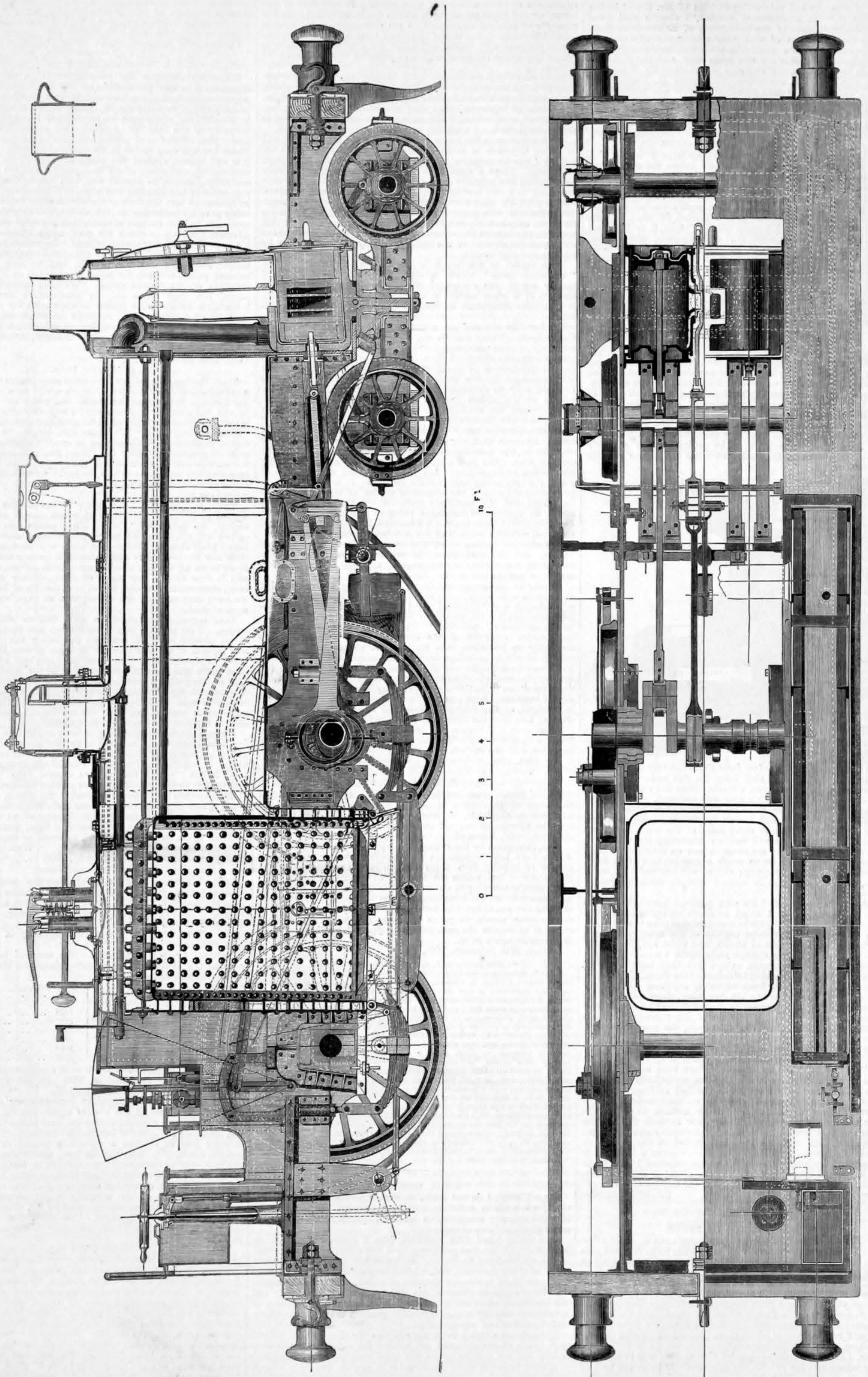


STANDARD ENGINE, NORTH LONDON RAILWAY.

DESIGNED BY MR. W. ADAMS, LOCOMOTIVE SUPERINTENDENT, BOW.



TO CORRESPONDENTS.

NOTICE.—A SPECIAL EDITION of THE ENGINEER is published for FOREIGN CIRCULATION. This edition, printed upon paper manufactured for the purpose, will pass through the foreign post offices at the charge of a single postage.

* * 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 of 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; any received after that time must necessarily stand over till the following publication.

* * 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.

E. F. (Kensington).—Yes.

T. E. G.—Thanks for your note.

E. A. (Clarence-street).—Humber's.

INQUIRER.—The weight of the rim only.

A. C.—We cannot understand the construction of your slide valve from your description. Send a sketch.

T. W.—There is no separate treatise on the subject. You will find it carefully treated in Rankine's "Applied Mechanics."

T. M.—Several experiments have been made. The results have been disputed, and the whole question deserves further investigation. The force pump is very much more economical than the injector.

H. W.—The steam jet in the chimney has been included in many patents, but it does not form in itself a good subject for one, and you may use it as freely as you please. It is public property in the fullest sense of the term.

W. W.—The cup leather packing consists of a ring of stout leather doubled on itself, so that its cross section resembles a. This is slipped round the ram and lies in a recess near the top of the cylinder. The water entering between the two leather surfaces forces them apart and against both the ram and the cylinder, making a tight joint.

W. H. S.—More power is expended in causing the revolution of the cylinder than can be recovered from the steam produced, therefore the machine would not work. Power can never be had for nothing. Purchase and read Tyndall's "Heat as a Mode of Motion." You will find it equally interesting and instructive, and the price is very moderate—only a few shillings.

P. J. L. (Manchester).—We have closely examined the specification, and we confess we are at a loss to trace any remarkable resemblance between the two inventions. That certain principles are common to both is true, but the details are as dissimilar as they can possibly be; and in this respect the design we have illustrated is so much more simple than yours that it is much the better of the two.

W. R.—We might write a long treatise in replying to your question. We have only space for a general answer. The friction of steam and air flowing through straight pipes is practically so small that you need not include it in your calculations; that of water is more considerable, and depends on the diameter of the pipes—their form, material, length, the curves to which they are laid, &c.

W. H.—Fours is really a wonderful invention. As you have managed to dispense with ropes, blocks, tackles, handspikes, winches, slides, endless chains, friction rollers, compressors, turntables, hydraulic and steam power, in working guns, do you not think it is possible that you may yet succeed in dispensing with powder and ball, and ultimately with the guns themselves? We think it very probable.

MANCHESTER.—Your first question involves points of such extreme nicety that it can only be satisfactorily answered by a lawyer skilled in patent business. We fancy that in the second case it will be possible for an experienced person to draw up a specification which cannot be readily infringed. Still, if you can work your invention to advantage in secret we cannot advise you to patent it.

LITTLE.—The phenomena to which you refer has no connection with the working of the injector. Water boils under atmospheric pressure, at 212 deg. As the pressure is reduced so is the boiling point. When water is poured on the outside of the flask the steam within is suddenly condensed, a partial vacuum is formed above the heated water, and being thus relieved of pressure to a certain extent, the water boils at 180 deg. or thereabouts, and will continue to do so until the pressure is raised sufficiently to arrest it.

STEAM RAM.—Isherwood's book is exceedingly useful, provided it is read with judgment. It contains almost as many truths as it does fallacies. We advise you to read it, but do not suffer yourself to fancy that deductions from isolated experiments constitute laws of unvariable application. Brown and Maine on the steam engine is a useful work for sea-going engineers. Messrs. Lockwood, Ludgate-hill, will possibly procure for you the pamphlet referred to.

R. E. S.—1. It would be very unwise to reduce the area of water surface, because it would induce priming. 2. The economy of fuel is not affected by the quantity of water carried as much as you suppose. 3. We fancy that you would experience much difficulty from the over-heating and burning of the plates. 4. The scheme is so similar to that commonly known as Lefroy's, and illustrated in THE ENGINEER last year, that we cannot help regarding the principles involved as being very nearly identical, although the details are not quite the same.

TROUGH GIRDETS.—We think it possible that we misunderstood a question asked us by a correspondent with regard to trough girders last week. We gathered that he alluded to a peculiar channel beam, proposed, we believe, by a Mr. Latham, of Cambridge. Assuming that the ordinary flanged trough girders were really meant, then the calculation of the breaking weight does not in any respect differ from that of simple web girders. Taking $W =$ the breaking weight in tons; $c =$ a constant, say 26, for cast iron; $a =$ the area of the bottom flanges in square inches; $d =$ depth of girder at centre; and $b =$ length between supports, both in inches; then—

$$W = \frac{c a d}{b}$$

S. B. (Dublin).—There is always a loss of pressure between the cylinder and the boiler, and therefore, in the absence of an indicator, it is impossible to determine actually what the initial pressure is. Assuming, however, that it is known, and also the point of cut off, which may be ascertained by taking off the valve-chest lid and ascertaining the point of the revolution at which the valve just covers the port, or by setting out the gear carefully, the average pressure may be ascertained by the following formula:—Let $L =$ stroke in inches; $R =$ ratio of expansion; $X =$ the hyperbolic log. of R ; $P =$ initial pressure per inch; \bar{p} , mean pressure. Then $\bar{p} = \frac{P}{R} \times (1 + X)$. Or, by rule; divide the initial pressure by the ratio of the expansion, and multiply the quotient by the hyp. log. of the ratio + 1. If steam is cut off at half stroke the ratio is 2, and the hyp. log. of this is .693; if at one-fourth, the ratio is 4, and the hyp. log. 1.386, and so on.

COKE GRINDING MILLS.

(To the Editor of The Engineer.)

SIR,—Can any of your readers inform me where I can purchase a machine which will grind small coke to a powder? I have tried rollers, they are of no use; edge runners will not turn out a sufficient quantity. J. E. February 28th, 1866.

FRANKLIN BRICK.

(To the Editor of The Engineer.)

SIR,—I shall feel much obliged if you will favour me with the name and address of a maker of frames for manufacturing Franklin brick. W. H. D. Devonport, Feb. 28th, 1866.

RAILWAY SIGNALS.

(To the Editor of The Engineer.)

SIR,—Replying to your correspondent, "A Subscriber," I beg to say that the locking system, as applied to railway signals and point levers, was first invented by my client, Mr. Austin Chambers, whose patent was purchased and is now worked by Messrs. Saxby and Farmer. FRANCIS WISH. Chandos-chambers, W.C., Feb. 28th, 1866.

EXHAUST FANS IN COTTON MILLS.

(To the Editor of The Engineer.)

SIR,—Can you, or any of your able correspondents, inform me when, and by whom, the exhaust fan was first applied to the scutching machines in cotton mills? The introduction of this apparatus dates from at least forty years back, but I should be glad to know the exact date of the first application of the EXHAUST FAN.

RAISING STEAM WITH GAS.

(To the Editor of The Engineer.)

SIR,—Can you, or any of your numerous readers, inform me of any instance in which gas is in practical use as fuel for steam boilers; also if there are any makers of steam boilers and engines specially designed for the purpose? Manchester, February 27th, 1866. H. F.

ENGINEERING DIPLOMAS.

(To the Editor of The Engineer.)

SIR,—You will much oblige by informing me what colleges or universities in the United Kingdom have schools of civil engineering attached to them, and grant diplomas in engineering, and which of them you would recommend as the best a student could enter. Whether or not a student, in order to receive a

diploma in engineering, would be compelled to pass preliminary examinations in classics, &c. What treatise on civil engineering would you recommend? February 20th, 1866? A. M.

[The Universities of Dublin and Glasgow, and the Queen's Universities in Ireland, have schools of engineering attached to them, and grant diplomas. King's College, London, has also an engineering school. The diploma of the Dublin University is considered to stand high as a qualification. In the Irish Universities, and probably also at Glasgow, matriculation is essential before the student can join the engineering school, and therefore a certain degree of classical knowledge is requisite, but no more is exacted than the minimum that a civil engineer should possess. No single treatise that we know of can we recommend as thoroughly practical in all branches of civil engineering. Rankine's Manual is probably the best.—ED. E.]

MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, 6th March, at 8 p.m.: Discussion on "The Hydraulic Lift Graving Dock."

SOCIETY OF ENGINEERS.—Monday, March 5th: "On Arched Roofs," by Mr. C. R. Wessely, at seven.

ROYAL UNITED SERVICE INSTITUTION, Whitehall-yard.—Evening meeting, Monday, 5th March, at 7.30 p.m.: "The Mode of Testing Electric Cables," by C. W. Siemens, Esq., C.E., F.R.S.

Advertisements cannot be guaranteed insertion 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.

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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.

THE ENGINEER.

FRIDAY, MARCH 2, 1866.

THE STANDARD ENGINES ON THE NORTH LONDON RAILWAY.

THE North London Railway presents many points of interest for the engineer. The line abounds in sharp curves and steep inclines. The stations are situated in close proximity, and a heavy passenger traffic has to be conducted under all the difficulties peculiar to metropolitan railways, without interfering with a still more heavy goods traffic. Locomotive power is, therefore, taxed to the uttermost, and large demands are made upon the skill and judgment of those who have the management of the line. The North London Railway, properly so called, consists of a very few miles indeed of track, but these few miles form connecting links for other lines, such as the London and North-Western and the Great Eastern, and thus the aggregate distance run over, including the various branches, amounts to about twenty miles. To work this properly no fewer than fifty-three engines are at present found necessary, and this number, large as it is, is being augmented from day to day. An engine per mile is considered rather a liberal allowance for ordinary service, yet it will be seen that the North London Railway has none too much power, when we state that of these fifty-three engines forty are under steam daily. This is very sharp work, and it becomes important that no time should be wasted in effecting repairs. For some years past Mr. William Adams, the superintendent of the line, has been devoting his energies to the production of a standard locomotive which shall satisfactorily comply with the conditions under which alone the line can be worked with regularity and economy. It is not too much to say that he has succeeded in producing a locomotive which, if not the very best of its kind, is certainly not very far short of being so. Mr. Adams has courteously placed drawings of this engine at our disposal, from which the engraving on the opposite page has been prepared. It possesses several peculiarities which render it well worth the attention of our readers.

As will be seen at a glance, this locomotive, the third completed as yet, eight or ten being still in hand, is an inside cylinder tank engine, with the driving and trailing wheels coupled, while the forward end of the machine is supported on a four-wheeled bogie invented by Mr. Adams, of rather novel construction. We have already described and fully illustrated this bogie in THE ENGINEER for the 12th January, and we need not therefore stop to consider its peculiarities at length here. The weight of the engine is 42 tons full—almost exactly the same as that of Beyer and Peacock's engines working the Metropolitan (underground) line—of which about 30 tons are carried by the four drivers, 5ft. 9in. in diameter, and 12 tons by the bogie, which is fitted with wheels 3ft. in diameter. The tires are all of Krupp's or Bessemer steel. The tanks, placed on the side frames, hold 1,100 gallons of water, and the coal-boxes 25 cwt. of coal. The cylinders are 17in. in diameter and 24in. stroke. They are cast by a private firm at Bow. We have been unable to ascertain the exact mixture used. The grain of the castings is rather coarse, yet we understand that the cylinders are very hard and equable in their texture, and wear remarkably well. All the valve link motion is of Bessemer steel, case-hardened as though it were wrought iron, and from its peculiarly equable texture, it assumes a surface and takes a polish seldom attained with wrought iron. The eccentric sheaves, of cast and wrought iron, are of the ordinary construction, each secured to the Bessemer steel crank shaft by two set screws and a small key. The straps fitted up with brass rings are of wrought iron, in one piece with the eccentric rods. Liners, also of brass, are interposed between the bolt cheeks, and as these are hollowed out at the sides a small bearing surface is left, which is easily filed down when it is required to tighten up the straps. All the valve gear is made of unusual strength to provide for the strains thrown upon it by the great pressure—160 lb.—at which the engine is worked; it will also be seen that the steel guide bars are of unusual breadth, while an enormous surface has been given to the guide blocks.

The boiler barrel is 49in. in diameter inside, made with a flush fire-box, and put together with welt joints. The rivetting is double throughout. The plates are 1/2 in. thick—possibly the heaviest ever used in a modern locomotive.

The products of combustion are led to the smoke-box by 120 tubes of brass, 2 1/2 in. diameter at the front end, where they are flared out for a short distance to a diameter 3/8 in. greater than at the back tube-plate, allowing the ferrule to run flush with the inside of the rest of the tube, or nearly so, and thereby leaving the draught space free from obstruction. One hundred and twenty tubes may be considered by some engineers as a small number for a 49-in. barrel; but Mr. Adams prudently attaches much value to internal circulation. The tubes are, therefore, spaced 7/8 in. apart, and are arranged in parallel vertical rows. His practice, in this respect, deserves to be commended. The fallacy involved in filling a boiler with tubes without providing means for ensuring efficient circulation, is so evident that it is a matter for some wonder that it has not been fully recognised long ago. The dimensions of the fire-box may be obtained from the engraving. The brick arch is supported, not, as is usual, on angle irons, but on studs screwed into the internal fire-box, and these are easily replaced when burned out. At the lower corners of the arch, right and left, an open space is left at each side, through which dust and ashes that would otherwise choke up the lower row of tubes by settling on the bridge, pass through and fall back to the grate as they are shaken down by the motion of the engine when running. A ring of jets is employed in the chimney to keep down smoke with the aid of a scoop deflector, when the engine is standing. The fire-doors slide right and left, and therefore do not take up space on the foot-plate, which is excessively roomy, we may add, for a tank engine.

The coupling rods of the engine are of Bessemer steel forged in one piece from the ingot, without a weld. They are made without adjustable brasses, on a system worked out very extensively by Mr. Ramsbottom, which deserves a moment's notice. Mr. Ramsbottom, as is well known, has brought labour-saving appliances to great perfection. He assumes that standard engines should be adopted for each species of traffic, and that the parts of these engines should be interchangeable. He further assumes that the principal cost of repairs is due to a multiplicity of trifling little jobs, which occupy much time, and show little for it. Of these repairs a large proportion is connected in some way with the wear and tear of brasses. In order to get rid of them he makes the small ends of his connecting rods without straps and cotters, fitting them with a hardened steel bush working on a hardened steel pin. The large ends are lined with Babbitt's metal, a mixture of tin with a little copper and antimony. As a rule no brasses are ever tightened up on the London and North-Western Railway. The bearings are bored out to gauge in the first instance, and sent to work. When they have worn slack, the Babbitt's metal "brasses" are removed and replaced by new ones, the old ones being melted up. In like manner the eccentric straps are lined with white metal. The moment they become slack these lining rings are removed, melted up, and new liners put in their place. But the sheaves wear as well as the strap liners, and therefore three different sizes of eccentric strap liners are kept in stock. When the sheave becomes too small for the smallest of these it is in turn rejected and replaced by a new one. Mr. Adams has not yet been able to adopt this system fully, because his engines differ greatly in pattern from each other, but he applies it where practicable. The bearings of his coupling rods consist of Babbitt's metal fixed in a cast iron bush, which is forced into the eye forged on the coupling rod end by a flogging hammer, and secured by a key and a couple of bolts. These bearings last for four or five months without being adjusted in any way. When they become slack, the cast iron box is driven out and replaced by a duplicate ready lined. Thus there is neither delay nor trouble; and as all the bearings are accurately bored to fit the pin, which is 4in. in diameter, heating never takes place. The keys and bolts cost money, however, and this Mr. Adams proposes to save in future by strengthening the eyes of the rods and forcing in wrought iron or steel boxes, lined up as before, by hydraulic pressure, thus rendering keys and bolts unnecessary. The horn-blocks are simple steel castings, supplied by Messrs. Naylor and Vickers, costing at the rate of about £40 per ton, at which they prove as economical as the ordinary cast iron blocks, when all things are considered, and make an admirable job. Their wedges are also of cast steel. The coupling rods are very deep and thin; they never break since they have been made each in a single piece.

The regular load for these engines at present is twelve passenger carriages, weighing empty about 7 1/2 tons each. The second-class carry fifty passengers, and the first-class thirty-two. But they are employed for both goods and passenger traffic indiscriminately; and goods trains usually consist of forty-six wagons, each having a minimum weight with its load of 7 1/2 tons. Thus the gross load to be moved, including the engine, reaches 387 to 400 tons. There is an incline of 1 in 60 on that part of the line between Dalston and Shoreditch, entered, too, by a curve of but ten chains radius; and leaving out minor curves, inclines, and crossings without end, we find another incline of 1 in 100 between Kingsland and the Caledonian-road, on which there are no fewer than three stopping places. It is true that in theory these latter should not affect the goods traffic, but in practice they do; and thus extraordinary power is necessary in engines, which must not only be able to start and haul their trains, but to start them and get up speed with great rapidity, no matter what the weather. In order to provide against slipping, the use of sand has been brought to the greatest perfection apparently attainable. We have had occasion ere now to call attention to the admirable system under which sand is used on this line, and we need only add as far as regards this sanding apparatus, that Mr. Adams has applied one or two finishing touches which render the whole affair so far perfect that we really do not see what more is required. We hope to be able to publish a drawing of this apparatus to a large scale in an early number. The sand used is of excellent quality, and it may startle some of our readers to learn that no less than twenty tons of it are used per week on the line—that is, half a ton per engine. The sand is brought into the running shed in trucks, and

shovelled into a large tank over the lighting-up furnace, where it is effectually dried. From this it is passed into a revolving screen worked by manual power, by which all the stones are quickly removed, and the fine sand is then delivered clean and dry to the engines.

We have not space at present to dwell more fully on the working of this line; we may possibly return to the subject at an early opportunity. We must add one word, however, as to the working of Mr. Adams' bogie. We have ridden on the buffer-beam while the engine illustrated ran at speed over the worst bits of road near Bow, and we found the motion as easy as that of a first-class carriage. Vibration is completely taken up by the india-rubber blocks, and the engine, instead of jerking and grinding round curves, swings—we cannot think of a more expressive word—round them with an ease which, if not surprising under the conditions of its structure, is at all events unique.

COMMUNICATION WITH INDIA.

On Tuesday night the unusual phenomenon of a warm debate on an Indian subject took place in a full meeting of the House of Commons. In the days of old the eloquence of Burke roused indifferent members to a half appreciation of the fact that, far away in the remote East, was a country vastly larger than the United Kingdom, peopled by millions of inhabitants, having a high state of civilisation, originally governed by native princes outshining European potentates in the splendour of their courts, and possessing a literature of nearly the highest antiquity upon earth. Yet Indian legislation once more fell into the hands of yawning members and half empty benches, so much so that a year or two ago there would have been a count-out on the Indian budget, with its rich rain of golden figures, had the ordinary rules of the House been in force, whilst the few who listened on the occasion seemed to be "Nid, nid, nodding, around the great Mogul," as the song has it. At the present time, also, thousands of the members of our richest and poorest English families should draw attention to India, where they are finding either a home or a grave—to the land where the "gentle Indian" of the poet "kneels to the lotus flower," and where the lying Asiatic of real life burns widows, feeds crocodiles with children, and gets drunk on bhang.

The subjects of debate on Tuesday night, were railway and telegraphic communication with India. These matters during the past year, have received constant attention at the hands of THE ENGINEER, later still the example was followed to a limited extent by the *Times*, but as far as we are aware by no other English journals; yet how different was the state of public feeling on the subject in India, where the newspapers teemed with complaints of the want of communication with home, and they do so still. The motion of Mr. W. Crawford attracted no previous attention in England, yet it was canvassed in the *Friend of India* and other journals in that country, more than six weeks ago, so the interest in the subject is very warm on the other side of the world. Mr. Crawford, who said that he spent £3,000 a year in telegraph messages, moved for a select committee to inquire into the practical working of the present system of telegraphic and postal communications between this country and the East Indies. He and other speakers then produced statistics proving that our telegraphic communication with India is in a most disgraceful state, but they cited scarcely any additional facts beyond those which have already appeared in our columns. It was stated that in 1864 our imports amounted to £275,000,000, of which India supplied no less than 20 per cent., and Ceylon, China, Singapore, Japan, and other eastern countries, 12 per cent. more, making a total of one-third of the whole, or £91,700,000. Of the exports amounting to £212,500,000, these countries had taken no less than £42,000,000 sterling. Such a trade as this, it was submitted, would well support a telegraph to India and the East. The speakers, however, brought forward some instances of the great injury inflicted upon business men by the blunders in messages by the Indo-European line. A Liverpool house sent a message to India in September last, "Contract for 1,000 bales." This was delivered as "Contract for 21,000 bales"—not a very slight alteration when it is considered that the bales cost £20 each. A great mercantile house was ruined rather more than a year ago through a similar error, a message requesting them to purchase 500 bales of cotton, being telegraphed as 5,000 bales. Another firm received a message to the effect that their managing partner at Bombay was seriously ill and about leaving, so they at once sent out a gentleman at a salary of £1,000 a year to take his place. It afterwards turned out that the message did not come from Bombay at all, but Madras, and that it originally simply stated that one of the clerks was ill. The same parties complained that eleven messages had not been delivered at all, and that four were above a month in transmission, and that two when delivered were quite unintelligible. Such are a few of the examples given in the House of Commons, and we may add that the latest news from India announces that the delays still continue, the average time for the transmission of messages being three weeks, so that letters get there nearly or quite as soon, and have the advantage of being intelligible.

In England the sender of messages to India has the choice of two companies, to either of which he may confide his communications, together with £5 odd. The first of these, the Electric and International Telegraph Company, sends the message first to Hamburg or Berlin, then to Vienna, then over another system to Belgrade, Constantinople, then to the head of the Persian Gulf, where it passes into the hands of English signallers, and is then sent through the cable to Kurrachee. The other route, by the Submarine Telegraph Company, is to Paris, thence either to Vienna, as before, or by way of Italy, Macedonia, or Thessaly, to Constantinople. In either case it has to go through Turkey, where the greater part of the mischief is perpetrated. Sir Charles Bright stated that were it not for Turkey the average rate of transmission between England and India would be three

hours. Now as the average rate to and from Spain is more than three hours, this is a stretch of the imagination of the speaker, who, nevertheless, is a good practical man, and must know that with the few wires, numerous transmitting stations, and superfluity of messages, the best English signallers obtainable could never send the Anglo-Indian telegrams at an average speed of three hours between the terminal stations. When Mr. Henley's new Persian Gulf cable is laid, there may be more chance of the execution of such feats on the removal of Turkish obstructions.

As regards Turkey we have already published the fact that many of the Turkish telegraph officials get no salary, and frequently earn a living by delaying and selling the English telegrams, so no wonder these sometimes never arrive, or are delivered in such a fragmentary condition that Professor Owen could scarcely unite their disjointed bones. This fact was mentioned in the House of Commons; also another, namely, that in some instances persons in the fields have attached wires to those on the line, and read off the messages by means of instruments sheltered by a tent. These curious facts must be very interesting to those English merchants who paid for the said telegrams. Messages formerly went quicker because Daoud Effendi, who once had control of the telegraph department, had a considerable amount of conscience for a Turk, and tried to do his best with the other "true believers" under his charge. This officer, however, has been removed, and appointed to the government of the Lebanon, and is succeeded by a true Turk, who not only will not assist, but opposes improvement. We gather further information about the delay of messages in Turkey from the *Levant Herald*, which says:—

"Practically, the whole traffic—not merely between Constantinople and Western Europe, but between the latter and India, and *vice versa*—is cast upon a single wire. The result is, that messages accumulate at the two Servian frontier stations by hundreds at a time, entailing delays which, when aggravated by a break-down of the Turkish wires, often leaves the telegraph hours, or even days, behind the post. In Asia the state of things is, if possible, worse. The line to Bagdad and Fao, along which the Indian messages are sent, consists of only two wires—except to Diarbekir, to which a third wire has recently been laid without a single insulator from Scutari to the Tigris. Of this line again, one at least of the wires is generally unserviceable, and the other is then monopolised by the Government, to the complete suspension of the Indian traffic, be the pressure or importance of this last at the time what it may. Thus it is that a London message for Kurrachee is not unfrequently six, eight, or ten days in reaching the Gulf cable, while there is no physical reason whatever why the transmission should not be effected in as many hours."

This local authority then states that the mismanagement begins at the extreme edge of the Turkish dominions, on the borders of Servia. In fact the difference between the Servians and Turks has within the last two or three years become physically visible all along the frontier line; because recently the Servians have been making good roads which run right up to the Turkish line of demarcation, and there end abruptly in fields, bogs, or waste land. Thus the Turk preserves his character, earned in ancient times, and is the same arrogant, ignorant, fanatical, and tyrannical individual who blighted Grecian civilisation, and brought the character of the finest empire of the olden time down to his own level. Turkish attendants on Europeans are usually known to their acquaintances as "hog drivers," and once, when a European ambassador told the Grand Vizier of the recent marriage of the Imperial potentate he represented, he was answered that "the Sublime Porte did not concern itself in the union of one hog with another." Just so will not the Sublime Porte trouble itself about the union of two pigsties by a telegraph wire, especially as, under present circumstances, the missing telegrams bring cash into the pockets of the faithful.

Turkish officials being quite unfit under any circumstances to transmit English messages with care and accuracy, applications have been made to the Sublime Porte to allow European signallers to be placed on the lines. In opposition to this reasonable reform, comes the great hindrance to better communication of any kind with India. French and Russian jealousy at once opposed the installation of English signallers, and the same would be the case with England and Russia against France, or England and France against Russia, for not only does the "sick man" hold the key to the Black Sea, but guards the great highway between the Mediterranean and the East.

Fortunately for the Peninsular and Oriental Steam Navigation Company, the great failure of the Indo-European telegraph distracted most of the attention of the House from the high charges and low rate of speed of the vessels of this otherwise well-managed body. No mention was made about the enforcement or non-enforcement of the conditions of the contracts for the conveyance of mails, but the committee would do well to examine whether the statements made in Indian newspapers are true—that responsible Government officials have neglected their duty, and not enforced the penalties due from the Company when the mail steamers did not keep time.

It will scarcely come within the province of the committee to consider the question either of a through railway to India, or the line to the head of the Persian Gulf, proposed by Mr. W. P. Andrew. Political more than physical difficulties stand in the way of both these undertakings. The Emperor of the French watches any movement connected with the Euphrates Valley scheme with much interest, perhaps with the same keen and needless jealousy with which the English have watched the progress of the Suez canal. At one time, in fact, it was seriously contemplated to unite these two schemes under one board of directors composed of English and French capitalists. The late Lord Palmerston was a friend to the construction of this railway, and would probably have given his influence in its aid had not miserable political complications stood in his path. Because of these hindrances a week of waste and expensive time unnecessarily separates the English in India from their native land, from home, and from health. The Sublime Porte in this instance does not stand in the way, and has actually raised its original

offer of guaranteed interest by two per cent. A short length of line only to the Euphrates would partly open the new route at once, as the river is navigable a long way from its source. The recent surveys that have been made of the river have given less favourable results than those of Major-General Chesney, and to secure safety there is no doubt that the railway must transfer its traffic to the Euphrates much lower down than was at first proposed by the Euphrates Valley Railway Company, which will ere long again show signs of life.

THE VENTILATION OF MILLSTONES.

It becomes every day more and more evident that the greatest modern improvement made in corn mills consists in the application of a current of air to the grinding surfaces. We will not now enter into the history of this great improvement, more especially as we have heard from a trustworthy source that M. Armengaud (*ainé*), of Paris, is now preparing an historical account of these inventions, which is to appear in the next volume of his noted *Publication Industrielle*. There are many unhappy millers in this country who need not to be informed that the English history of ventilating millstones is not devoid of even sensational features. It may be sufficient for our present purpose to refer to an article we published last year,* which clearly showed that the first steps in this direction, as in so many others, were taken by our ingenious neighbours the French, who were, indeed, always noted for their excellent system of milling. Again in this case did necessity conceive invention; and the luxurious demand for perfectly white bread required an attention to the means for obtaining the finest flour. Perhaps the most elaborate and scientific system of milling is to be found in the large mills of the imperial city of Vienna. There, absolutely all the bread makes its appearance on the table in the form of small rolls of the most varied shapes. The pastry of the *Kaiserstadt* is also renowned, and the generally severe continental system of general police supervision prevents the employment of such surreptitious aids to the miller and baker as the adulteration of flour by means of alum and other deleterious chemical means.

Nor are continental millers contented with our still somewhat rough modes of applying air to the grinding surfaces of millstones. We are inclined to think that the well-known and very generally used system of exhaust is adapted there in a more scientific way than is generally the case with ourselves. As good testimony we would refer to a really important work on milling, published some few years ago in Germany, but which is little known in this country. No book in the English language treats the matter so thoroughly as Professor Wiebe's *Die Mahlmühlen*.† The subject is handled in all its branches, and in a philosophical and practical way.

Confining our attention for the present to those portions which refer to ventilating millstones, we will notice those statements which appear to us of most importance. The great utility of the passage of a current of air through the grinding surfaces of millstones is due to the simple fact that the process of grinding necessarily heats the meal. The stones may be ever so good and sharp, yet friction will always occur between the grain and the grinding surfaces, thus consuming mechanical work and producing heat. This increase of temperature undergone by the substances being ground is attended with two principal evils. In the first place it evaporates the water which is mechanically combined with the grain, and in the next, this heat itself injures the flour produced, making it less suitable for baking, giving it a worse appearance, and diminishing its storing properties. The vapours produced also condense on the sides of all the pipes, the cases for the endless screws, and the elevators. This moisture forms, with the flour hanging to it, a pasty substance which soon ferments, giving out a bad smell, and spoiling any good flour coming in contact with it. The dressing apparatuses especially suffer; the meshes get filled up, and the stuffs spoiled. Herr Wiebe omits mentioning the production of what we call stive, or the fine flour dust which is driven about the mill by the centrifugal action of the stones. The injury to the flour, by heating and other causes, would be most felt in a country where very fine white flour was in most demand. With ourselves the general application of the exhaust fan to millstone cases is more owing to its preventing the blowing about of the stive.

The reason why fine dust generally is so easily taken up by the air is well worth some explanation. The atmospheric aerial sea, at the bottom of which we live, has a noticeable tendency to buoy up minute bodies—not merely those of small specific gravity, but also of the densest class. It is but too well known to the Sheffield grinders and file cutters that lead and steel and millstone-grit easily swim about in the air, following with the greatest ease the slight suction or exhaust current due to the inhaling motion of the lungs. The notes seen in a sunbeam are evidently particles of dust, and under favourable circumstances, such as its attenuation by heat, the air deposits this fine dust on our furniture. The fact is that the air affords a considerable resistance to the fall of these small bodies, however high their specific gravity. It is true that the greater the surface the greater the resistance of the air, the mass of the body being equal; but with the diminution in volume of any heavy body, it will fall much slower in air or water, as the diminution of its volume, and therefore of its gravity, takes place in a much more rapid ratio than its cross-sectional area. A piece of meal, for instance, of (say) $\frac{1}{2}$ in. in diameter, will fall with a certain speed; a particle of meal, however, one-tenth of this size, weighs 1,000 times less, and gravitation acts on it with 1,000 times less force, though its surface is only 100 times smaller than that of the $\frac{1}{2}$ in. ball. For the particle of stive, the proportion of the resistance of the air to the accelerating force of gravity is evidently ten times greater than for the larger ball.

The prevention of the blowing about of this fine dust has thus for result a great increase in the comfort of the workers in the mill, as this fine dust acts on their organs of

* See THE ENGINEER of Jan. 10, 1865, p. 10.

† Stuttgart, Carl Mäcken, 1861.