unions could have conceived." Upon that report the following resolutions were passed:—"That this meeting regrets to hear the select committee of the House of Commons declines to take evidence on the Factory Act Extension Bill, a bill which they were appointed to consider, and that hereby a great injustice is likely to be inflicted on the iron trade. There is no indisposition on the part of the iron trade to be placed under the operation of legislative enactments for the employment of women and children, but the present bill is considered crude, unsatisfactory, and almost inoperative. That it will further tend to materially increase the cost of production without securing any corresponding advantages, and is likely to create great hardship in some families, as well as to disturb those generally existing rules between employers and employés in their trades." "That this meeting requests the hon. secretary to communicate with the members of South Staffordshire and East Worcestershire, and all the borough members in those divisions, to use their most strenuous efforts to get evidence received by the select committee on the bill before it passes; and that he will put himself in communication with all other members known to be interested in the iron trade and this subject, with a view to convene an early meeting of delegates from all the different iron-making districts."

To-day (Friday) a general meeting of the iron and tinplate trades, convened by the South Staffordshire Association, is to be held in London, for the purpose of deciding what course shall now be pursued. It has been remarked that upon the third reading of the bill in the House of Commons a motion may be made to except the iron trade from the provision of the Act, and to arrange that a special and separate bill shall be drawn up for that industry; or that the bill may be opposed in the Lords. The iron trade have much cause for complaint in this matter, but it does not necessarily follow that they will be successful in either of the proposed efforts to remove the injustice from which they are now suffering. They have clearly a cause for complaint that their testimony has not been taken. That complaint is finding stronger expression here from the supposition which is entertained to the effect that the committee have not only declined to receive evidence, but have also refused to introduce any of the more important modifications which the trade suggested, during their interview with the late Home Secretary, when they waited upon him at about the end of April last, and pointed out that the assumptions in the bill, as taken from the third report of the Childrens Employment Commissioners was unfair, untrustworthy, and therefore injurious to the iron and tinplate trades. The ironmasters correctly describe their feelings in their resolutions when they state that they are prepared to adopt all necessary and practical measures for the extension of education and for the protraction of juvenile labour. At the same time the peculiarities of this trade require that the regulations should be so framed as not to interfere with the operations of the works to the extent, as will be inevitable if the propositions to which the committee are understood to have agreed should be carried out. There can be no doubt that the tendency of modern legislation is in the direction of increased restrictions, with a view to bring about the object desired by the Government inspectors of schools—gentlemen upon whose testimony so much reliance is placed by the Government authorities. Perhaps it is owing to their knowledge of the temper of the House in this respect that the members of Parliament who should be most ready to forward the views of the Ironmasters Association are affording very little practical help to the ironmasters' executive. Of this absence of help, much complaint is now heard. There will be less languor on the part of these gentlemen now that the trade are expressing their views somewhat plainly, but there is not much room to conclude that a material alteration will take place. If these expectations should prove correct, the committee can do no more than protest, and when the measure comes into operation it will then be seen whether or not it is possible for the regulations of the bills to be carried out and the objects aimed at attained. At present the manufacturers of hardwares in particular assert that the effect will be very unmistakably to increase ignorance and misery. Large employers of labour, whose men have children under them, declare that they will not run the risk of having half-timers upon their works. The risk spoken of relates to the fines which may be imposed on account of children being kept at the manufactories longer time than the Act specifies, and it applies to other regulations over which the proprietor, who scarcely knows that the children are upon his works, has no control. Yet he, and not the real employer of the child-labour, is to be responsible by the terms of the Act. The argument of such manufacturers is, that although there may be a slight additional cost entailed by the employer of older hands, yet that the risk avoided will leave very little difference in the ultimate cost. They deny that child labour is as profitable to them as it is asserted by persons who are unfamiliar with the trading operations of this district. Many children, they state, are taken into works from charitable motives, or because their parents are employed there. The operative classes themselves continue, where expressions of opinion at all find utterance, to pronounce in favour of the Act as sketched by the Government, but it is patent that according to the expectations of these people the effect will be to increase wages and the employment of adults, and that much of the cost of the education of the children will fall upon the manufacturers themselves. There is, however, much ground for concluding that when the Act has been in operation these people will entertain a different opinion, and they will be amongst the first to desire that it shall be repealed.

Very little change has taken place in the iron trade or any other trades of this district during the past week. The interim between the preliminary meeting and the quarterly meetings is usually a very quiet time, the fortnight being spent at Midsummer and Christmas in particular in taking stock, and making inquiries preparatory to the quarter-day purchases. The orders that have come to hand since our last have been comparatively insignificant, but on account of the stock-taking further, because it is the habit of many of the men to find employment in the hay harvesting, when at this season orders are scarce, the comparative insignificance of the new orders has not been so much felt as at other times. The Americans are again making a good demand for hoops, and the inquiries for sheets keep up in some instances. In others, however, they were never fewer for the galvanising descriptions. So much dulness in the trade in iron of the description mostly used by galvanisers as that which now exists was never before known. Owing to the recent small consumption in the chief foreign markets—that of Australia—is glutted, yet consignments continue to be made, and when there is an order to be got the competition is very severe. One firm who have been successful in securing an order in the past few days, has cut it so fine that he is now offering to hand over the specification to another manufacturer if the latter will allow him merely one per cent. on the order. The firm to whom the order has been thus offered assures that the profits that have been recently obtained have often not exceeded that proportion. Bars are also being sent away somewhat more freely to New York.

The inquiries for pigs and for ironstone are to an encouraging extent. In both these departments prices are firm, with the certainty of an advance upon the first appearance of improvement in the trade. Already the highest prices that are known to have been secured for Cumberland ore of the best class have been got here in the past few days. That material is in increased demand at those furnaces at which the best quality of pigs are produced in this district, and the poor Northamptonshire ore is in fair request.

Coal is slow of sale at the thin mines and where the habit has been to sell to ironmasters in large quantities, the prices now being obtained are lower generally by threepence a ton than was got three months ago.

The evidence of Mr. A. S. Hewitt, the American ironmaster who has given evidence before the Trades Union Commissioners, was known to the leading members of the trade here three months ago. It was regarded as interesting, but it gave rise to no surprise.

A small party of persons about to emigrate to New Zealand, in connection with a Taranaki Iron and Steel Company, held meetings in Birmingham and Wolverhampton on Wednesday, to induce others to join them, with a view of promoting an iron trade special settlement on land near the Taranaki Sands. Mr. J. Everitt, of London, the chairman of the company, presided, and specimens of the iron and sand were exhibited. A similar meeting was to be held this (Friday) evening in Birmingham.

No change of importance has taken place in the hardware trades of Birmingham and South Staffordshire during the past week. A fair proportion of the medals awarded to the English exhibitors at Paris has fallen in this district.

The negotiations between the proprietors of the Worcester and Birmingham Canal and Messrs. McClean, Brassey, and Elliott, for the purchase of that concern by the latter, have fallen through. The firm named alleging as their reason for not closing the bargain that the alterations the committee of the Lords had made would impose burdens and restrictions which had not been previously contemplated.

The Birmingham Joint Stock Bank have again resolved to declare a dividend at the rate of 20 per cent. per annum for the last half-year. The Coventry Exhibition continues to excite considerable interest.

The Birmingham Chamber of Commerce have held another ordinary monthly meeting (in council). At that meeting the chairman stated, with reference to the artisans' visit to Paris, that a circular had been forwarded to a member of the chamber asking for subscriptions to the fund. Upwards of £80 had already been promised, and it was anticipated that additional subscriptions would be yet received. It was expected that twenty workmen, representing the principal trades of the town, would be sent to the Exhibition to make a report, each on his own particular industry. The chairman also stated that Mr. Henry Weiss and Mr. W. H. M. Blews had left for Vienna, to represent the hardware trades of the town before the Anglo-Austrian Treaty Commission. Two resolutions, passed at a meeting of the Quebec Board of Trade, convened to meet Mr. Alfred Field, vice-chairman of the Birmingham Chamber of Commerce, upon the subject of abolishing privateering, were read. They were to the effect that the board were strongly of opinion that such changes should be made in the international maritime laws as would protect all private property during war, under any flag, whether neutral or belligerent, except such articles as might be declared contraband of war; and that they would be happy to co-operate with the Birmingham Chamber in any measure proposed to secure that end.

The council decided to petition in favour of the Admiralty Jurisdiction Bill now before Parliament becoming law, which has for its object the extension of the jurisdiction of County Courts to disputes relating to shipping, where the sum claimed does not exceed £500.

The export trade of the country during the month of May was a slight increase upon the corresponding month of 1866 and a considerable increase on that of 1865; but the five months' trade this year are a diminution on the first five months of last year of upwards of £6,000,000 in value; and an increase of only £1,000,000 on the corresponding period of 1865. The precise figures are, May 1865, £13,194,758; May 1866, £15,170,131; and May 1867, £15,936,864. The five months' returns are for the first named year £60,901,476, second £78, 227,710, and the third (this year) £72,123,393. The imports in May are a decrease of about three millions and three quarters, and for the five months a decrease of about twice that amount. Taking iron, we find the falling off to be in railroad iron, in castings, in hoops, sheets, and boiler plates, and—here chiefly—in wrought of all sorts. All the other kinds show an increase. The following table gives the figures for the month and five months of 1866 and 1867 respectively:—

	Month of May.		Five months.	
	1866.	1867.	1866.	1867.
	£	£	£	£
Iron, pig and puddled ..	127,951	168,034	580,181	707,268
Bar, angle, &c.	199,505	208,517	1,016,726	828 525
Railroad	568,172	522,399	1,662,440	1,616,815
Wire	41,589	33,058	193,194	148,158
Telegraphic ditto	36,860	36,478	206,477	66,146
Castings	81,935	72,429	305,347	240,188
Hoops, sheets, &c.	17',593	157,258	768,630	638,435
Wrought of all sorts	271,134	196,284	1,112,070	869,364
Old iron	3.113	23,360	16,047	73,410
Steel, unwrought	94,025	102,162	461,136	59',694

The increase in pig iron is due chiefly to the United States and the group coming under the head of "other countries." The former shows an increase of £20,000, the latter of £22,000 Holland falls off from £32,000 to £23,000. In bar, angle, bolt, and rod iron the increase is mainly due to India, which increase, from £25,000 to £40,000, and to the United States, which goes up from £32,000 to £37,000. There is also a slight increase in the exports to Holland, France, and Italy. British North America falls from £19,000 to £16,000, and Australia from £11,000 to £5000. The falling off in railroad iron is pretty equally distributed among all countries, except Spain, the United States, Cuba, and Chili. Spain shows an increase of £7000; the United States an increase of £45,000; and Cuba an increase of £5000. Chili appears in the return for nearly £3000, as against nothing last year. In castings the increase is mainly due to British India, the round figures being, May, 1866, £9000; May, 1867, £23,000. "Other countries" show a decrease from £41,000 to £27,000. In hoops, sheets, and boiler plates the decrease is pretty equally distributed among all the countries. The only increase of note is in British North America, which only goes up £5000 in a total of £34,000. In wrought iron of all sorts the immense falling off is due mainly to India, British North America, Australia and the United States.

In hardware and cutlery there is considerable increase under the last head, and a more than usually large increase under the head of tools and implements. Manufactures of German silver, pewter, papier mâché, lamps, chandeliers, &c., show a falling off. The figures are as follows:—

	Month of May.				Five months.	
	1866.	1867.			1866.	1867.
Cutlery	£22,868	£39,343	..	..	£200,885	£203,767
Tools..	46,641	62,240	..	..	194,248	189,968
Chandeliers, &c.	277,087	261,147	..	..	1,367,759	1,367,759

The increase in cutlery is almost wholly due to the United States. In May, 1866, the exports were £1402; last month they were £14,593. In tools and implements the increase may be traced mainly to Russia, the United States, and British North America. The Russian exports go up from £16,000 to £25,000. The falling-off in manufactures in German silver, papier mâché, &c., is pretty equally distributed. In copper and brass the decrease lies in brass of all sorts, and in wrought or partly wrought copper, and yellow metal. These are the figures:—

	Month of May.				Five months.	
	1866.	1867.			1866.	1867.
Unwrought copper	£83,513	£87,819	..	..	£258,327	£293,515
Wrought, &c. ..	227,232	179,944	..	..	747,728	785,509
Brass..	22,551	14,466	..	..	99,074	66,810

The marked falling off in wrought copper is mainly due to British India, which shows a decrease from £113,000 to £76,000; and Italy, which shows a decrease from £20,000 to £2000.

There was an increase in arms (excepting small arms) and ammunition, railway carriages, coals, and tin-plates. In the following articles there was a decrease:—Small-arms, carriages, cordage and twine, saddlery, jewellery and watches, ribbons, and carpets. The comparative returns are:—

Miscellaneous.	Month of May.		Five Months.	
	1866.	1867.	1866.	1867.
	£	£	£	£
Arms (small)	32,010	29,783	158,265	182,326
Ammunition, P.	18,312	66,608	101,077	256,682
Railway Carriages	14,580	19,660	70,763	66,963
Carriages (other)	7244	3806	35,601	17,636
Coals, &c.	453,728	563,654	1,948,110	1,985,609
Cordage and Twine	38,483	31,505	193,037	150,610
Carpets	65,484	54,628	451,893	506,149
Jewellery, Watches, &c. ..	35,246	29,617	15',704	173,296
Ribbons	8459	5773	40,073	30,081
Saddlery	24,234	19,143	105 457	81,300
Tin-plates	142,301	200 435	798,232	824,332

There is an increase in the exports of coal everywhere excepting to India. Carpets have fallen off everywhere, particularly in the United States, the exports to which have decreased from £42,000 to £35,000. The United States are accountable for the greater part of the increase under the head of tinplates, the export for the month having gone up from £96,000 to £127,000. British North America shows a falling off of £4000. Other countries show an increase of £16,000. The falling off in ribbons is due to Egypt and Australia.

SCOTLAND: ITS TRADE AND OPERATIONS.

(From our own Correspondent.)

THE GLASGOW PIG IRON MARKET—MANUFACTURED IRON—THE COAL TRADE—VESSELS LAUNCHED DURING THE MONTH OF JUNE—THE SHIP GLENLEE OF GLASGOW—LAUNCHES DURING THE PAST WEEK.

THE pig iron market has been inactive during the past week, with but little desire for business; prices are on the turn in favour of buyers. The stock in store has been reduced 7964 tons during the month, and now is 249,168 tons, being in Connal and Co's stores, 230,271 tons, with warrants in circulation for 214,200 tons; and in the Canal Co's. stores 18,197 tons, with warrants in circulation for 16,700 tons. To-day, Wednesday, only 500 tons reported at 53s. 4½d., one month. Full quotations are as follows:—pig iron, mixed Nos, warrants, 53s. 1d., to 53s. 3d.; No. 1, g.m.b., 53s. 9d. to 54s.; No. 3, 52s. 9d. to 53s.; Gartsherrie, No. 1, 62s. 6d.; Coltness, No. 1, 63s.; Glengarnock (at Ardrossan), No. 1, 60s. to 61s.

At a full meeting of ironmasters on Wednesday, the 26th ult., it was unanimously agreed to continue the reduced make for six months longer.

The shipments of the week are still rather under those of the corresponding week of last year.

The manufactured iron market continues much the same. Prices remain without alteration, but there are more orders in hand, and most of the works in the district have been doing a greater amount of work these last eight days than for some time past. As the season advances we may expect this to continue, as the specifications for autumn shipment will soon be in hand. The demand for warehouse is quiet, and few orders can be looked for till after the fair holidays. In shipbuilding iron there is rather more doing, but we hear still of low prices being accepted, and most of the makers of plates complain that they have only work to keep them going about half-time. Current prices are as follows:—First common bars, £7 10s.; second ditto, £6 17s. 6d. to £7; nail rods, £7 10s.; angle iron, £7 5s. to £9; plates, £8 5s. to £10; all f.o.b. here less usual discount.

Coals have become very dull of sale, the market being almost in a state of stagnation. The limited business done has been at a reduction on our last week's quotations. Freights to the Irish ports are now lower. The advices of coal shipments at the principal ports show an amount rather under that of the corresponding week of last year.

The Board of Trade have presented a handsome gold watch, suitably inscribed, to Captain Bettincourt, commander of the Portuguese schooner Salvador, of Terceira, in recognition of his gallant conduct in rescuing from their perilous position—the ship having lost her rudder—the captain and crew, twenty in all, of the ship Glenlee of Glasgow, on the 4th February last.

Messrs. Barclay, Curle, and Co. launched on the 1st inst., forenoon, from their Stobcross yard, a beautiful iron sailing ship of 1400 tons register, for Messrs. George Smith and Sons. The vessel, which was named the City of Delhi, by Master John Brown, St. Vincent Crescent, will form one of Messrs. Smith's East India packets, and will sail for Calcutta on an early date.

The steam-ship Siberia, the latest addition to Messrs. Burns and Mac Iver's magnificent fleet, was successfully launched from Messrs. Thomson's yard at Govan on the 2nd inst. The Siberia is intended for the Atlantic service of the company.

WALES AND THE ADJOINING COUNTIES.

(From our own Correspondent.)

THE IRON TRADE: *Prospects not so Discouraging: Easier Tone of Monetary Matters: Expected Orders for Railway Iron*—TIN PLATES: *Increase in the Last Five Months' Exports*—THE STEAM COAL TRADE: *Continued Quietness of the Market: Better Inquiry from Continental Markets: Consumption not Equal to the Resources of the District*—PATENT FUEL: *Gradual Extension of the Trade*—THE ROYAL SPANISH COMMISSION: *24,000 Tons of Welsh Coal Required*—THE NEW PIER AT CARDIFF: *Commencement of the Work*—BRECON AND METHYR RAILWAY: *Re-commencement of the Cefn Section*—THE EBBW VALE COMPANY: *Ordinary Meeting*—SHORT SEA COMMUNICATION BETWEEN WEXFORD AND SOUTH WALES: *Proposed Harbours at Rosslare and Fishguard.*

THE prospects of the iron trade at the commencement of the new quarter just entered upon are not so discouraging as at the commencement of the previous one, although it cannot be said that the present quarter has been entered upon under the best of auspices. Last quarter everything looked gloomy, hardly a ray of hope appearing anywhere, and the business of the country seemed to have arrived at a dead lock. Railway securities have since then become more negociable, and monetary matters generally have assumed a somewhat easier tone, although it must be admitted the improvement experienced, comparatively speaking, is a very small one. The confirmation of the old list prices was, under the circumstances, to a great extent anticipated in this district, and now that prices are settled for the next three months it is to be hoped buyers will show more readiness to enter into transactions. As yet no fresh engagements of any importance have been secured, and three or four weeks must pass away before makers are able to form a reliable opinion as to what the requirements of consumers will be. There is no doubt, should the necessary funds be forthcoming, that a good many specifications for railway iron will be offered.

The demand for tinplates remains about the same, but there is better inquiry from the American states. The exports for the past five months amounted to 567,000, or 25,000 boxes more than in 1866, and 110,000 boxes more than in 1865.

There are but few features of change in the steam coal trade since last week's report, and quietness is still the prevailing characteristic of the market. From three or four of the continental markets there is, perhaps, a somewhat better inquiry; but the consumption of the Continent generally is considerably below what it was last year, the falling off being no doubt caused by the depression in nearly all branches of trade. The exports to the West Indies and other mail packet stations keep about the same. In the shipments at Birkenhead there has been a slackening, but this is probably due to exceptional circumstances, and July may witness a decided revival in the railway returns. Before employment at the collieries resumes its wonted regularity there must be a large increase in the consumption, the resources of this district being of a character to require a very large demand. A moderate coasting trade is being done in house coal, the clearances being slightly below the corresponding period of last year.

It is satisfactory to know that several of our local colliery proprietors are exhibitors at the Paris Exhibition, and the massive specimens of coal which they show have rather astonished the French. Quietness prevails at the patent fuel trade, although as a branch of industry it is gradually becoming of some importance in South Wales. Formerly Swansea had a monopoly as regards the manufacture, but the advantages which Cardiff presented soon attracted the attention of capitalists, and several works were established which now give employment to a good number of hands.

The Royal Spanish Commission require 24,000 tons of best Welsh coal to be delivered at ports of the Philliping Islands.

The new pier works authorised by an Act of Parliament obtained last session are now being carried out by the trustees of the Marquis of Bute, who will find all the funds required for the same. It is intended to establish a packet service between Burnham and Cardiff, in connection with the South-Western Railway, when the works are completed.

The works for the completion of the Cefn section of the Brecon and Merthyr Railway, which stopped a few weeks ago, have again been commenced by a new contractor, and it is to be hoped that no further delay will take place in finishing the line.

The third ordinary general meeting of shareholders in the Ebbw Vale Company (Limited) was held in London on Friday last. The report of the directors stated that there were no available funds for declaring a dividend, and the directors reminded the shareholders of the severe financial crisis from which they were then emerging, and which, from its disastrous effects, and from the continued panic feeling which had since prevailed, had never yet been equalled. The balance-sheet showed a profit of £100,551 3s. 2d. for the year, which, added to the balance of £19,172 6s. 2d. brought forward from last year, and to the amount of £4260 8s. 4d. for dividends provided for in last account on shares not entitled to the same, made a total of £123,983 17s. 8d., which, after the payment of interest and expenses and the reduction in the value of stock to meet the present state of trade, will leave an available balance of £35,968 5s. 6d.; this, with the reserve fund, amounting to £85,968 5s. 6d. The directors recommended that of this sum £70,000 be written off against bad and doubtful debts, and that £5,000 be added to the real guarantee fund. There will then remain a balance of £10,968 5s. 6d. to be carried forward to the next account. The produce of the works has been as follows:—

	Years ending March, 1867.		1866.		1865.
Coal	1,023,763 tons.	..	986,575 tons.	..	911,404 tons.
Pig iron	168,841 tons.	..	165,812 tons.	..	148, 43 tons.
Rails and finished iron	109,425 tons.	..	100,066 tons.	..	94,714 tons.

As will be observed from these figures, the annual production of coal, pig-iron, rails, and finished iron has been steadily increasing, and as soon as trade revives, of which signs are becoming apparent, the appliances would be found equal to a considerably increased make of both pig and finished iron, and the supply of coal will be adequate to any demand that may arise. The chairman (Mr. John Platt, M.P.,) having alluded to the unfavourable light in which the directors' report had been regarded by many of the shareholders because no dividend was to be declared, went on to say the fact was doubtless an unpleasant one, but still it was made known at the last meeting that there would not be any dividend this year. Taking into consideration the disastrous character of the past twelve or eighteen months, anyone who would consult their friends who were connected with the coal and iron trade, would find that they would come to the conclusion that a profit of £100,000, which had been fairly earned, was satisfactory, although, from the circumstances explained in the report, the directors had not felt justified in declaring a dividend. The most extraordinary thing about this report was the observations made by the auditors. If those observations were correct the balance-sheet would appear to be very fallacious, but when he told them those observations were not correct, and that, in one essential particular, were totally false, perhaps the shareholders would look a little more charitably upon directors. He (the chairman) would take one of the most material points which had been referred to by the auditors—the bills in hand, which amounted to £41,000. Now the auditors had thought proper to put against that item the words "good and doubtful," which was a most extraordinary phrase—at any rate it at once suggested to the mind of anyone that there was some misgiving about the quality of the bills held by the directors. Then the item of sundry debtors had the same phrase attached to it—that item was a large one, amounting to £320,000, and therefore if there was any doubt about it there would be some reason to expect disastrous results to the Ebbw Vale Company. One satisfactory feature was that since March 1863 not a single bad debt had been incurred, so that whatever proportion of these accounts was doubtful was inherited from the previous company—in other words, the old company had contracts in hand, and the accounts were handed over to the present company. But the most serious statement made by the auditors was that "there was no stock-taking on March 30th." If that statement had been true that of the directors would be altogether fallacious, but he (the chairman) had no hesitation in saying that there was not an atom of truth in it, and that there was no foundation for it whatever. The facts of the case were these—in a large concern like Ebbw Vale, the works of which extending over two or three counties, were every item to be weighed and separately valued, it would necessitate the stoppage of the works for at least six weeks or two months, and that would be necessary every year. As regards the coal, the moment it was taken from the pit's mouth it was weighed and delivered into the store, and entered to the person in charge, and again weighed when it left; thus was kept a regular debtor and creditor account. The same plan was adopted with the iron ore, puddled iron, scrap iron, in fact in every department. After some other remarks a motion adopting the report and balance-sheet was put and carried unanimously. Mr. J. Aspinall Turner and Mr. Francis Phillips were re-elected directors, and the names of Mr. Curtis, Mr. Longsdon, and Mr. Sington were also added to the board of directors, and Mr. W. Cooper and Mr. Quilter were appointed auditors.

A subject of paramount interest to the inhabitants on the Welsh and Irish sides of the Channel is now being agitated by Mr. George Le Hunt and other gentlemen, namely, the opening of steam and railway communication between the south of Ireland and England by means of a proposed harbour near Rosslare, in the bay of Wexford, and a harbour to be constructed in Fishguard Bay, South Wales. It has been ascertained, upon unquestionable data, that Rosslare and Fishguard offer the best points of communication between the two coasts in question, not only as regards length of passage, but also facility of approach and departure at all times. The harbours have been designed to meet the requirements of a packet service equal to that between Holyhead and Kingstown, and a depth of water sufficient for an equally powerful class of steamers will be found at the lowest state of the tide at each place. A revenue sufficient to pay the interest on the capital to be expended on the harbour works may be expected from the tolls to be levied under the Acts of Parliament. The harbours may be easily extended so as to form two of the most useful refuge harbours in a part of the Channel where such refuge is most needed. By means of the railways in Ireland that will converge upon Rosslare, a direct through route, *viâ* South Wales, will be opened to all places in England situated to the south of Birmingham, and a great reduction in the length of journey will be effected between the west of England generally and the south of Ireland. Bristol will be brought nearer by rail to Wexford by 153 miles, to Waterford by 190 miles, and to Cork and Killarney by 145 miles; and when the railway authorised for crossing the Severn near Chepstow is constructed the journey from London to Fishguard will be further shortened by twenty miles.

NOTES FROM THE NORTHERN AND EASTERN COUNTIES.

(From our own Correspondent.)

LIVERPOOL: *Mersey Docks and Harbour Board: The Galvanic (s.): Trade of the Mersey*—LEEDS CORPORATION WATERWORKS—STATE OF TRADE: *Sheffield: South Yorkshire*—THE OAKS COLLIERY—NATIONAL MINERS' CONFERENCE: *Sittings at Bolton*—MANCHESTER STEAM BOILER ASSOCIATION—NORTH EASTERN DISTRICT: *The St. Magnus (s.): Shipments of Rails: Steam Shipbuilding: Death of Mr. R. Hawthorn: Hartlepool Bay: The Cleveland Iron Trade.*

THE Mersey Docks and Harbour Board has carried a bill which it had pending in the House of Lords, with, however, some important provisoes. Thus a proposal that the board should be authorised to borrow capital to the further amount of £1,100,000 was rejected, and a Board of Trade auditor of the accounts of the board is to be appointed. In 1866, the bonded debt of the board was about £13,000,000, while in 1859 it was only about £7,000,000, the revenue of the board in 1859 was £600,000, while in 1866 it was £866,000. The amount paid for interest on bonds in 1866-7 was £625,000. It appears that in the past financial year the warehouses of the board produced a profit of £82,000, or nearly double the amount of profit realised in the previous year. On Friday the new screw steamer Galvanic made her first run from Liverpool to Belfast, accomplishing the distance from quay to quay in eleven hours and twenty minutes. The engines of the Galvanic were supplied by the Greenock Foundry Company. It appears that in the year ending June 24th, 1867, there entered and left the Mersey 3339 foreign trading sailing ships and 4498 coasters, 1328 foreign, and 4184 coasting steamers, making a total of 20,170 vessels, against 21,720 in the previous year. The total tonnage of all classes was 5,318,057 tons against 5,581,322 tons in 1865-6, showing a decrease of 263,265 tons.

The preamble of the Leeds Corporation Water Bill has been declared proved by a Lords committee. Mr. Hawksley, C.E., was examined in support of the bill.

The iron trade of Sheffield and its neighbourhood is dull, but if anything it has become a shade more active during the past week. The demand for steel is on the whole moderate, but there is still a good business doing in steel railway material—rails, tires, axles, and points—much being sent to the Continent and America. Only a moderate business is doing in the file trade. There is little alteration to note in the South Yorkshire iron trade. At the larger works generally the men are more fully employed, but orders are given out sparingly, more particularly on home account. There are a few continental orders for manufactured iron, but the demand generally is languid. Boiler-makers are, upon the whole, doing a fair trade. The machine and casting shops continue busy with colliery and other work.

It is feared that there is still a considerable body of fire in the workings at the Oaks Colliery. A few days will show more definitely how matters stand.

A "national miners' conference" has been sitting at Bolton during the past week. Regret was expressed that for three sessions the reform topic had impeded the progress of the mines inspection question, although recent colliery explosions had demonstrated the necessity for an increase in the number of inspectors. A resolution was adopted in favour of the "eight hours principle," and also in favour of Lord Elcho's Workmen and Masters' Bill, it being affirmed that more injustice and hardship had been caused by the present state of the law to workmen engaged in mines than to any other branch of trade.

At the last monthly meeting of the executive committee of the Manchester Steam Boiler Association, Mr. L. E. Fletcher, the chief engineer, presented his report, which stated that during the past month 202 visits of inspection had been made and 485 boilers examined, 279 externally, 14 internally, 4 in the flues, and 188 entirely. In these boilers 188 defects had been examined, four being dangerous. In one case a double-flued boiler 7ft. in diameter was found to be so seriously corroded internally—the plates in some parts being reduced to half their thickness—that the boiler had to be condemned. The corrosion was due to the character of the feed water, which was drawn from one of the Manchester canals.

On Friday, the St. Magnus, a new paddle steamer built to replace the ill-fated Prince Consort, started on her first voyage from Granton to Aberdeen, Caithness, Orkney, and Shetland. The St. Magnus was built by Messrs. C. Mitchell and Co., of Newcastle-on-Tyne. She is a steamer of 519 tons with engines of 300-horse power. Two large vessels, the Delhi and the Nydia, have been loading in the Tyne docks,—the former with puddled iron from Stockton for Quebec, and the latter with railway rails from Darlington for Madras. Shipbuilding is pretty brisk at Hartlepool, and two large iron vessels at Middleton are nearly ready for launching. Messrs. Pearse and Lockwood, of Stockton, have a twin screw on hand for a Brazilian company; this vessel is nearly ready for launching. The same firm has a steamer of 1000 tons in a forward state, and they are beginning with a gunboat for the English government. At Messrs. Richardson and Ducks, of South Stockton, a screw steamer is nearly finished, and another of 1300 tons is in course of construction. The yard at Middlesborough lately occupied by Messrs. Bimey and Co. is still closed. Messrs. Backhouse and Dixon are building a small screw steamer for the continental pig iron trade. The death is announced of Mr. R. Hawthorn, senior partner in the firm of Messrs. R. and W. Hawthorn, of Newcastle. At the time of his death Mr. Hawthorn was in his 71st year. Mr. Hawthorn began the engine works at the Forth Banks, Newcastle in 1817. The question of dredging the entrance to Hartlepool harbour has again come under consideration. The North-Eastern Railway Company has offered to lend the Hartlepool Port and Harbour Commissioners a powerful dredger at the rate of ten guineas per day, and this offer has been accepted. Mr. W. Jackson has entered into a contract to ship 200,000 tons of coal at West Hartlepool during the present year. The Cleveland pig iron trade is not very brisk; shipments are, however, proceeding to about the usual extent to Scotland, Wales, and the Continent. Contracts are said to have been concluded on continental account. The local demand is represented as somewhat flat. The stock in store at Middlesborough has increased to 74,300 tons; makers' stocks are said, on the other hand, to be slowly working off. The present state of the blast furnaces of the district is as follows:—In blast, 90; out of blast, 29.

PRICES CURRENT OF METALS.

	1867						1866					
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
COPPER—British—cake and tile per ton	78	0	0..	79	0	0	82	0	0..	86	0	0
Best selected	80	0	0..	82	0	0	84	0	0..	89	0	0
Sheet	82	0	0..	83	0	0	87	0	0..	91	0	0
Bottoms	86	0	0..	90	0	0	92	0	0..	93	0	0
Australian, per ton	80	0	0..	87	0	0	83	0	0..	88	0	0
Spanish Cake	72	0	0..	73	0	0	80	0	0..	0	0	0
Chili Slab.	69	0	0..	0	0	0	78	0	0..	0	0	0
Do. refined ingot	79	0	0..	0	0	0	0	0	0..	0	0	0
YELLOW METAL, per lb.	0	0	7	0	0	7¼	0	0	7½	0	0	8
IRON, Pig in Scotland, ton	2	13	1½ cash				2	16	6 cash.			
Bar, Welsh, in London	6	15	0..	7	0	0	7	0	0..	7	5	0
Wales	6	0	0..	6	5	0	6	10	0..	0	0	0
Staffordshire	7	10	0..	0	0	0	8	10	0..	0	0	0
Rail, in Wales	6	0	0..	6	5	0	6	10	0..	6	15	0
Sheets, single in London	9	10	0..	0	0	0	10	10	0..	0	0	0
Hoops, first quality	8	10	0..	0	0	0	9	10	0..	9	15	0
Nailrods	7	10	0..	0	0	0	8	10	0..	8	15	0
Swedish	10	5	0..	10	10	0	11	5	0..	11	15	0
LEAD, Pig, Foreign, per ton	19	5	0..	19	10	0	20	0	0..	0	0	0
English, W. B.	21	15	0..	0	0	0	22	5	0..	22	10	0
Other brands	19	10	0..	19	15	0	20	0	0..	20	5	0
Sheet, milled	20	15	0..	0	0	0	21	10	0..	21	15	0
Shot, patent	23	0	0..	0	0	0	24	0	0..	0	0	0
Red or minium	21	5	0..	0	0	0	22	0	0..	23	0	0
White, dry	29	0	0..	29	10	0	29	0	0..	32	0	0
ground in oil	28	0	0..	30	0	0	28	0	0..	30	0	0
Litharge, W.B.	25	0	0..	0	0	0	24	15	0..	25	0	0
QUICKSILVER, per bot.	6	17	0..	0	0	0	7	0	0..	0	0	0
SPELTER, Silesian, per ton	20	12	6..	20	15	0	24	0	0..	0	0	0
English sheet	27	0	0..	0	0	0	28	10	0..	0	0	0
White zinc, powder	0	0	0..	0	0	0	0	0	0..	0	0	0
STEEL, Swedish faggot	0	0	0..	0	0	0	0	0	0..	0	0	0
Keg	0	0	0..	0	0	0	0	0	0..	0	0	0
TIN, Banca, per cwt.	4	12	0..	0	0	0	3	18	0..	0	0	0
Straits, fine—cash	4	6	9..	4	6	10	3	15	10..	3	16	10
Prompt 3 months	4	7	0..	4	8	0	3	17	10..	3	18	0
English blocks	4	8	0..	4	9	0	4	3	0..	4	5	0
Bars	4	9	0..	4	10	0	4	4	0..	4	6	0
Refined, in blocks	4	12	0..	0	0	0	4	6	0..	4	8	0
TINPLATES, per bx of 225 sheets												
IC coke	1	3	6..	1	4	6	1	6	0..	1	7	0
IX ditto	1	9	6..	1	10	6	1	11	0..	1	12	0
IC charcoal	1	8	0..	1	10	0	1	11	0..	1	13	0
IX ditto	1	15	0..	1	17	0	1	18	0..	2	0	0

PRICES CURRENT OF TIMBER.

	1867.				1866.			
Per load—	£	s.	£	s.	£	s.	£	s.
Teak	9	0	10	10	11	10	12	10
Quebec, red pine	3	0	4	10	3	5	4	15
yellow pine	2	15	4	0	2	15	3	10
St. John's N.B., yel.	0	0	0	0	0	0	0	0
Quebec, oak, white	5	5	6	0	5	0	5	10
birch	3	10	4	10	4	5	4	15
Memel	0	0	0	0	0	0	0	0
elm	3	10	5	0	3	10	5	0
Dantzic, oak	3	10	6	0	3	10	6	0
fir	2	0	3	0	2	5	3	10
Memel, fir	3	0	3	10	3	5	3	10
Riga	3	0	3	5	3	5	3	15
Swedish	1	15	2	2	2	5	2	10
Masts, Queb. rd. pine	6	0	7	0	6	10	8	10
yl. pine	5	0	6	0	5	0	6	0
rd. pine	0	0	0	0	0	0	0	0
Lathwood, Dantz. fm.	4	10	5	0	5	0	6	0
St. Peter's	6	10	7	10	7	0	8	0
Deals, per C., 12ft. by 3ft. 9in.								
Quebec, wht. spruce	14	10	21	10	13	10	19	10
St. John, wht. spruce	13	10	15	10	13	0	15	10

	1867.				1866.			
Per load—	£	s.	£	s.	£	s.	£	
Yel. pine, per reduced C.								
Canada, 1st quality	17	0	19	10	17	10	20	0
2nd do.	12	0	13	0	12	10	14	10
Archangel, yellow	11	10	12	10	12	0	13	0
St. Petersburg yel.	10	10	11	0	10	10	12	0
Finland	8	0	9	0	8	0	10	0
Memel	0	0	0	0	0	0	0	0
Gothenburg, yel.	8	10	10	10	9	0	10	10
white	8	0	9	0	8	0	9	0
Gefle, yellow	9	0	11	0	10	0	11	0
Soderhamn	9	0	10	10	9	10	11	0
Christiania, per C. 12ft. by 3 by 9 in. yellow	16	0	22	0	18	0	23	0
Deck plank, Dnt. per 40ft. 3in.	0	15	1	0	0	14	1	6
Staves, per standard M.								
Quebec pipe	80	0	90	0	80	0	85	0
puncheon	20	0	21	0	20	0	25	0
Baltic crown pipe	150	0	180	0	170	0	190	0

ADMISSION TO PALACES, MUSEUMS, &c., DURING THE PARIS EXHIBITION.—It has already been announced that special facilities are afforded to visitors during the entire season of the present exhibition, but every day adds some new item to the list of attractions. The palaces of the Tuileries, Saint Cloud, the Trianon, and the Château of Malmaison are open three days in the week, and those of Versailles, Fontainebleau, and Compiègne every day with the exception of Monday, unless the Emperor or Empress should be residing there. The Imperial factories of Sèvres and the Gobelins also three times a week, the Louvre every day except Monday, the Museum of Cluny and the Ecole des Beaux-Arts every day without exception, the Sainte Chapelle and the Church of St. Denis four times a week. The usual hours of admission are from eleven or twelve to four or five, but there are some exceptional cases. No passport, ticket, or permission is required in the case of any one of the above establishments, no fees are permitted to be taken by the attendants, and visitors may, if they please, retain their sticks or umbrellas in the Louvre or at Versailles. The Trianon and Malmaison have been placed, under the direction of the Empress, as nearly as possible in the same state in which they were in the time of Marie Antoinette and the Empress Josephine, all the existing relics having been replaced. The museum of arms and armour in the Château of Pierrefonds has also been opened to the public on two days of the week since the commencement of the present month. The Prefect of the Seine has decided that the catacombs shall be open every Saturday during the period of the Exhibition to all persons who may apply to the prefecture for tickets of admission. Lastly, Prince Napoleon has thrown open his artistic and other collections in the Palais Royal five days in the week; tickets to be had on application to the Prince's private secretary, or to the Intendant of the Palais Royal. It may not be out of place, in connection with the above, to add that in a few days the restorations of the interior as well as of the exterior of the cathedral of Notre Dame will be completely finished. Much of the decoration of the choir, executed in the time of Louis XIV., has been replaced, including a marble group by Nicolas Coustou; the statue of Louis XIII., by Guillaume Coustou; that of Louis XIV., by Coysevox; and six statues of angels. The mosaic pavement has also been completely restored. The railings of the choir, of the time of Louis XIV., having been destroyed, they have been replaced by a new gilded iron screen bearing the cyphers and emblems of Louis XIV. and Napoleon III., and a Latin inscription describing the enclosure and decoration of the choir from 1163 to the present time. The carved stalls and other fittings and decorations have also been restored or replaced.—*Journal of the Society of Arts.*