## THE DESTRUCTION OF THE PALLISER GUN.

SIR W. PALLISER continued and effectually completed the testing of his gun to destruction on Saturday last, May 28th, nearly following the course he proposed, which was indicated by us in THE ENGINEER of January 28th. It may be, perhaps, remembered that in his previous trials the gun had been double-loaded five times, commencing with a hinder charge of 13 lb. 12 oz. with an 88 lb. solid shot, and a forward charge of 10 lb. 10 oz., and a solid shot of 75 lb., and ending with 22 lb. of powder and a 100 lb. shot, having in front of them 14 lb. of powder, and an 85 lb. shot, pebble powder being used throughout. There was abundant evidence of the gun having been subject to violent pressure. Indeed, it could not have been otherwise. It has been objected that pebble powder would not burn properly, and would not produce a high-pressure in a gun of this calibre. The employment of pressure gauges would be, of course, the immediate means of answering this objection. These were wished for by Sir W. Palliser, but were not procured in time to be used. Nevertheless, the violent recoil of the piece and other proofs existed to show that the gun had been subject to very severe stress, apart from the fact that the authorities have committed themselves to a sort of scale of comparison as to the action of pebble and R.L.G. powder in a 7in. bore in laying down as alternative service charges 22 lb. R.L.G. or 30 lb. of pebble. Sir W. Palliser was himself unable to be present on Saturday last, but had given orders that the gun should be fired in the same way as on the last occasion, except that a shell was to be substituted for the front shot, and that pressure gauges should be employed. We have already—see ENGINEER, January 28th—objected to the employment of a shell until pressures had been registered with shot only in the bore. We conceived that a shell was likely to wedge and burst the gun, however strong it might be, and then the opportunity would be lost of obtaining a register of pressures applicable more or less to all the previous firing. We hoped, therefore, that one round would have been fired with shot, and that the gun might have borne it, before employing shell.

Before the double-loading experiment took place, two rounds were fired from Sir W. Palliser's B.L. gun; that is to say, an old gun fitted with his breech apparatus. A description of this will be found in THE ENGINEER of November 12th, 1880. We have nothing now to add to this. A pressure gauge was inserted in the base of the projectile of the second round. After firing, the copper was set up to an extent arguing only 3·4 tons per inch as measured by Captain Morley, R.A., Proof Master, Royal Arsenal. Captain Edward Palliser, who had been detained in London, arrived just in time to be present at the firing of the double loading experiment. The loading had then been partly effected. It is due to the Pallisers to remark that they had left such orders, that in their absence the Woolwich authorities had every opportunity of examining—we might almost say of carrying out—anything they wished very fully. At Colonel Maitland's suggestion a pressure gauge was put in the front cartridge as well as on the base of the front projectile. We could wish that another had been employed in the hinder charge. Great or small, it seems desirable to investigate all that falls within our reach in an expensive and interesting experiment.

On firing, the whole bomb proof cell in which the gun was placed was blown open, beams and large fragments of metal shot up into the air perhaps to the height of 80ft. or 100ft. and fell at ranges which showed the desirability of keeping at a more respectful distance than had been thought necessary. On examination it was found that the gun had been blown completely to fragments, being torn open longitudinally and transversely, each trunnion having its own fragment, and the breech portion being completely torn to pieces. The wrought iron lining tubes were found in small pieces, broken up somewhat in the same way as portions of those of the 38-ton gun at Woolwich. The largest portion was the muzzle end, which remained entire to the length of from about 4½ft. The solid—hinder—projectile was about 10 yards to the right. The gun had not apparently recoiled to any discernible extent.

Before going into further detail, we would call attention to the broad features of the case, especially as bearing upon the Thunderer guns. On the fact of Sir W. Palliser's gun eventually bursting we lay no stress. Every one knows that it must be possible to burst a gun sooner or later. This, also, was an old, patched-up, and greatly-abused weapon. It was wonderful that it should stand so long, but we think it important to notice certain features, for the sake of doing justice to our wrought iron guns, which we are not likely to be accused of specially favouring by those who have read our articles on steel and iron ordnance. Let us look at the broad features of the case. A gun bears four rounds of double loading with shot without showing further signs of yielding than slight local expansion at the seat of explosion. The fifth round exactly resembles the fourth, except that a shell is substituted for the front solid shot, this being done on the plea being urged that the shell in the 38-ton gun had certainly assisted to break up the piece. Sir W. Palliser was then warned that his gun might be expected to yield similarly. The result is that the gun not only yields, but it yields in a most violent way.

Sooner or later unquestionably the gun must have given way; but is it likely if the shell had no effect—if, in fact, the gun could be said to be fired precisely under the conditions of the previous round—that the whole thing would so completely shiver into fragments and discharge masses of metal, earth, and timber into the air. We must remember this gun had three wrought iron tubes. Might we not expect that the overstraining caused by the exact repetition of the last round, while it might burst the gun, would yet be so far resisted by the coils that they would not fly into scores of small fragments, and also that the gun would recoil? Three guns, or certainly two, chiefly made of, or lined with, wrought iron have now been burst with a shell in front of a forward charge with shot and charge behind them, and each of them has in the immediate locality of the front charge shivered as wrought iron or soft steel seldom shivers. In the case of the 38-ton in the Arsenal there was undeniable evidence that the shell had broken up and wedged violently outwards into the very grooves of the gun; that, then, and not till then, the gun had burst. We naturally look for evidence of a similar kind at Erith in the Palliser gun experiment. In the meantime it is due to the Woolwich guns to point out that behind the trunnions they held together intact. It is terrible to contemplate what might have happened on board the Thunderer had its gun burst almost like a 38-ton shell. It is not fair to compare the patched up and much enduring old gun employed by Sir W. Palliser with them; but the fact must be noticed that its breech portion went to pieces when it eventually yielded.

It might be going too far to say that when a shell is fired under these circumstances it would invariably break up and wedge the bore tight, but we are inclined to think that it would generally do something of the kind—in fact, that the charge behind it, being driven up and fired under great pressure, would generally act so suddenly as to break it up, and then, probably, jamming would follow, resulting in something for the moment like the plugging up of the gun, which would fly into fragments either about the seat of pressure or throughout its mass. A thorough investigation of all the fragments of the gun is necessary, in such a case as this, to arrive at anything like a satisfactory conclusion.

Fig. 1 shows the state of the gun when loaded, except that the hinder projectile being flat-headed, not ogival, as here shown, it is probable that the front projectile and charge were further back than shown in figure. The muzzle portion then broke off entire, opposite about the centre of the front projectile. This in the case of a complete jam up without fracture of the shell might, and probably would happen. In fact, in this case we should have perhaps even a more violent burst than took place in the 38-ton gun, when a great part of the projectile went through the bore. This, indeed, we think would account for the tremendous violence of the strain on the breech portion of the gun. Nevertheless, we are unable to explain how the front projectile under these conditions got clear of the muzzle portion and went 13ft. 6in. into the butt.

The shell is not, as we should have expected, broken and wedged up, but it is in what may be an equivalent condition. It is set up and bulged as shown roughly, and in an exaggerated form, in Fig. 3. One stud, it will be seen at A, is torn away, carrying a considerable piece of metal with it. The base is forced in to a certain extent; the iron at the side B is forced into the groove D a considerable depth, so as to form a distinct rib along the shell. Slight indications of moulding from the other grooves may exist, but are doubtful without means of measurement. The pressure gauge C cannot be got out of the base without special means. The projectile entered the butt to a depth of 13ft. 6in. Fig. 2 shows the muzzle fragment considerably bell-mouthed, and opened at the broken end, but free from all scoring or cuts in the forward portion of the bore. It is impossible to enter the shell in the bore of this fragment, owing to the shell being too much set up. The stud D hardly shows signs of driving fairly through the bore. In default of gauges and further investigation it is necessary to speak doubtfully. The tool marks, however, are sharp all round the shell, and it has no appearance of having been driven through a bore which human strength could not now cause it to enter. On the whole, we are inclined to hold that the shell jammed, and then by some means cleared itself of the parting bore. We do not consider that the Palliser system is at all in fault because the gun burst under such circumstances. It could do nothing else. We much regret having no record of previous rounds by pressure gauges, and also that no pressure gauge was put into the breech end but we feel confident that the former experiments threw a very violent strain on the gun which it bore admirably, but we must recognise this trial as further evidence that the Thunderer guns had a more severe shock than many believed. We must, however, record the fact that Sir W. Palliser, as well as another high authority, consider that the shell passed through the bore. In this case this round differed from previous ones in a less degree than we have supposed. In the same degree then would the double shot trials more nearly represent the conditions of the Thunderer gun experiment; so that there might be better ground for comparing the Palliser gun favourably with the latter, but both of them would have been blown into pieces under a rather less extraordinary strain than we have supposed. Personally we should enjoy seeing a few other typical guns tested in the same way. If the authorities are not going to employ the 35 tons Whitworth guns taken out of the Neptune, might not one of them be available for such a purpose?

We trust that the pressure gauges employed in the above trial may be soon examined, when it will be seen no doubt that the pressure was very high—very possibly beyond the power of the gauge to register.

Briefly, as far as we can see, these Palliser guns, which are only old cast iron pieces patched up on the Palliser system of conversion, have stood tests of unheard of severity. If this is questioned, it is open to Government or anyone else to double load their guns with shot and powder placed alternately, and fire them pitblicly, as Sir W. Palliser has done. At the same time we do not regard this double loading with shot as representing the conditions of the Thunderer guns, even on its own scale.

Lastly, we are inclined to think that the last shell trial fell proportionately more heavily on the Palliser gun than on the Thunderer guns if the shell wedged up and closed up the bore as we suggest. The Thunderer gun fired in the Arsenal was cracked and torn up to its muzzle; in fact, that portion of the gun was a total wreck, being shivered as well as cut deeply in the interior by the passage of langridge through the bore, at the same time the violence of the recoil was much dwelt on. The muzzle portion of the Palliser gun in front of the seat of the front projectile is intact, and shows no signs of anything having passed through it. The shell was not of the same section as that of the Thunderer gun. It was softer and smaller, and hence, perhaps, instead of breaking, it set up and

FIG. 1

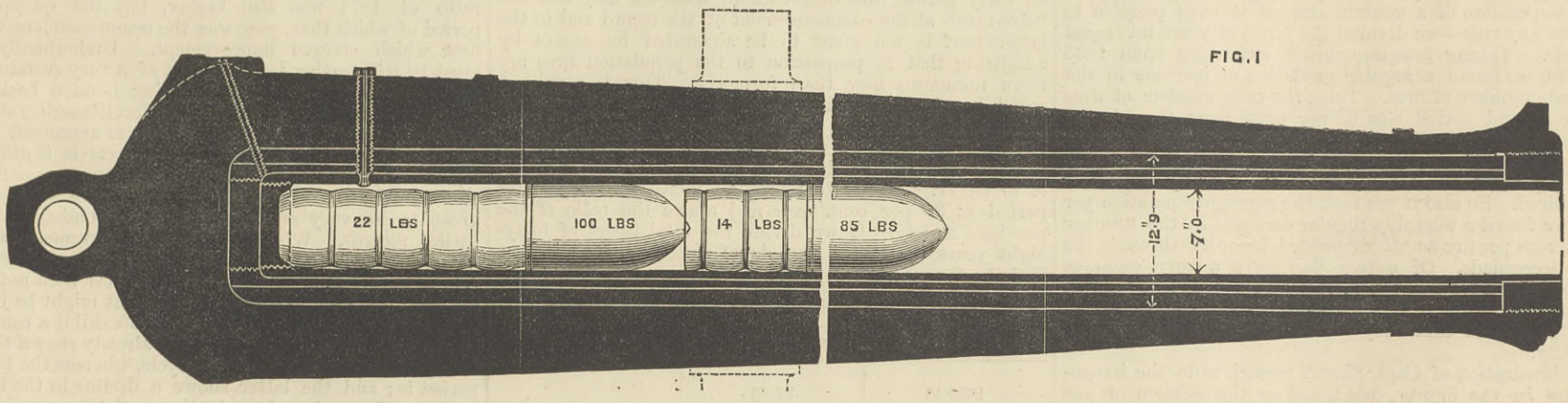



FIG. 2.

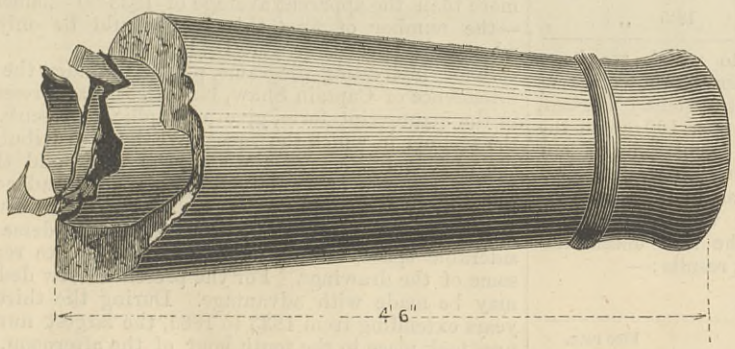
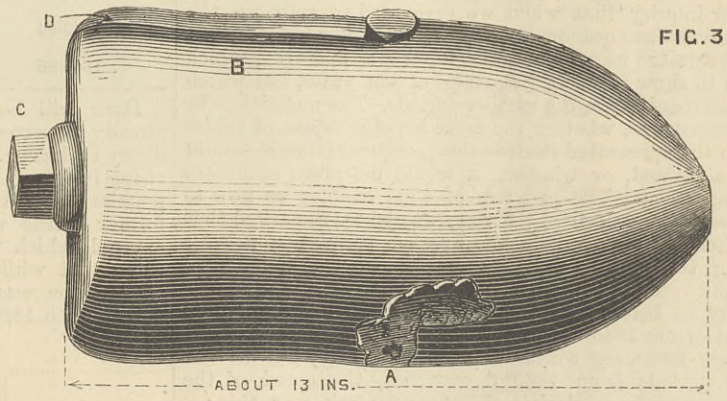



FIG. 3



plugged the bore, which was then certain to go with great violence, the earth being blown and torn up in a crater beneath the breech, and the breech cascable lying with the rope through it about 7ft. away.

## LONDON FIRES.

IN THE ENGINEER, Vol. xxxix., No. 1008, p. 273, we devoted a statistical article to the subject of London Fires, ranging over the entire period of forty-two years, from 1833 to 1874, both inclusive. Six years more are now added to the account, and with additional data thus obtained, it becomes a matter of more interest, and, perhaps, of practical importance also, to inquire how the metropolis stands at the present time in respect to the general fire risk. The test which we applied to this subject on the former occasion consisted in the observed ratio between the number of fires and the population. Thus, in 1833 there was one fire to each 3734 of the population, whereas in 1874 there was a fire to each 2162, thus showing a much higher proportion of fires at the latter date than at the former. Captain Shaw, C.B., the able and devoted chief officer of the Metropolitan Fire Brigade, in his report on London fires during the year 1872, had remarked that while the number of fires for the previous forty years had been, "on the whole, progressive," yet there had been, in some instances, such extreme irregularity as to make the statistics "a most perplexing subject of study to those who desired to ascertain the cause with a view to applying a remedy." In order to merge the irregularities in the operation of a general law—if it were possible to discern any rule—we divided the series of years into equal periods. Taking four decenniads, extending from 1835 to 1874, we found a regular gradation of increase in the absolute number of fires. Thus, the total number of fires in the second period was 35 per cent. more than in the first, in the third period the fires were 36 per cent. more than in the second, and in the fourth period the increase was 37 per cent. Anything more symmetrical could not be desired. So also if we took the average population per fire, we found a tolerably regular decrease in the number of persons per fire as we descended in order through the four decenniads. Of course this gave a very ominous outlook, for a careful consideration of the figures showed not only that the fires were gaining on the metropolitan population, but that they were doing so with increasing rapidity.

In illustration of Capt. Shaw's remark as to the irregularities in the figures, we found on the occasion of our former inquiry that when we proceeded to split up the decenniads into quinquennial periods, a somewhat different result awaited us. Apparently a law was operating which failed to show itself in the groups of ten years, but which became manifest in the smaller periods. The question to be considered was, whether the more hopeful aspect of affairs which thus presented itself in the quinquennial series would be maintained, or whether it would disappear as a mere passing effect. The progress of time enables us now to deal with this question. Five years ago we remarked that the decrease per cent. in the average population per fire during the quinquennial periods was becoming of less amount. Things were still getting worse, but not so rapidly as before. It was true that the six quinquennial periods from 1845 to 1874 showed the average population per fire becoming continually less and less; but in the three periods from 1860 downwards, the speed of the decline had been slackened. Our remark was this:—"Hence it would seem as if a turning point had been reached, the gaining ratio—of fires to population—going on less rapidly than before." Another quinquennial period has since elapsed, and our expectation is happily verified in a very marked manner. It is not merely that the gaining ratio of the fires as against the population has been subjected to a further check, but the process has been actually turned the other way. In the five years 1845—1849, the average population was 2721 per fire. In the next period it was 2628; and, finally, it declined in 1870—74 to 1965. But now, in the period 1875—79, we have an average of 2227 persons per fire—being an increase of 13 per cent. It is true that we have an increase in the absolute number of fires in 1880 as compared with 1879, and to a greater extent than the increase in population; but this may be reckoned as one of the irregularities which will disappear when merged in a longer period.

In continuance of one of our former tables we give the statistics of each of the years since 1874:—

| Year. | Fires. | Population per fire. | Percentage of serious fires. |
|---|---|---|---|
| 1875 | 1529 | 2275 | 11 |
| 1876 | 1632 | 2166 | 11 |
| 1877 | 1533 | 2342 | 10 |
| 1878 | 1659 | 2198 | 10 |
| 1879 | 1718 | 2155 | 9 |
| 1880 | 1871 | 2009 | 9 |

The reduction in the proportion of serious fires is a satisfactory feature, and points to the efficiency of the Metropolitan Fire Brigade. The Act under which the Brigade is constituted came into operation on January 1st, 1866. In 1865 the serious fires were 34 per cent. of the total. In 1866, being the first year in which the Brigade operated, the percentage fell to 25, and in 1867 it was 18. The lowest was in 1872, when only 8 per cent. of the total fires were serious. If we divide the sixteen years, 1865-80, into four periods of four years each, we find the average percentage of serious fires in these several periods to be as follows:—23, 11·5, 10·75, and 9·5.

On the present occasion we have thought it desirable to enter upon another mode of dealing with the fire question. Instead of calculating the number of persons per fire, we have adopted a plan similar to that of the death rate; that is to say, we have calculated the number of fires per 100,000 of the population. This appeals more readily to the eye, and assists the judgment more effectually. We now append a table based on this principle:—

*Fires per* 100,000 *of the Population in Each Year from* 1833 *to* 1880.

| | | | | | |
|---|---|---|---|---|---|
| 1833 | 26·8 | 1849 | 36·9 | 1865 | 50·5 |
| 1834 | 27·7 | 1850 | 37·5 | 1866 | 44·3 |
| 1835 | 26·7 | 1851 | 39·3 | 1867 | 45·6 |
| 1836 | 31·4 | 1852 | 38·4 | 1868 | 53·6 |
| 1837 | 27·4 | 1853 | 36·8 | 1869 | 49·8 |
| 1838 | 30·6 | 1854 | 38·3 | 1870 | 60·7 |
| 1839 | 31·0 | 1855 | 38·8 | 1871 | 56·6 |
| 1840 | 35·5 | 1856 | 37·2 | 1872 | 45·3 |
| 1841 | 35·7 | 1857 | 42·4 | 1873 | 46·0 |
| 1842 | 38·7 | 1858 | 41·8 | 1874 | 46·0 |
| 1843 | 37·0 | 1859 | 40·2 | 1875 | 44·0 |
| 1844 | 36·9 | 1860 | 38·3 | 1876 | 46·0 |
| 1845 | 33·6 | 1861 | 42·2 | 1877 | 42·7 |
| 1846 | 38·9 | 1862 | 45·8 | 1878 | 45·8 |
| 1847 | 38·2 | 1863 | 48·6 | 1879 | 47·0 |
| 1848 | 36·1 | 1864 | 50·7 | 1880 | 49·8 |

This table is peculiarly instructive, combining in a very expressive form the two elements in the problem, namely, the growth of the population and the number of fires. It was our contention in the former article that if any reliance was to be placed in statistics, a number of scattered towns would have fewer aggregate fires than the same population concentrated in one town. We may admit that the statistics of London fires are more carefully kept now than formerly. But it must be observed that the figures of the later date refer to actual fires, and do not include cases of trifling damage, insufficient in importance to require the presence of firemen and their engines. Neither do they include ordinary cases of chimneys on fire. Nevertheless, allowing that the returns are more complete now than at an early period, the difference in what we may call the "fire-rate" at the commencement of the record and in the latter part is too great to be accounted for except by admitting that in proportion to the population fires are more numerous now than formerly. This is a subject which becomes clearer if we deal with the years in groups. Thus, if we take the average of the ratios in the first twenty-four years, we find it to be 34·8; whereas in the second period of like duration, ending with 1880, we find it to be 47, showing therefore an increase in the latter period of 35 per cent. over and above the ratio of the previous moiety. If we divide the total range of forty-eight years into three periods of sixteen years each, we find the fire-rate to run thus:—

*Periods of Sixteen Years.*

| | Average fire-rate. | Increase. |
|---|---|---|
| 1833-48 | 33·26 | |
| 1849-64 | 40·82 | 22·7 per cent. |
| 1865-80 | 48·36 | 18·5 ,, |

Here will be observed that law to which we have already adverted—that the rate of increase shows a tendency to decline. But the increase is sufficiently marked, rising from an average of about 33 fires per 100,000 of the population to 48. In the decennial calculations of our former article we ended with the year which had just expired, which was 1874, and found, as in other calculations, that while things were getting worse the rate of aggravation was declining. Taking the four decenniads ending with 1880, we get the following results:—

*Periods of Ten Years.*

| | Fire rate. | | Fire rate. |
|---|---|---|---|
| 1841-50 | 36·95 | 1861-70 | 49·18 |
| 1851-60 | 39·15 | 1871-80 | 46·92 |

Here it will be noticed that while the third period shows a marked advance upon the second, the fourth shows a decline as compared with the third. It is rather curious that if we divide the entire forty-eight years, beginning with 1833, into four periods of twelve each, there is a continuous rise in the fire-rate, the figures being 32·12, 37·50, 45·33, and 48·30. If we take six periods of eight years we find a constant rise to 1872, and then a decline. Thus:—

*Periods of Eight Years.*

| | Fire rate. | | Fire rate. |
|---|---|---|---|
| 1833-40 | 29·6 | 1857-64 | 43·8 |
| 1841-48 | 36·9 | 1865-72 | 50·8 |
| 1849-56 | 37·9 | 1873-80 | 45·9 |

A table for periods of six years shows 50·80 as the average for 1869-74, with an improvement in 1875-80, when the fire rate becomes 45·9, or less than it was in 1863-68, when it was 48·90. At the beginning, in 1833-38, the rate was 28·43.

If we take the average rates for periods as short as four years, we find the figures fluctuating up and down, losing that degree of regularity which we have hitherto observed. Five years appear to constitute the shortest period in which the occasional disturbances may be said to equalise themselves. In the quinquennial periods, from 1836 down to 1880, we find the average fire rate rising persistently as far as 1866-70, when it becomes 50·8. In 1871-75 it falls to 47·76, and in 1876-80 it becomes 46·3.

We are now presented with a curious anomaly. London growing between 1833 to 1870 from a population of less than a million and three-quarters to one of nearly three millions and a-quarter, shows an increasing risk from fire. So great is the rise during this period that we argue for the general principle of an extra risk consequent on an increase in the number of inhabitants. Since 1870 London has become bigger still, but instead of growing continually worse with regard to the prevalence of fires, it has become better. The decennial period shows an improvement since 1870. Not only so, but the latter half of this last decenniad is better than the former. Why should an increasing population make matters worse during a long series of years, and then, while still increasing, be accompanied by signs of improvement? It cannot be pleaded that the reduction in the fire-rate was a sequence from the passing of the Metropolitan Fire Brigade Act. The Act, as already stated, came into operation at the commencement of 1866, and it will be observed that the fire rate was higher in 1866-70 than previously. The fact that 1870 was the very worst year on the list goes to prove that the existence of the brigade exercised no perceptible check upon the outbreak of fire, but simply served to reduce the ratio of serious fires. The latter is obviously all the brigade can do, unless we are to suppose that its vigilance acts as a discouragement to incendiarism. That incendiarism has any appreciable effect on the statistics of London fires is contrary to the opinion of Capt. Shaw, though some amount of alarm has been expressed on the subject lately, possibly in view of the Irish question. The excitement was also heightened by the extremely suspicious and destructive conflagration at the Victoria Docks a short time ago.

With reference to the suggestion that fires have been more fully registered in recent years than formerly, we may observe that the argument has no application since Captain Shaw commenced to keep the account in 1866. This allows a tolerably long stretch of time, and in that period we notice that fires continue to increase in their ratio to the population until the close of 1871. After that period comes the decline in the ratio. If the statistics are more complete now than formerly, the improvement is even greater than appears. We may regret that 1880 ranges so high as it does, but there is no reason to look upon this as anything more than an isolated advance. The ratio of 1871 was still higher, but the quinquennial period of which that year was the commencement was the first which showed improvement. Undoubtedly there must be still further improvement of a very sustained and marked character in order to bring London back to the ratio of its more favoured period. That the earlier statistics were not complete is very likely a true averment. What allowance should be made for such defects it is difficult to determine; but the difference between an average fire-rate of 28 in the first five years and 46 in the last five is too great to be very sensibly affected by omissions in the earlier records. What degree of improvement we may now hope for is a matter of speculation. The average fire-rate of all the years is 41; but there has been nothing so low as this since 1860. Discouragement might be inferred from the fact that the last four years exhibit a continuous rise in the fire-rate. But we have already shown that the four-year period is not a real cycle, whereas the five-year period is; and the latter shows a decline in the last two periods. The value of a reduction in the fire-rate is shown by the fact that, if the fire-rate of the present were no more than the apparent average of 1833-80—namely, 40·8—the number of fires this year would be only 1556, whereas last year they were 1871.

Some interesting diagrams, prepared under the superintendence of Captain Shaw, but existing at present only in the manuscript form, give a graphic representation of the manner in which the fires have been distributed over the various divisions of the year, the week, and the day. By the courtesy of Captain Shaw we have had access to these diagrams, and have examined them somewhat minutely. Their complete description would demand considerable space, and it might be desirable to reproduce some of the drawings. For the present a few deductions may be made with advantage. During the thirty-three years extending from 1833 to 1865, the largest number of fires took place in the tenth hour of the afternoon, that is to say, between 9 p.m. and 10 p.m. But in the twelve years extending from 1869 to 1880 the maximum seems to fall somewhat earlier. There are three instances in which the maximum occurs in the tenth hour, and only two in which it falls later, namely, in the eleventh hour. But in the remaining seven years out of the twelve, the ninth hour furnishes the maximum. On the whole, the maximum period may be said to fall about half an hour earlier in the latter period than in the years preceding 1864. If this is to be associated with any change in the habits of the people, we might attribute it to a practice of closing the business of the day somewhat earlier than heretofore. In other words, we seem to be tracing in these statistics the effect of the "early closing movement." Rather oddly, the hour of the morning which is distinguished by the minimum number of fires has a tendency to fall a little later in the second period than in the first, though the difference is very slight, being less than half an hour. Whether the increasing use of gas in private houses in later years has anything to do with these variations is a matter perhaps deserving of some consideration. But it will be observed that the change is slight, and it is a remarkable fact with regard to the hours, that throughout the whole series of years the diagrams vary very little in their outline. The drawing presents substantially the same appearance from year to year, showing that no material alteration has taken place.

While some very regular and persistent law thus appears to govern the incidence of fires in the several hours of the day, the proportions remaining practically the same, though the aggregate continues to enlarge almost yearly, we fail to find this kind of symmetry in the diagrams of days, weeks, and months. In the series 1833-65 Tuesday has the largest number of fires, and Friday the fewest. But the difference is not great, the Tuesdays having a total of 4252 fires, and the Fridays 4013. Amongst the hours the difference is much more marked, the tenth hour having 2549 fires, and the seventh hour 540. In the period 1869-80 there are four years in which Saturday has the largest number of fires, and three years in which Thursday has the larger portion. Wednesday prevails in two years, and Sunday, Tuesday, and Friday each in one year. It will be seen, therefore, that the two periods differ essentially in regard to the predominant day. So also the day which most frequently had the fewest fires in the second period was Monday, while in the first period it was Friday.

When we proceed to consider the statistics of weeks, we find it very difficult to arrive at a conclusion. In the first period the fifty-first week had most fires, and the forty-second the fewest. But the second period seems to give no decided results. In respect to the months, there is a curious contradiction as between the first and second periods concerning the maximum. Thus in the period 1833-65 the largest number of fires occurred in December, but in 1869-80 July is the most fiery, carrying off the prize on six occasions out of the twelve, the next prevailing month being May, which had the pre-eminence in two years. In the four other years the months with the greatest number of fires were January, June, August, and December. The smallest number of fires during 1833-65 occurred in the month of October, and the same rule holds good for 1869-80. Last year May had the greatest number of fires, and February the fewest.

Without pretending to have treated the statistics of London fires exhaustively, we venture to hope that the observations we have thus made will be found of service in relation to a subject possessing peculiar significance in large cities. We would direct special attention to the calculation connected with what we have termed the "fire-rate," and should be glad to see the same system applied to the statistics of fires in some of our large provincial towns. In reference to the ratios employed in this article, we should state that we have made use of the statistics of the metropolitan population first issued by the Registrar-General in connection with the census of 1881.

## LETTERS TO THE EDITOR.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

### LIGHT DRAUGHT STEAMERS.

SIR,—Having seen in your valuable paper an account of the steam trial of the first of the two stern wheel steel steamers, built by Messrs. Yarrow and Co., of London, to the order of Mr. F. P. Cisneros, for navigation of the river Magdelina, in the United States of Columbia, South America, and believing it would be interesting, I beg to forward you account of the steam trial of the second, which is now in working order and giving excellent results as to speed, economy, &c. It is named Inez Clarke. The machinery is in every respect similar to that of the General Troujillo, with the exception of the stern wheel, which is fitted with iron floats in place of wood, and which appear to enter and leave the water cleaner, and can be straightened when bent when wood floats would break.

We left Barranquilla at 1.32 p.m., 3rd March, draft 3ft. ½in. forward, 2ft. 8in. aft, having about 76 tons of cargo. Passengers and baggage arrived at Perico—about one mile from Honda—at 5 p.m. on the 12th, running time 94 hours 13 minutes. This is allowed to be one of the best, if not the very best, run ever made on the river Magdelina for the entire distance in the existing state of the river, which is at present extremely low. The Francisco Montoa upon one occasion went to Honda in 89 hours, but having a good state of river and going through a passage called the Brasa da Mampos, which is now impassable from want of water, but when navigable reduces the distance to Honda by 12 leagues, or 36 miles, and the result was obtained with an expenditure of about double the amount of fuel that we used. On the second day out we ran from Mata Caña to Maginguay, a distance of 44 leagues, against an average current of 4½ miles; started at 4.50 a.m., arrived at 10.30 p.m.; delay for mails 2 hours 9 minutes; had not to stop for wood total time.

We carried an average steam pressure of 160 lb., vacuum 25in.; we experienced no difficulty in getting all the steam we required; average air pressure for draught, 2½ in water; wood of ordinary quality; we used 300 Booras, costing about 260 dollars, and 40 blocks of Heath and Co.'s, of Cardiff, patent fuel, which we find gives excellent results, especially when mixed with wet wood, which we meet with very often. It is proposed to place stations along the river for coal, as the wood is getting continually dearer. There are at present seventeen steamers navigating the Magdelina, six for Mr. Cisneros, the remainder for four companies.

I experienced very little trouble from priming, though the boilers have no steam domes. On examination of the boiler of the General Troujillo after forty-two day's steaming, I found it in clean good condition, no scale appearing—it had not been washed out, but scummed and blown off occasionally. I hope I have not trespassed too far on your valuable space. JOHN TOBIN.

Barranquilla, United States of Columbia, 16th April.

### CONVERSION OF IRON ORE INTO STEEL.

SIR,—If I am rightly informed, the entire merit of the process covered by the patented invention of Messrs. Thomas and Gilchrist consists in lining the converter with bricks made of lime. When the incandescent iron comes in contact with the lime the latter is rendered anhydrate, and absorbs the silica and phosphorus contained in the iron. By the application of these lime bricks the poorer iron ores have been rendered available for conversion into steel. I have no desire to deprive the patentees of the merit of their invention; still I believe you will admit that the use of lime to effect this purpose was long since proposed by myself.

In the early part of September, 1856, I received an invitation to witness the first Bessemer experiment at Baxter House, Somers Town, and reported the impression I there received relative to the great value of the new process in the *Mining Journal*, September 13th, 1856, page 615. I used these words:—"I would suggest, with due deference, that a stream of pulverised anhydrate of lime be forced at a given time with the compressed air into the incandescent mass of iron; the lime having a great affinity for silica and phosphorus, would form a phosphuret and siluret of lime, and be thrown off with the slag. By this contrivance I cannot conceive but that the phosphorus would be got rid of."

It now occurs to me that this identical process would be as effective in removing the phosphorus as the lining of the converter with bricks made of lime. Practically, I see no difficulty in the way, as nothing would be more simple than injecting the pulverised anhydrate of lime with the compressed air into the incandescent iron.

I trust in fairness to myself that you will give this insertion.

ROBT. H. COLLYER, M.D.

21, Cockspur-street, Charing-cross, S.W., May 20th.

### STEEL *v.* IRON.

SIR,—In reference to some remarks made on p. 394 of your last week's issue, as well as in a former leading article, about some results of my experiments, will you kindly allow me space for a few words. I do not wish to enter into any discussion upon the steel *v.* iron question, but simply to point out that some of the facts which you mention, and for which you partly make me responsible, are really not borne out by my experiments. So far as I know, permanent set occurs much earlier in first-rate iron than in mild steel. You will find this stated in my paper. I have made very few experiments on the extension of inferior iron under low load, but it certainly does also take permanent set very early, often enough far under 8 tons per square inch.

The "breaking down" is certainly not so marked in common iron as in good iron or in mild steel, but it is distinctly enough marked to form what is commonly known as the limit of elasticity. It occurs, on the average, at a load about as much less than 18 tons, as the breaking load of the iron is less than the breaking load of the steel. The only case of wrought iron that I remember where I have not found any breaking down is in exceedingly inferior metal, when tested across the fibre. The absence of break down is the characteristic of a hard, brittle metal like cast iron. So far as my own experiments go, I should like distinctly to place on record that in respect to the points just mentioned, mild steel differs from common iron only in the same way that Yorkshire iron does, although to a greater extent. Any arguments against it upon these grounds would tell equally against the use of Yorkshire instead of common plates.

In reference to the question of very thick steel plates, I should like also to say that the only statement I am responsible for is that it appeared to me that a single rivetted lap joint could be made as strong in good iron as in ordinary mild steel plates, if both were very thick. It does not follow that the advantage of the superior strength of the steel cannot be utilised in double rivetted, and still more in chain-rivetted joints, which are, of course, the types most likely to be used with such plates. I shall be exceedingly obliged if you can find room in your columns for this note.

ALEX. B. W. KENNEDY.

Engineering Laboratory, University College, W.C., May 30.

### THE MILLING EXHIBITION.

SIR,—In your article on "The Milling Exhibition, No. II.," after cursorily describing the surfaces of a decorticator, and the cross cut fluting of a cracking mill, you mention incidentally that they were introduced by Mr. Buchholz, at a mill in Ipswich and a few other places. As your paper and the article referred to will no doubt furnish material to the future history of the improvements in flour milling, will you permit me to call your attention to some facts which, while they explain much of the present movement among mill engineers, will do justice to its originator. The decorticator, or hulling machine, referred to in your article was but the first in a long series of inventions after Mr. G. A. Buchholz had turned his attention to the improvement of flour milling. The object being to remove the branicuticles, as far as the crease, while the other machine you mention, viz., the cross cut fluted roller, was intended to sever the bran in the crease. So far as I am aware his decorticator is the only one that ever accomplished its object, though only intermittently; and after several years of fruitless efforts to render the perfect decortication continuous, that is, regular, Mr. Buchholz resorted to that gradual reduction by rollers, which is now attracting so generally the attention of millers in this country, as evinced at the recent exhibition of mill machinery. It was worked in some of our largest mills some fifteen years ago. After 1874 it was very successfully introduced into Hungary and Austria, by Messrs. Ganz and Co., Budapesth. In 1878 one of the most prominent firms of American mill machine manufacturers sent their head engineer to study this process at Budapesth, in some of the mills as well as in the workshops of Messrs. Ganz and Co., and then introduced it extensively last year in American mills, whence it is brought to English millers as an American invention; and I feel sure most people will agree with me that America gains the credit of so many inventions that we can hardly afford to lose those of which the origin can be so clearly traced as in this instance. In support of my statements see Mr. Proctor Barker's paper on this subject, read before the Institution of Mechanical Engineers.

Vauxhall, May 23rd. J. S. ARNOLD BUCHHOLZ.

### HIGH-SPEED LOCOMOTIVES.

SIR,—In reply to Mr. E. L. Pearce's last letter, I beg to say that I quite understood the scope of his suggestions, but I merely wished to point out that the combination of wheel arrangement with radial axles shown in them, formed no inconsiderable part of his suggestion, "Fig. 1" and the whole of "Fig. 2," was in neither case new; at the same time by calling his letter "suggestive," I desired to convey the impression that I thought his suggestions did him credit—all the more so that he seemed to be unaware of their having been previously used.

I had no intention of discussing his suggestions, for I have long settled my opinion of these types of engines based upon my own practical experience of them, and, as I before remarked, there is much more in connection with them than appears in his suggestions which requires to be gravely considered.

Just in order, however, to draw his attention to points which appear to have escaped his view, in reference to "Fig. 1," as an express engine, I would now ask the following questions:—(1) Is there any necessity for the duplex framing arrangement only to obtain the increased fire-bar surface, seeing that with a radial trailing axle the same can be easily obtained with the ordinary framing by simply lengthening the fire-box? (2) Are there not grave objections to four bearings on the crank axle of an express engine? (3) Is not a leading wheel of large diameter more unsafe in rounding a curve at high speeds than a wheel of small diameter?

In reference to "Fig. 2," "the express engine of the future," I would ask:—(1) Is not the wheel base of the coupled wheels too short for safety at high speeds? (2) Would it not be desirable to place the leading and trailing wheels further apart, with the framing cut out above them so that they could pass under it, as they might be required to do in radiating?

Engines of this type, designed by the able locomotive superintendent at Glasgow, are, I now learn, at work on the Oban section of the Caledonian Railway. I have no particulars of them, but I hear their performance is good.

A sound radial axle-box is the chief aid to these designs—without it, in fact, they would be worthless. A "bogie" for such engines is inadmissible. JOHN C. WILSON.

Westminster Chambers, Victoria-street, London, May 24th.

SIR,—I beg to make the following remarks in reply to your correspondents, "Running Board" and Mr. Ed. Gobert, and will endeavour to show that either of the engines of which I sent a sketch would have enough adhesion to do the work required. In making the necessary calculations I did not think it necessary that the train should be run up the incline of 1 in 200 at sixty miles an hour. If this is the case, then a four-coupled engine could not do it. For such a speed there is nothing to beat an 8ft. single engine; and it is well known that a single engine is more free in running, and more economical, than a coupled one; therefore I believe that a four-coupled engine, capable of taking a train of 220 tons at sixty miles on a level, would be more economical, and do better in the long run, than a six-coupled. Any time lost in running up the banks could be made up in running down the other side. I took the weight for adhesion as one-fifth, and the average pressure in cylinders at 120 lb., and weight of train, including engine and tender, at 300 tons. At sixty miles per hour, the resistance would be 13,050 lb., requiring a weight of 29 tons on driving wheels; and with 16 tons on each pair of wheels, the fraction would be between one-fifth and one-sixth.

If it is decided to use a six-coupled engine, there are other questions to consider—viz., the limit to size of driving wheels, and arrangement of tubes and fire-box area. I will suppose that driving wheels 7ft. 6in. diameter be employed, as suggested by Mr. Gobert, then the rigid wheel base would be about 16ft., the engine to be arranged on the "Mogul" type; the fire-box is limited to the clear distance between the driving and trailing axles, and the grate area to 21 square feet; the diameter of boiler to the distance between the driving wheels. To me it is doubtful if a boiler of this size could make sufficient steam. Now, if driving wheels about 6ft. diameter be used, the rigid wheel base need not be more than 13ft.; and by making centre line of boiler about 7ft. 6in. from rails, its diameter could be increased to 4ft. 9in. This would give a good area for the tubes; the fire-box would have to be carried over the trailing axle. The question seems to be whether, if 7ft. 6in. to 8ft. driving wheels be adopted, the boiler could maintain an average pressure of 130 lb. in the cylinders, or can 6ft. coupled wheels be run with safety and economy at a speed of above sixty miles an hour. In the two arrangements submitted to you, I have tried to arrive at something between the two, with a large and effective heating surface. E. L. PEARCE.

May 30th.

SIR,—Our attention has been directed to an article in your last week's issue describing a high-speed engine which we are now manufacturing, and as there are a few points in it which require correction and explanation, we shall be much obliged if you will have the kindness to insert the following.

The engine we are now making is the joint invention of the Hon. C. A. Parsons and the Hon. R. C. Parsons, a member of our firm. The principle of the engine is substantially what you describe, but we must beg leave to differ with you with respect to the objections you raise. With regard to the cost of these engines, it will at once be observed, after a careful inspection of the details of its construction, that hand fitting is reduced to a minimum, and most of the work is effected by machine tools. The casing enclosing the engine, as you state, forms the bed, and the total weight of the engine is less than that of an ordinary high-speed engine for a given horse-power developed.

After manufacturing several of these engines, we find that we are able to turn them out and offer them to the public at prices which compare very favourably with others—a fact which, we consider, is the best proof that this engine is not out of the field on this point.

In conclusion, we must add a few words as regards economy. We have made some careful experiments on this point, which has had our careful attention, and we now have no hesitation in stating that by the use of an automatic expansion valve worked by the governor, by steam jacketing the cylinder, and by the use of a special rotating valve, which has the peculiarity of not allowing leakage of steam after it has received a considerable amount of wear, we are satisfied that on this point, also, this engine can compare very favourably with other engines for high speeds.

KITSON AND CO.

Airedale Foundry, Leeds, May 31st.

### CHEAP PATENTS.

SIR,—I take the liberty of addressing you in the hope you would broach the following proposition in your paper. I know your sympathy is with the money classes, but do you not think it would be to their interest to encourage invention of any kind? My reason for addressing you is that your paper is more read by people interested in the subject that any other. Mechanics and others are virtually excluded from the benefits of the patent laws, viz., if any of us have anything worth patenting we must show it to a man—or men—with money. They cannot or will not see the value of it, consequently it drops through for a time, and is then brought out by the persons who have seen it; we have no money to oppose the grant of a patent to them, and they can laugh at us. What I should propose would be a small fee—say, 5s.—on deposit of drawing and written description of the article to be patented, and that should protect the inventor for, say, two months, to give him a chance of showing it to people likely to join him. The patent, if taken out, to date from application for this protection. Five pounds is not much to some people, but it is a large amount to us, and, as a rule mechanics who save money have very little thought beyond their daily work.

Enfield Wash, May 28th. WM. DAVIS.

[If, as Mr. Davis supposes, all our sympathies were with the monied classes, we should not take the trouble to discourage cheap patents. What we have said on this subject, we have said in the interest of the poor inventor. Cheap patents would be as good a lure to deprive poor men of all that they have as the glittering prospectuses of the bubble companies which meet our eyes at every turn.—ED. E.]

### THE CARLSCRONA FIRE ENGINE TRIALS.

SIR,—We notice in your last Friday's issue a report relative to some trials of fire engines undertaken at the request of the Carlscrona authorities. Our representative who attended the trials in question on our behalf is now on his way home. He has particulars which impugn the accuracy of the report, and show that the trials were carried on under conditions which render the results obtained of little practical value. Indeed, the Carlscrona Fire Commissioners have highly complimented us upon, and thanked us for sending out "so complete and good a machine in every respect, and so simple in construction," at the same time informing us that it was only in consequence of its fulfilling their special requirements that they were induced to give the preference to the Shand and Mason engine. We will endeavour to send you for your next number the full particulars, which we are hoping every day to receive; and shall be greatly obliged if you can find space for their insertion. MERRYWEATHER AND SONS.

Greenwich, June 1.

SIR,—Referring to your article last week upon the above subject, we wish to make the following explanation upon the extract from the minutes of the Fire Commissioners' meeting, appearing at the end of your article on steam fire engine trials at Carlskrona. We beg to state that subsequently other meetings were held, when it was unanimously resolved by the Fire Commissioners to purchase our No. 2 equilibrium steam fire engine for the town, and we beg to state that we have received payment for the same.

SHAND, MASON AND CO.

Upper Ground-street, Blackfriars-road, London, June 2nd.

### PROPOSED BRIDGE OVER THE DOURO.

SIR,—In THE ENGINEER of May 20th you published the stress diagrams of the above bridge, which I have examined and should be glad if any of your readers would be kind enough to prove, either by calculation or by the graphic method: (1) Why the lines D E C and C K H, on page 365, should not form the letter V? (2) Why a load, acting vertically, would produce a less strain on a strut making an angle of, say, twenty degrees with the vertical, than on a strut making an angle of, say, fifteen degrees? (See B A and m A.) (3) How is the vertical component of the oblique reaction at A transmitted to D? (See pp. 364 and 366—"8. *Moving load between E and K.*") A COMMON FIVE-EIGHT.

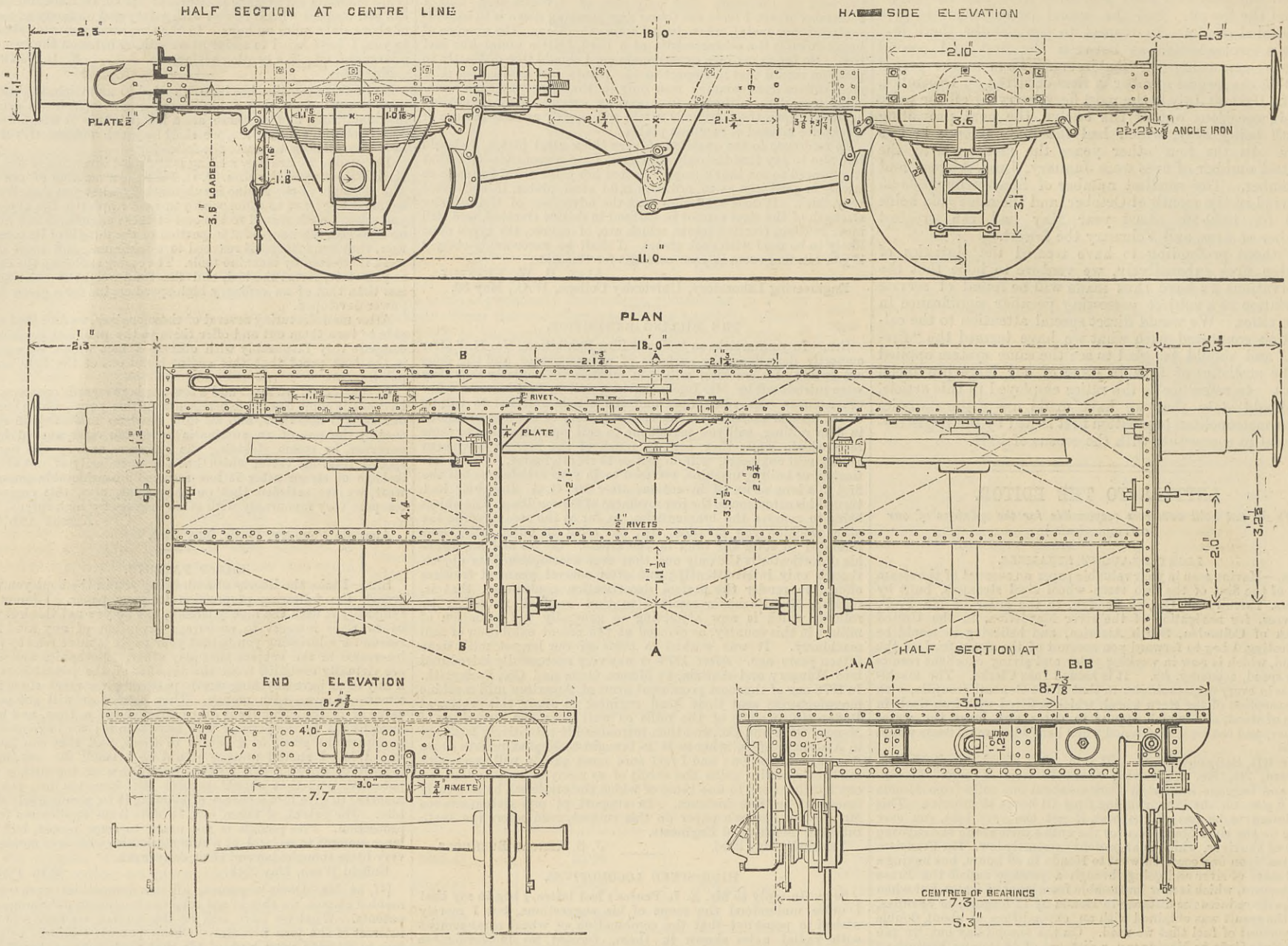
Greenock, N.B., 25th May.

### SAFETY VALVES.

SIR,—In reply to "Chief Engineer" of the 18th inst., I think that he makes a mistake if he imagines that I should expect to find the water perfectly clean in any boiler, or the safety valves in the same condition, but I still say that with an ordinary clean boiler the scum and dirt from it, through steam blowing-off or any moderate amount of priming, will not cause Adams's valves to be affected by it to the degree that "Chief Engineer" would try to make me believe. In conclusion, he admits that he served in one boat for upwards of a year, and that there the safety valves, Adams's, worked to perfection; again, four lines lower down in the same letter, he says that he thinks that they are a very long way from being perfect. Now this kind of thing I cannot make out; in his first two letters he condemns the valves because he had trouble with them, in his last letter he acknowledges that he was over twelve months with them and that they worked to perfection—quite two opposite stories, If they worked all right in one boat why not in the other? I wish that "Chief Engineer" would give us what he thinks was the reason of their not working, and also the name of a valve superior to Adams's. J. H. W.

Cheshire, May 30th.

# CONTRACTS OPEN.—COAL WAGONS FOR THE INDIAN STATE RAILWAYS.




## CONTRACTS OPEN.

### IRON UNDERFRAMES AND IRONWORK FOR UNDERFRAMES AND BODIES FOR COAL WAGONS.—INDIAN STATE RAILWAYS.

THE work required under this specification comprises the construction, supply, and delivery in England, at one or more of the ports named in the conditions and tender, of iron underframes and ironwork for underframes and bodies, with all requisite bolts and nuts, rivets, and washers, for putting the work together in India and fixing the bodies to the underframes, for sixty 10-ton coal wagons; forty buffers, each consisting of one buffer, plunger, and shank, nut, and cottar; one buffer case; six washers and spring plates. All fastenings, bolts, and nuts, and rivets are to be supplied in quantities sufficient for putting all the work together in India, with an allowance of 20 per cent, for waste. The contract does not include wheels and axles, bearing springs, india-rubber of the draw and buffer springs, and axle-boxes. All these parts will form the subjects of separate contracts. The general construction of the underframes, ironwork for underframes, and bodies, brake, and buffing gear, and couplings is shown on the annexed drawings.

The whole of the materials used for this contract are to be of the best quality, and subject to the approval of the inspecting engineer. No other material than wrought iron is to be used, except where specified otherwise or shown on the drawings. All drawhooks, drawbars, scre 7 couplings, safety chains, hooks, eye-bolts, nuts and pins, for same, are to be forged from Lowmoor iron. All other iron is to be best best Staffordshire or other iron of similar quality in the opinion of the inspecting engineer, and is to be specially suited for smithing purposes. No iron of foreign manufacture is to be used throughout the contract. The iron is to be well and cleanly rolled, and free from scales, blisters, laminations, cracked edges, defects, and blemishes of every sort, and the name of the maker must be stamped or rolled on every piece where practicable. When scrap iron is used it must be cleaned in a properly constructed machine before being used for the manufacture of forgings.

The iron must be of such strength and quality that it shall be equal to the undernamed several tensional strains, and shall indicate the several rates of contraction of the tested area at the point of fracture that follow, namely:—

| | Tensional strains. per square inch. tons. | Percentage of contraction of fractured area. |
|---|---|---|
| Bars and rods .. .. .. .. .. .. .. .. | 24 ..... | 20 |
| Plates .. .. .. .. .. .. .. .. .. .. | 21 ..... | 10 |
| Channel, angle, and T-iron .. .. .. .. | 22 ..... | 15 |

The intention of this contract is that every piece of iron shall be manufactured with such accuracy that any piece may be used without dressing of any kind in the place for which it is designed in any of the wagons. To ensure this, every piece must be made from a carefully prepared metal template or gauge, and all holes n it, whether hereafter specially mentioned or not, must be drilled. It must further be drilled through the holes in the template, so that the corresponding parts in the different wagons may without doubt be exact duplicates of each other. All templates and gauges must be provided by the contractor at his own expense, and must be of such material, and made in such a manner, and be renewed as often as the inspecting engineer shall desire. All holes in the pieces of iron which form the underframe must be drilled, except those in the floorplates, which may be punched, provided that all the holes in each plate are punched simultaneously; if this system of punching be not adopted, all holes must be drilled. The pin holes through the scroll irons and shackles are to be drilled, and the pins turned. The scroll irons are to be forged out of the solid and all hole through them are to be drilled. The buffer faces must be turned to a perfectly spherical or flat surface, as shown on the drawing, and the edges must be faced up true. The buffer shanks must be drawn down under a steam hammer, true to the form shown and turned. The draw and buffer spring plates must be dressed off perfectly true to the dimensions given. The knees connecting the channel bars forming the underframe may be made out of angle iron, but the edges of the angle irons must be neatly dressed off, and the holes through them drilled. Great care must be taken that these knees are fitted so that the whole breadth of each side bears against the channel irons which they connect. The ends of all channel irons must be finished in a machine to the exact shape and dimensions shown on the drawing. The wings of the axle guards are to be carefully let into and welded to the main pieces. All the working parts of the wagon brake gear must be planed, bored, or turned so as to make good machine work. Generally all surfaces tinted red on the detail drawings are to be bored or turned and finished up smooth and bright, whether mentioned in this specification or not, and all pieces of iron not bored or turned must be cleaned up with the file and finished off in first-class style. Great care is to be taken to cut the threads of the screw couplings accurately to dimensions given on the full-sized drawing exhibited, and generally to finish them up in the best and most accurate manner. All nuts are to be square, and must fit so tightly on their bolts that they cannot be turned by hand. Whitworth's standard gauges must be used in turning all pins, boring all holes, and forging or finishing all bolt heads and nuts, and all bolts and nuts must be screwed to his standard pitch, the bolts to a length of three diameters. The side and end sheets, and the bars and angle irons connected with them, that are not part of the underframe, may be punched, great care being taken that all holes correspond accurately. The edges of the floor plates must be planed so as to make a close joint when rivetted on the underframe. The door hinges and fastenings must be forged out of the solid, and faced in a machine, all holes of every kind in them being drilled and the pins for them turned. All the sheets must be rolled carefully to the weights given. The floor, side, and end sheets must be carefully flattened by planishing so as to be without buckle or wave. All rivets that are rivetted up in England which are found to be loose or to have cracked heads, or to be in any other way defective, must be cut out and replaced by others. Any part of the work which is found to be in any way defective, or not to be in accordance with the tests and other requirements of this specification, will be rejected. All bolts and nuts, washers, and rivets are to be provided up to the numbers and weights named in the schedule attached to this specification.

One wagon is to be built and rivetted up complete, and approved by the inspecting engineer as a pattern, before the rest of the contract is proceeded with. Should an examination of this pattern lead the inspecting engineer to order any alterations in the designs of any of the parts, he is to be at liberty to do so, without claim on the part of the contractor for loss on any parts which he may have made prior to the approval of the sample, or for any extra payment, except in regard to weight at the schedule rates. The wheels and axles, axle-boxes, bearing springs, and draw springs necessary for erecting the pattern wagon will be supplied to the contractor. The whole of the underframes are to be rivetted up complete with the iron flooring plates, and all attachments rivetted to them, except the buffer cases, scroll irons, stanchions, and coupling suspending hooks, brake gear, and axle guards. These portions are to fitted and bolted to their places on every wagon, and then taken down and packed. Every detail must be tested by gauges at each stage of its manufacture, and be to the satisfaction of the inspecting engineer. Every wagon must be completely erected, and the body work must be rivetted up to the following extent:—The top beading must be rivetted on to the side and end sheets. The doors will be rivetted up complete with the hinges and fastenings. Generally all rivetting is to be done compatible with the mode of delivery hereafter specified. All workmanship and materials are to be the very best of their respective kinds.

After each wagon has been inspected and approved, it is to be taken down and the various parts are to be marked to their places in some manner to the satisfaction of the inspecting engineer; each piece is then to be carefully cleaned from all rust, and then painted with one coat of red lead and linseed oil, and is afterwards to have one coat of good oil paint, proper time for drying being allowed between the application of each coat. All ironwork belonging to the underframes must be finished black. The remainder of the ironwork must be finished slate colour. Every piece of ironwork must be stamped "I. S. R." The channel irons of the underframes must have the same letters, the name of their manufacturer, and the date of their manufacture rolled on them.

When the last coat of paint has thoroughly dried, the work is to be packed and delivered in the following manner:—The underframes are to be delivered completely rivetted up. No packing will be required for the underframes. All the remainder of the work is to be packed in cases, with the exception of the side and end sheets, which may be packed in strong crates made of cross and longitudinal battens, secured by bolts, and which must be entirely to the satisfaction of the inspecting engineer. All the ironwork for the underframe and body of one wagon must be packed so as to be contained in one or more cases and crates, each of which must not exceed 10 cwt. in the gross. The cases are to be made according to the pattern lodged at the India Store Department, of 1¼in. deal boarding, with elm ends, secured by battens passing round them, tied with 1½in. hoop iron, No. 18 B.W.G., and the whole properly nailed down with wire nails. The joints in all cases are to be tongued and grooved. Every piece or bundle of iron is to have such descriptive and shipping marks painted on it, or punched, and all cases are to be clearly branded or cut, and not merely painted, with such descriptive and shipping mark as the inspecting engineer may require. The cost of all oiling, painting, temporary erection, testing, marking, packing, and delivery is to be included in the price named in the tender. Tenders are to be sent in to the Store Department of the India Office on the 8th of June, before 2 p.m., after which hour no tender will be received. They are to be addressed to the Secretary of State for India in Council, with the words "Tender for ironwork for coal wagons" on the left-hand corner of the envelope, and are to be placed in a box provided for that purpose in the Store Department.

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THE MILLING EXHIBITION.—By a typographical omission, Fig. 5 was printed in the description, page 385, of the exhibition mill of Messrs. Dell and Son, instead of Fig. 35.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending May 28th, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m to 10 p.m., Museum, 8289; mercantile marine, building materials, and other collections, 3722. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 2188; mercantile marine, building materials, and other collections, 344. Total, 14,543. Average of corresponding week in former years, 16,453. Total from the opening of the Museum, 19,983,214.

LAUNCH OF THE DE BAY.—On the 28th May, Palmer's Shipbuilding Company, Limited, launched from their Yarrow Yard a steamer of 1700 tons register, to be called the De Bay. This vessel is 260ft. long, 35ft. 4in. beam, 24ft. 1½in. depth, and is to be fitted with compound engines working at 80 lb. pressure, having cylinders 30in. and 55in. diameter with a stroke of 42in. These will drive a dual propeller on De Bay's patent system, which has already given encouraging results upon the Cora Maria, a vessel belonging to Messrs. Capper, Alexander, and Co., of London and Cardiff, the owners of the s.s. De Bay. The construction of the vessel and machinery has been superintended by Mr. J. F. Flannery, consulting engineer to the owners, and the vessel is intended for the Eastern and Atlantic trades.

# THE TIGHE-HAMILTON BEVEL GEAR CUTTING MACHINES.

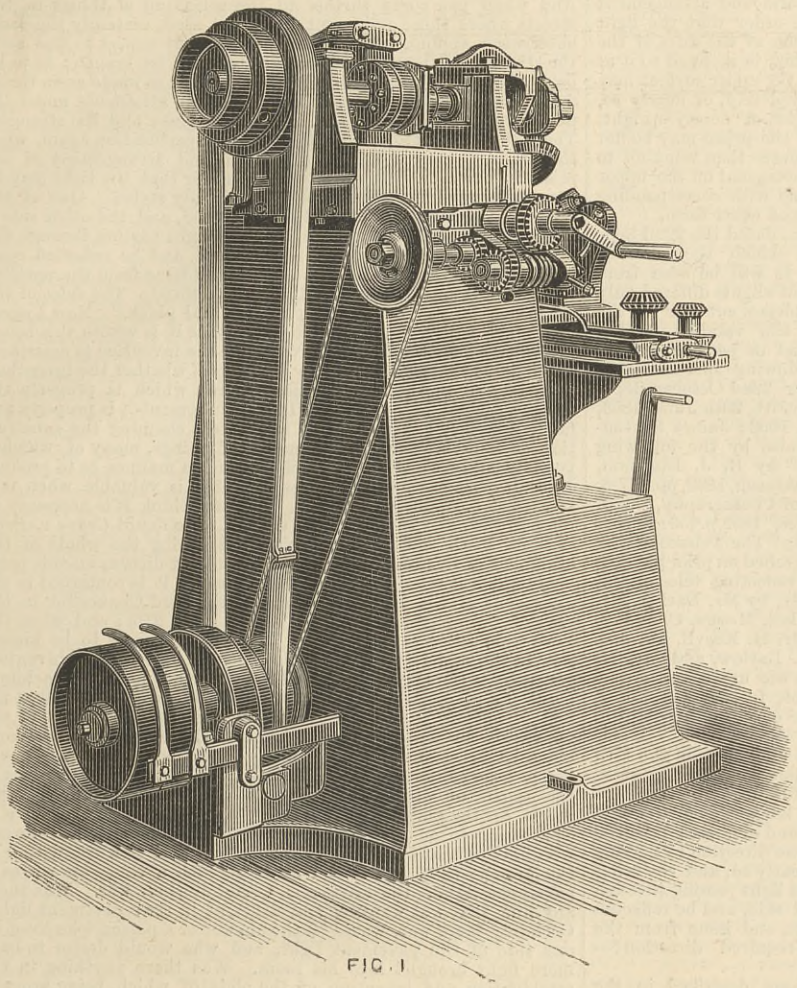


FIG. 1

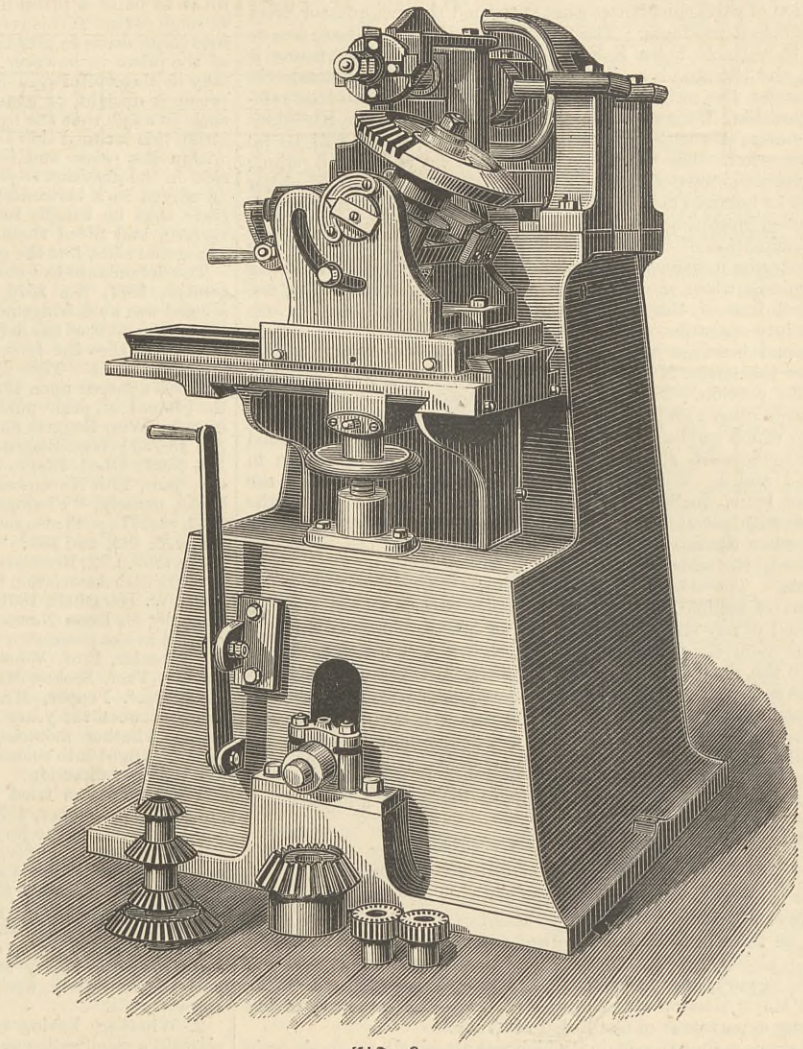


FIG. 2

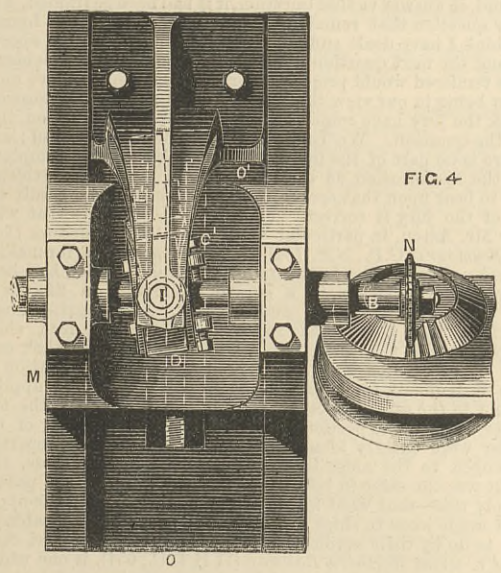



FIG. 4

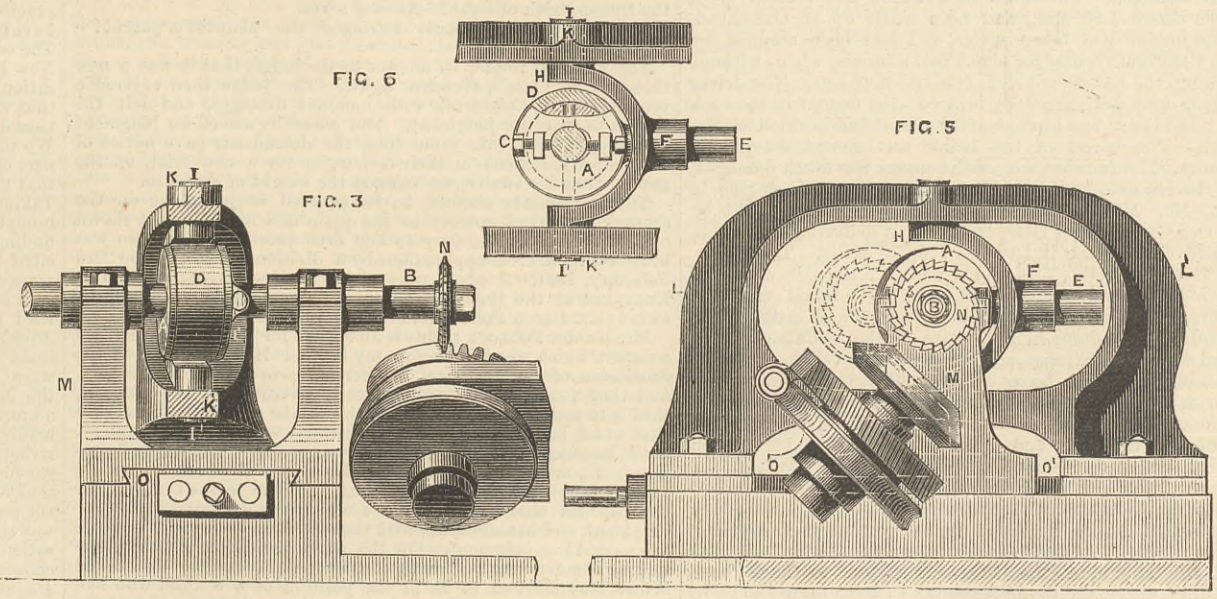



FIG. 6 FIG. 3 FIG. 5

THE action of the machines which we illustrate is remarkably original. Their actuating principle first appeared in the Tighe-Hamilton patent dovetailing machine, which we noticed some time ago, and of which two of the largest yet made have been recently erected in the Government Dockyard, Portsmouth, to carry on the work previously done by a smaller type of machine of older date. Our illustrations are taken from photographs of the first bevel gear cutting machine recently erected in the same establishment.

The nature of this invention can be best understood by a comparison with the common wheel cutter. Here, in order to open the interval between two teeth in a bevel wheel, it is usual to pass the cutter just through its centre, in order to obtain central freedom. The blank is then turned over to shape one face, and then back again, to shape the opposite one. It is thus that the proper taper of the interval, and the curvature of the teeth are produced. But the results generally need the file to remove the marks. But in the machine before us, these several operations are all completed by a single passage of the cutter, because the novel mode of motion—called a reciprocator—when set at the proper angle, by a very simple method, causes a varying degree of throw in the spindle. Thus the cutter which enters at the wide end of the interval gradually contracts its action, until it reaches the narrow end, when the result is a perfect finish, and the blank is returned for the next cut.

In Fig. 1, which is a front view, the reciprocator is seen in the middle of the headstock, along with the plate for regulating its angle of inclination. This angle of inclination must always be one-half the proper taper of the teeth in any wheel to be cut. In this figure is also seen a singular union of the back gear principle with a worm and tangent wheel for dropping the worm out of gear the moment when the cutter has finished its passage. There is then an easy and quick return motion worked by hand. The figure does not clearly show the simple dividing apparatus. But this is so formed as to secure perfect pitch distances, without the aid of change wheels.

In Fig. 2, which is an end view, the blank to be cut and the cutter block are seen more clearly, as also the index for regulating the angles at which the blank must be set, so as to suit mitres or bevels of any relative sizes. The derivation of this machine from the dovetailers will be evident to any one who sees that the interval between any two teeth of a bevel wheel is in fact a triangular space, similar to that which constitutes a dovetail in cabinet work, and what removes the space in one case has here been made to remove a like space in the other by an analogous operation. The special feature then of these machines is the action which causes a cutter to cut tapered intervals, and thus form tapered teeth—by a single passage across the front of a wood or metal blank—of a proper shape. This results from the fact that the reciprocator causes the cutter to contract or spread whilst it passes across the front of the blank. It is thus in the fact that the spindle reciprocates as it rotates that the speciality lies, whilst the extent of its throw is made to depend upon the advance or retreat of the headstock, together with the degree of inclination given to the reciprocator by its adjusting screws. The working of the cutter is very rapid, as the rate may be taken at from one to six passages per minute, according to size and material. All sizes, pitches, angles, and taper of teeth are variable at will, as in the dovetailer, and the results come from the machine quite finished and without the use of file or scraper. The operation can be well performed with an ordinary milling cutter of proper curvature, but more conveniently by a special block, as the cutters are changeable and easily sharpened on the grindstone, whilst a special machine gives them any degree of curvature desired.

The contrast between the work done by these machines and those now in use is great. In some cases wheels are cast and the teeth filed up, but these are never true. In others they are cut out of the solid by machinery by several passages of the cutter; these generally leave markings and require filing again. Machines made upon the copying principle are very tedious and require a preliminary clearance; they thus sink to the rank of trimming devices. In the machines under notice, for all wheels under 4in. in diameter one passage of the cutter is quite sufficient, as the slight difference in depth between the front and back intervals is not preceptible, it is even advantageous, and is a feature common to all types of gear cutting machines except those which copy. It has been found by the skilful operators working these machines at Portsmouth dockyard, that as in larger wheels, there is more material to remove, it takes only one-half more time to make two passages than one. The bottom of the interval is cut at the first, whilst the second passage follows the pitch line. The pitch line thus becomes a mean, and all lines then converge to the centre of the cone. For small wheels these exact mathematical lines are not worth the trouble of two passages. There is still another interesting feature to notice in these machines. In wheel castings it is usual to provide a slight contrary taper in the teeth of the pattern, so as to allow a certain degree of "draw." The principle is valuable in castings, as the fitter thus obtains a better fit by reversing the taper; but in wheels cut by machinery this has hitherto been unattainable except by much waste of time. In the Tighe-Hamilton machines this is readily obtained, and a perfect fit at the same time secured. We have recently inspected the working of these machines, and much admired the simplicity of the working parts, with the novelty of their combination and the beauty of the work turned out.

We have not been surprised to hear that the head of an eminent American firm has lately come over here, specially to examine these inventions. Labour-saving machines are much appreciated in America, and he was so satisfied with what he saw in Portsmouth Dockyard, and elsewhere, both in this country and in Ireland, that he at once decided to take up the American patents. He is now gone back, after a stay of only a fortnight, to start their manufacture in the States. Mr. Hamilton's agents in this country are Messrs. Powis, Bale, and Co.

The accompanying engravings indicate the functions and relations of the essential parts of the machine. A grooved sheave A, Fig. 3, is so mounted upon the spindle B that it can be inclined to it at any desired angle by the set screws C $C^1$, whilst a ring D is introduced into this groove by the removal and replacement of a side plate. The boss of this sheave, that is to say, the bottom of the groove, revolves within the ring, when this is prevented from turning by the round radial pin E, which is fixed into it in a line through its centre, and through the axis of the spindle. These three parts are analogous to the body strap and rod of a steam engine excentric, but here the sheaf is concentric with the shaft, but not at right angles to it, and therefore the derivative motion is of a different nature and in a different direction. The outer portion of the pin E passes through a round hole F in the boss G of a vertical stud H, which is free to swing or rock as a hinge upon pivots or trunnions I I. Fig. 6. Its vertical axis of motion is through the trunnions, and at right angles to the line of the pin. The pin E is thus free to have a twisting as well as an endway motion, and then when the spindle and sheave rotate, this pin acts as a lever, with the boss

of the stud H as a fulcrum, and compels the spindle to reciprocate as it rotates with a throw in proportion to the inclination of the sheave and the distance of its centre from the vertical line which passes through the trunnions or pivots of the stud. This combination of parts constitutes what is termed the reciprocator, from the effects it produces. The trunnions of this stud H are free to turn in suitable holes K $K^1$ in the frame L $L^1$. This frame is fixed, and the stud is so shaped that its trunnions can stand over and under the reciprocator when this is brought into that relative position. Then when the vertical line through the trunnions also passes through the axis of the spindle there will be no reciprocation. The reciprocator will then be at its dead point; but when the axis of the spindle is moved to a position, either before or behind this vertical line, there will be a degree of reciprocation increasing in proportion to the distance moved, and to the inclination of the sheave. The dotted lines in Fig. 4 show the extreme positions of the reciprocator caused by the throw of the spindle when moved forward to a position in advance of the vertical line of the trunnions. In order to put these various parts into operation a spindle without shoulders is mounted in the usual bearings of an ordinary headstock M. This spindle carries the cutter N at its extremity, and the reciprocator at its middle portion. This headstock is movable backwards and forwards upon a slide block O $O^1$ fixed upon the bottom of the frame which carries the stud by such means as may be deemed most convenient. The blank to be cut is mounted as shown in Figs. 1 and 2. When the headstock is moved forward, and the sheave is not inclined, the cut will be the exact width of the cutter with parallel sides, as in the usual form of spur wheels. But when the headstock is moved forward, and the sheave is inclined, the sides of the cut will be divergent, as in mitre wheels. The degree of this divergence will depend upon the degree of inclination given to the reciprocator, and can thus be adapted to any size of cut or pitch of wheel. The action of a cutter upon the face of a blank is shown at Figs. 3, 4, and 5, where the dotted lines in Fig. 5 indicate the extreme positions of the cutter when it has passed out of the cut. The degree of curvature along the side of the tooth will depend upon the form of the cutter. When for a single passage it may be of the form usually adopted to effect sufficient rolling contact, but if a different degree of curvature is desired, it only involves the passage of a second differently curved cutter at a lesser depth along the pitch line.

## THE RAINTON BOILER EXPLOSION.

On page 410 we illustrate the remains of a North-Eastern goods engine which exploded at Rainton Crossing, near Leamside, on the North-Eastern Railway on the 12th November, 1880. The explosion was, of course, made the subject of a Board of Trade inquiry, and the following facts concerning it are taken from Major-General Hutchinson's report to the secretary of the railway department of the Board of Trade.

It appears that the engine, which was attached to a goods train of forty wagons, was standing at Rainton Crossing when the explosion occurred. The train in question had started from Newcastle about 4.50 a.m., had been made up at Gateshead, where the engine had taken water, and had been stopped by signal at Rainton Crossing for about two minutes, when, without any warning, the boiler exploded, at about 6.40 a.m. The driver and fireman were both seriously injured; the former in the back and hip; the latter was hurt about the head and scalded on the left thigh. The barrel of the boiler was almost completely blown away. The framing, &c., of the engine was much damaged, and the driving axle broken in the right crank. The engine in question, No. 941—six-coupled, with a tender—was built by Neilson and Company, of Glasgow, and was delivered in March, 1874, since which time it had run 186,000 miles. The boiler, made of Lowmoor plates $\frac{7}{16}$in. thick, was of telescopic construction, having a mean diameter of 4ft. 2⅞in.; the barrel was built up of three rings, with one plate to each ring, with ordinary lap joints, and a steam dome in the centre of the middle ring. It was fitted with two ordinary safety valves and a lock-up valve, the working pressure being 130 lb. The boiler had been repaired on June 14th, 1877, when six new roofing bolts and twenty-four copper stays had been put in, and fifty-nine tubes taken out and repaired; and again on June 22nd, 1878, when the fire-box had been restayed with 572 copper stays and the mouth-piece had been repaired. In July, 1878, the boiler had been tested up to 220 lb. with hydraulic pressure. It had never been examined internally since it had commenced working in March, 1874, a period of nearly seven years. At the time of the explosion the boiler is stated to have been nearly full of water, the steam pressure to have been 130 lb. to the square inch, and the steam to have been just beginning to ease off at the safety valves. The result of the explosion was that the barrel of the boiler was nearly totally destroyed, being broken up into about eleven fragments, the form and dispersion of which are shown in our engraving, which we reproduce from General Hutchinson's report. There appears to be no reason to doubt that the cause of the explosion is to be attributed to deep grooving along the horizontal joint of the middle plate. This joint, which was 15in. below the water-line, was grooved inside, more or less along the whole of its length at the bottom of the lap, the sound metal being in some parts not more than one-sixteenth of an inch in thickness. The plate also was not originally of good manufacture, but showed lamination, which, no doubt, contributed to the rapid increase of the grooving after it had been once set up. The flaw was not ascertainable by any outward inspection, and the boiler had never been examined internally. The plates were very little pitted.

General Hutchinson properly points out that this explosion of a comparatively new boiler raises several important questions:—(1) Whether every boiler ought not to be submitted to internal inspection after running a certain number of miles—say 100,000. (2) Whether boiler-barrels should not be constructed with butt-joints rather than lap-joints, so as to ensure their being perfect cylinders, and thus to make as uniform as is possible the effects of expansion and contraction at every part of the barrel. (3) Whether, with boiler-barrels made with one plate in each ring, the joints should not be arranged in all cases so as to be above the water-line. In the present case the joint was 15in. below that line. This explosion made ten in six years on this one railway, out of a total of sixteen on all British railways.

## LEGAL INTELLIGENCE.

### IN THE COURT OF APPEAL.

*Before* The Lord Justice Bramwell, Lord Justice Brett, *and* Lord Justice Cotton.

HAYWARD *v.* HAMILTON.

This was an action instituted by Mr. William Hayward, carrying on business as Messrs. Hayward Bros., of Union-street, Borough, against Messrs. Hamilton and Co., of Kingsland-road, to restrain the infringement of a patent granted to one Edward Lambert Hayward, on the 31st July, 1871, No. 2014, and now vested in the plaintiff. The patent related to "Improvements in pavement lights," which were designed not simply to allow the light to pass through, but also to direct the light in an inclined direction into the room to be lighted. For this purpose the specification stated that the frame was to be glazed "with glass moulded so as to be of a prism-like form on the under side, resembling to some extent in this respect the glasses which are often inserted into ships' decks to give light below. The form and arrangement of the prism is, however, entirely altered in order that the light may be thrown forward in one direction. One of the sides of the prism is upright, or nearly so, and the other is inclined to it at such an angle that the light passing through the upper surface may strike this inclined side and be reflected completely, or nearly so, within the prism and issue from the upright, or nearly upright, side in the direction required. The sides of the prism may be flat or curved in a horizontal plane." The patentee then went on to state that he usually formed the glasses hexagonal on the upper surface, and fitted them into an iron frame with corresponding hexagonal cells, but the glass might be made of other form.

The defendants had obtained letters patent, dated the 22nd September, 1877, No. 3574, for an invention which the plaintiff alleged was an infringement of his patent. It will be seen from the judgment that the defendant's and plaintiff's lights differed only in the fact that the former had notches or pieces cut out of the latter's prisms. The defendants denied the validity of the plaintiff's patent upon the usual grounds, and in particular upon the ground of prior publication by the following specifications, namely, Wm. Boggett and George H. Palmer, 22nd October, 1851, No. 13,783; Wm. Boggett and George B. Pettitt, 20th June, 1853, No. 1503; Obed. Blake, 6th May, 1856, No. 1062; James Stevenson, jun., 12th November, 1857, No. 2853; also by the following books, namely, "Photogenic Manipulation," by R, J. Bingham, 1864, part II., p. 45; Ganot's "Physics," by Atkinson, 1862, pp. 467-8, 469, 478, 482, and 483; "Practical Manual of Photography," by J. Hogg, 1853, p. 22; Brewster's "Treatise on Optics," 1852, p. 453; Report of the British Association for 1851, part 2, p. 12; "The Telescope," by Sir J. W. Herschell, 1861, p. 76. They also relied on prior publications by Sir Isaac Newton in 1671, on the reflecting telescope at present in the possession of the Royal Society, by Mr. Darker, Mr. W. Wheeler, Prof. Wheatstone, Prof. Tyndall, Messrs. C. and F. Darker, Prof. Stokes, Mr. W. M. Ayres, Mr. H. Keevil, Mr. Jas. How, Prof. Pepper, Mr. Barlow, Mr. Jas. Barlow, and Mr. H. Gore, between the years 1830 and 1871, by the use of prism-like forms, whether mounted in frames or not, for the purpose of directing light into rooms, or for the purpose of deflecting light in any required direction.

The action was tried before Mr. Justice Hawkins on the 17th and 18th November, 1879, on which occasion the following questions were left to the jury and answered as follows:—

1. Whether, having regard to the state of knowledge at the date of the patent, it was a new thing to form and arrange a prism so that the light might be thrown forward in one direction by making one of the sides of the prism upright, or nearly so, and the other side inclined to it at such an angle that the light passing through the upper surface may strike this inclined side, and be reflected completely, or nearly so, within the prism, and issue from the upright, or nearly upright, side in any required direction?—Answer: No.

2. Whether, having regard to the prisms described in the plaintiff's specification and shown in his drawings, and especially to the operative parts thereof, used in the transmission of light, the defendants use any glass light having the same operative parts for the transmission of light?—Answer: Yes.

3. Have the defendants infringed the plaintiff's patent?—Answer: Yes.

The jury also found, in answer to the judge, that it was a new thing so to glaze pavement lights. The judge then entered a verdict for the plaintiffs with nominal damages, and left the parties to move for judgment. The plaintiffs moved for judgment accordingly, and at the same time the defendants gave notice of motion for judgment in their favour, or for a new trial, on the ground that the verdict was against the weight of evidence.

The defendants claimed to be entitled to judgment on the ground of want of novelty in the plaintiff's invention, as shown by the answer of the jury to the first question. The case was heard on these cross applications by a divisional court on the 23rd February, 1881. A short note of the case was reported in The Engineer at the time,* and we now give the judgment of the Court (Mr. Baron Pollock and Mr. Justice Hawkins) in full.

Mr. Baron Pollock: This is an action for the infringement of a patent which was tried before my brother Hawkins, who, at the conclusion of the evidence, put certain propositions to the jury, and they found what was practically a verdict for the plaintiff, that is to say, that the subject matter of the patent was new, that that which had been done by the defendants was an infringement, their language also being that it was a mere colourable imitation. Upon that my brother Hawkins directed a verdict to be entered for the plaintiff, but told the learned counsel for the plaintiff that he must move under the Judicature Act for judgment, and in accordance with that direction to-day Mr. Webster has moved for judgment. On the other hand, Mr. Aston, representing the defendants, having mentioned the case to this Court before, was allowed to be in the position of a counsel who had obtained a rule *nisi* on the ground that the verdict was against the weight of evidence. Mr. Aston was heard therefore to-day not only to resist the motion for judgment which was moved for by Mr. Webster, but also to urge to the Court any grounds he desired to urge to us that the verdict was against the weight of evidence. Now, that being the state of the matter, our attention was called, and very properly, by Mr. Aston to the specification of the plaintiff, because, as Mr. Aston said, it was essential for the proper consideration of this case that the Court—it being their duty to put a proper construction on the specification—should say what that construction is before the Court could possibly consider what was the effect of the verdict, and what were the rights of the plaintiff under the specification and on the evidence adduced in the case. Now the specification is to our minds clearly a specification which claims not merely an invention with regard to one particular matter which is not a new discovery, but what it does claim is an improvement in pavement lights, and I think this is one of those cases in which it becomes the Court to be extremely careful, that because the plaintiff has claimed by his specification in this large modes it should not give to him more than he is strictly entitled to under those considerations which have now been thoroughly established in patent law. Having claimed an improvement in pavement lights, the patentee, as is usual in modern specifications, shows first what it is he does not claim, that is to say, he shows what he takes to be the existing condition of the subject matter with which his patent deals before he makes known what is his improvement, and he says, "Pavement lights are commonly used to cover the areas in front of windows in the basements of buildings, and the object of my invention is so to construct them that they may not simply allow the light to pass through, but that they may also direct the light in an inclined direction into the rooms it is desired to light. For this purpose I glaze the frame of the pavement light with glass which is moulded so as to be of a prism-like form on the under-side, resembling to some extent in this respect the glasses which are often inserted into ships' decks to give light below." Now I pause there to consider what was, as proved at the trial, the known condition of things before this specification. I think we have had now amply established—not that it was necessary to do it with any great nicety—what was the condition of the ordinary ships' lights, as they were called, as fixed to the deck of a vessel. We find there were different forms, some of which were produced; and I hold one in my hand which has no element whatever which connects it with the prism, or with any of the things connected with the prismatic reflection or division of light in any shape or way. It is simply a piece or block of glass which is inserted in the ship's deck. That being the affirmative state of things, one asks, Do you find anything in all the history of ships' lights of any persons who, being desirous of lighting cabins, have dealt with the light so as to make the prism throw one part of the light into one cabin, and one into another? Or, to state the proposition more clearly, Do you show any user of any prism whereby the light has been thrown at any particular angle? The answer is, you do not. And when you come further to the condition of things in the streets where those pavement lights are used, certainly the same observation applies. You find all you would expect to find as to the strength of the glass, so that it shall not be broken; as to its being as pellucid as possible; as to its being so made as to throw down the greatest volume of light which is attainable under the necessary conditions of the size of the glass and its strength. There the thing stops. To take up the specification again, what the plaintiff says is this: "The form and arrangement of the prism is, however, entirely altered, in order that the light may be thrown forward in one direction, as already stated. One of the sides of the prism is upright, or nearly so, and the other side is inclined to it at such an angle that the light passing through the upper surface may strike this inclined side, and be reflected completely, or nearly so, within the prism, and issue from the upright, or nearly upright, side in the direction required. The sides of the prism may be flat, or curved in a horizontal plane." Now I agree very much with what Mr. Aston said, that it is within this latter description that the force and value of the invention is described, and it is to this that we are to look to see whether the invention, as described in this specification, is one which is properly the subject matter of a patent. In our judgment it is properly and fairly described; it is described as a patent claiming the construction of something by a combination of things, many of which—possibly all of which—may be old, in such a manner as to produce a result that is new, and a result which is valuable when it is treated as a commercial article. I do not think it is necessary to refer to the older cases on this subject. No doubt *Crane v. Price* (1 Web. P. C. 393) was in one's mind during the whole of the argument of this case. But we have a recent dictum on this point—indeed, it is more than a dictum, because it is contained in the Judgment of the House of Lords by the Lord Chancellor in the case of *Cannington v. Nuttall* (L. R. 5 H. L. 216); and what the Lord Chancellor says is this:—"Few things come to be known now in the shape of new principles, but the object of an invention generally is the applying of well-known principles to the achievement of a practical result not yet achieved; and I take it that the test of novelty is this: Is the product which is the result of the apparatus for which an inventor claims letters patent effectively obtained by means of your new apparatus, whereas it had never before been effectively obtained by any of the separate portions of the apparatus which you have now combined into one valuable whole for the purpose of effecting the object you have in view?" That seems to me as clear and as reasonable a definition as one can well have of that branch of the subject; and if you apply that to the present case, and ask, Was there such a thing known as a pavement light? the answer is, Certainly there was. Was there anything that was wanting and deficient in that pavement light? Certainly there was, would be the answer of a person who lived on one side of the pavement light, and who would desire to have more light brought into his room. Was there anything in the combination and invention of the plaintiff which, being brought to bear upon the subject practically and effectually, produced a better result in the shape of a better article, both with regard to its efficiency, its cheapness, and the means of having it practically brought to bear upon that which was desired? The jury have found, in answer to that question, if it had been so framed, Yes. The only question that remains is, have they properly so found? Now I think I have dealt sufficiently with our view of the specification, and the next question that arises is whether the evidence that was tendered would properly bear out the result I have mentioned as being in our view the proper result of the specification. We think the jury have come to a very proper conclusion on that part of the question. We think if it was new it was useful; and that there is no part of the finding of which we should complain. Taking the specification as construed by us, taking the evidence brought to bear upon that specification, we think in the result the finding of the jury is correct. Then come some cases that were cited by Mr. Aston, in particular the *Patent Bottle Envelope Company v. Seymour* (5 C.B., N.S. 164) where the patent was for making rush envelopes for bottles by means of a mandril, which had been used for similar purposes in a similar manner. In *Horton v. Mabon* (12 C.B., N.S. 437 and 16 ibid. 141), again, angle irons which had been used for the building of iron ships were applied for the first time to gas-holders. In that case the late Chief Justice Erle said it was simply an application of a known instrument to a purpose for which it had been applied before, not to the same structure, but the requirements of the two structures, that is, the portion of the ship and the portion of the gas-holder were exactly identical, and the mechanical properties that belonged to the angle iron were the same in both cases, and the result was the same in both cases, and the effect of the patent was simply this—that what mankind had done before in the application of angle irons to ships and other like purposes the patentee claimed to do by their application to gas-holders. The last case, *Harwood v. Great Northern Railway* (11 H.L.C., 654), is one which perhaps is not so simple, but when once the findings of fact are established in that case the principle is exactly the same. The great engineer, Brunel, many years back wishing to keep together long undergirding strips of iron which were to support the planks on one of his bridges in the West of England, applied a mode of using rolled out pieces of iron into which square bolt heads were put, and then there was a flat piece of iron on the other side, through which the bolts were screwed up by a nut. Exactly the same thing was done by the Great Northern Railway Company when they came to apply the same kind of iron rolled out in exactly the same kind of way with the same kind of nuts to the fishing of iron rails in order to preserve one continuous rail for very many miles. In that case there was a great discussion as to whether the object of Brunel was really and practically the same as the object which was sought for and then attained by the engineer of the Great Northern Railway, but when once this was answered in the affirmative there was an end of the case. In all these cases the real question must depend very much upon the extent to which the subject matter, to which the particular apparatus or particular contrivance is applied, is cognate in its character, and wherever you find it is so cognate in its character, and that there is not sufficient novelty in the combination which is put forward, then the patent cannot stand. If, however, it is otherwise, if the subject matter is not cognate, or if the combination is really new, or if what is done comes within the language which was used in *Crane v. Price*, and in the later case of *Cannington v. Nuttall*, so as to show that there is in substance a new commercial product, then the patent is good. Upon that part of the case I think no more need be said. But there remains still one point to which, I think, we ought to give particular attention. I refer to the argument that was addressed to us very properly and very clearly by Mr. Aston for the defendant, and that relates to the particular evidence that was given by one of the witnesses, a Mr. Darker, which amounts to this: He was a man of skill, an optician, and it had been in his experience necessary to see how light could be obtained for a particular purpose through a vertical shutter. He brought to bear his knowledge upon the subject, and he produced in Court this instrument which holds a prism, and he pointed out that when he wished to make some particular kind of designs, selenetic designs, he found this a practical and useful mode of getting the ray of light which came down vertically, not upon the horizontal, but upon the angular face of a prism fixed in a shutter into his room for this purpose. No doubt all the actual processes of nature, if one may say so, were gone through in his case which are gone through in the case of the plaintiff when he uses his glass for the purpose of throwing light down into one side of an area from the street. But when you have said that you have said all that can be said. It certainly

* The Engineer, 25th February, 1881. See also the "Illustrated Record of British Patents," Part I., p. xxiii.

cannot be said that the result for which Mr. Darker used this was the same as the general and commercial result by which the plaintiff seeks to produce a better kind of pavement light, nor can it be said that any person before the plaintiff had ever applied that process which was applied by Mr. Darker for the same or for a like purpose. The application of the known science upon the subject in the particular manner in which it was applied by Darker cannot be taken to have been doing beforehand what was afterwards done by the plaintiff. Now the only remaining question is whether what was done by the defendant is an infringement. That was put before us by Mr. Aston in this form: Mr. Aston says, and says quite truly, the plaintiff's patent consists of iron frames which were known before, of a flange which was known before, and all that the defendant did was to take an iron frame and a flange of glass such as the plaintiff has used, and the properties of which were known, and he merely took from the glass which was used by the plaintiff a portion of it which was useless.

Mr. ASTON: That which was used for a ship.

Mr. Baron POLLOCK: He took away that which was used and known before, and that which was useless for the particular purpose for which he intended to use it, just in the same way as in the illustration I mentioned during the argument, when an engineer sees a solid piece of iron being used to strengthen a building he takes away from it that which is useless, and points out to the man who is using it that it would be better if he used only portions of it because he would economise his material, save the weight, and, indeed, in other respects get a greater strength by using rods of iron instead of solid blocks. So, says Mr. Aston in this case, there is a mere ademption of the material which has been used for many years. Whether that is a sound argument when you are considering this as an infringement or not depends upon whether our conclusions are true. If the conclusions at which we have already arrived are correct, and we find this is a patent which can be supported *in omnibus* on the grounds on which we have arrived, namely, that it is to be taken as a whole and good as a new manufacture, and a new application of known principles for commercial purposes, then in that case you cannot say that the defendant has not infringed. He has applied this particular piece of glass in the same way the plaintiff had applied it and for the same object, and he has adopted the plaintiff's user and invention simply with a variation, which variation the jury have found to be colourable. I do not mean that the finding of a jury in a matter of this kind would be binding upon us, apart from the true construction of the specification. But construing the plaintiff's specification as we do construe it, and finding it to be what we do find it to be, we are led to the same conclusion as the jury were led to, and we think this cannot be treated merely as an alteration of some known thing which existed before the plaintiff's invention, because that known thing, whatever it was, never was applied until the plaintiff's invention in the same way in which the plaintiff applied it; and we think it also should be laid down as a clear principle in patent law that you cannot by a mere ademption of some particular part of that which, as a whole, is a useful invention, take the benefit of the patent and say that you are not infringing it. That we think is perfectly clear, and if necessary it could be supported by decided cases. It is sufficient for the decision in the present case to say that we think the application of the principles laid down by Mr. Aston, and in no way controverted by us, do not meet the present case. Under these circumstances the judgment of the Court upon the finding of the jury will now be for the plaintiff, and with the usual result as to costs.

The defendants appealed from this judgment, and the appeal was heard on the 24th of May, 1881. The facts and arguments sufficiently appear from the above statement and the judgments.

Mr. Webster, Q.C., and Mr. Carpmael were counsel for the plaintiff; and Mr. Aston, Q.C., and Mr. Macrory for the defendants.

Lord Justice BRAMWELL: I think that this judgment should be affirmed. I think the plaintiff is an inventor. I think he has found out, and manufactured and patented, a thing, an article, namely, a light directing pavement light; that is the thing he has invented, and, to my mind, patented. I do not think there is any very great quantity of invention in it; it is not as though a man had sat himself down to consider how he could make a sewing machine, or a grain-pressing machine; it is a much humbler piece of invention than that, and it may possibly be nothing more than that the idea struck him, and immediately the idea struck him he could apply it or carry it into execution by a very obvious apparatus. But still it is an invention, and it is not the less an invention because it required but small inventive powers to enable him to do it. One may take an illustration in this way, the screw propeller; I suppose everybody knew that a screw used as it was would act in the way of screw propeller does; but the man who thought of it and applied it to a steamboat, which I suppose anybody could have done if the idea suggested itself to him, would have been called the inventor of a screw propeller or screw propelling steamboat, as the case may be. It does not depend upon the quantity of invention. Nor is it in this case the patenting of an idea. He does not say, "I have thought of such and such a thing, and I claim a patent for it," but he says, "I have thought of such a thing, and I will show you how to carry it into execution," and therefore it is not open to any objection such as I have indicated; nor is it open to any objection in regard to the constituent parts of it being old. No doubt the prism as the plaintiff uses it is old, it is as old as the world that a prism used as the plaintiff uses it will direct light in the way his prism does, and the other part of his invention is not new, that is to say, the particular mode in which he makes his pavement light, but the combination is a novelty. The thing was never practised before, and undoubtedly a combination of two old things may be made the subject of a patent. It seems to me then that the plaintiff really is an inventor—he has found out something. He makes an article that was not made before. This particular case may be, no doubt, upon the verge; but one cannot help making this remark, that it is very strange if it is no invention that it has never been done before. Why has it never been done before? Why, because nobody else found it out, which I take to be an equivalent to inventing, and I think, therefore, that his patent is sustainable. So much as to the first question. Then as to the infringement. That really is the most obvious thing in the world, It is perfectly manifest that the difference between what the defendant has done and what the plaintiff has done is, I will not say colourable, because it is not a right word, there really being no difference between them; it is the same thing; it is not one thing pretending to be another, but I think it is a direct claim to do that which the plaintiff is doing. Upon these grounds, I think, the judgment should be affirmed.

Lord Justice BRETT: I must confess that from an early stage I had very little doubt about this case. It seemed to me that the whole matter really depended upon what was the proper construction of the specification, and that if the specification did in truth claim a new machine, a new apparatus, or a combination, whichever you may please to call it, that then that combination was new, and it was palpable it had been infringed. If anything less than that new machine made up of combined parts was claimed by the specification, it seemed to me that the plaintiff's case must fail on several grounds, namely, that if less than the whole were claimed, that which was claimed was not new, and if less than the whole were claimed, there was no infringement. So that, according to my mind, the whole case practically depended upon what was the true construction of the specification, and of the claim. In my opinion the proper construction of that specification is that the plaintiff claims in it a new pavement light, made by combining together so as to make a new machine or a new apparatus, or a new pavement light, an old frame, an old flange, and perhaps an old half prism, which old portions of the new apparatus or machine had never before been combined together so as to produce the machine claimed by the plaintiff. In order to support that proposition one ought to examine a little the specification, and the very first phrase in it is this: "This invention has for its objects improvements in pavement lights." What is a pavement light? A pavement light as we have seen it, and as it is bought and sold, is a particular article. "Pavement lights," he says, and therefore pavement lights in one sense existed before, "are commonly used to cover areas in front of windows in the basements of buildings, and the object of my invention is so to construct them (what is the word 'them' referred to—why, pavement lights) that they may not simply allow the light to pass through, but that they (that is pavement lights again) may also direct the light in an inclined direction into the rooms it is desired to light." The problem which he had to solve was this: it is to be a pavement light, and it is necessary therefore that the upper surface should be horizontal, should be level with the pavement; it is necessary that it should be made of a frame strong enough to hold thick glass; and so thick that people may walk upon it, and it seems that it must be necessary to have something in the shape of a flange to the glass, and the other part of the problem was so to arrange a pavement light that it might "direct the light in an inclined direction into the rooms it is desired to light"—that is to say, that it might direct the light which falls vertically on to this horizontal pane of glass, so as to pass into rooms which are not under it. That was the problem in fact. In order to make that light effective in a room it seems to me it must go nearly horizontally into the room, because if the window were so far below the pavement that the light had to go at anything like a large angle down, it would only light a portion of the room, and, therefore, this thing can only be really used where the window of the room is sideways, and where the top of the window is not much below the level of the pavement. Therefore, that gave him another datum line, which was that the side of the prism with which he was about to deal should be upright or nearly so. The problem he had to solve, therefore, was to construct a pavement light with the direction of two given lines in it, so as to throw the light sideways, and he states that to be the object. He says, "for this purpose I glaze the frame of the pavement light with glass, which is moulded, so as to be of a prism-like form on the underside, resembling to some extent in this respect"—that is in respect of its only being in a prism-like form—"the glasses which are often inserted into ships' deck to give light below. The form and arrangement of the prism is, however, entirely altered"—so that it is not a prism like the one in the ship's deck, but it is a prism entirely altered, and the only similarity between the two declared here is that there is a certain similarity in this respect, that they are in prism-like form but entirely altered—"in order that the light may be thrown forward in one direction as already stated. One of the sides of the prism is upright or nearly so"—that was part of the problem he had to solve—"and the other side is inclined to it"—not at any particular angle but—"at such an angle that the light passing through the upper surface may strike this inclined side and be reflected completely or nearly so within the prism, and issue from the upright or nearly upright side in the direction required." Then he says:—"In order that my invention may be fully understood and readily carried into effect, I will proceed to describe the drawings," and he says, "Fig. 1 is a plan of a pavement light," and he describes it, to my mind, in unusually clear terms for a specification. I will not go through the rest of it, but what is claimed is "the construction of pavement lights, substantially as described." Therefore he does not claim a frame, he does not claim a frame which will hold glass with a flange, he does not claim a prism of any particular sort, but what he does claim is the construction of a pavement light, substantially as described, and it seems to me what he claims, and what he has just described, is a machine, or apparatus, or article, which is a pavement light. Now that pavement light he has described, and it is formed by the combination of three things which it may be said were known before. It is necessary, in order to make that pavement light of his, that there should be a frame; it is necessary that there should be flanges, so that the frame may hold with sufficient firmness the glass to be put into it; and it is necessary, in order to make that pavement light which he describes, that the bottom part of the glass should be in the form of a prism, but in a particular form of prism, which may be described at large, and not with total accuracy, as a half prism, but a half prism of which the upper side must be horizontal, one side must be nearly vertical, and the other side at an angle, and such an angle that the vertical rays, when striking against the inner circles of the inclined side of the prism, may not so strike the other side as to be reflected back into the prism, but may go at once through it. The true construction of the specification seems to me that he has claimed such a machine. Then comes the question, Is such a machine so formed a new thing? The frame is not new, the mode of putting the glass into the frame is not new, and the fact of the lower side of that glass being in a prism-like form is not new, because that had been done in the decks of ships, and if this light had been substantially like the deck light of ships, I should have thought that was a sufficiently analogous use to have presented the novelty of this machine, but it is not the same prism as was used in the deck lights of ships, and it is not used for the same purpose. In the case of deck lights of ships the prism was used for dispersing the light both ways into the cabin that was beneath it, and the problem of throwing the light only one way, and thus into a room which was not under the light, was not a problem which had presented itself to the minds of those who had to deal with deck lights. It therefore seemed to me that the deck light of ships was not an anticipation of this machine. Then it was said that a prism used by a man of the name of Darker was an anticipation of the prism used by the plaintiff. In the first place, if this claim had been only for the use of the prism in the way in which it is used, I should not have thought that Darker's was in anticipation. It is true that Darker used the prism to introduce light from the outside into rooms, but it was no part of the use of that prism that the upper side should be horizontal, or that the one side should be vertical; it turned upon a pivot, and was merely used for the purpose of directing the light to a given point, but not directed so as to disperse it into a room at the side. Supposing you could say that the prism, as a prism, was the same as Darker's; it seems to me really preposterous to say that Darker had used a machine such as is anything like the whole, which, as I have said, is the subject matter of the plaintiff's claim. Therefore Darker's prism is no anticipation at all, and if that be so there is no anticipation of what the plaintiff claims. I wish to say that I do not decide that Darker's prism might not have been an anticipation of the plaintiff's prism if the plaintiff had only claimed the prism. I assume for the purpose of this case that the use of the prism merely as a prism is old, but what I hold to be the plaintiff's claim is a new instrument or apparatus made up of three old parts which had never been combined before in order to make the whole machine. It seems to me, therefore, that the plaintiff has claimed a new machine, and that that machine was new. That it is useful none have denied. There was a point raised and discussed which for a time did seem to me to present a difficulty, namely, whether although this was new and useful it could be said to be an invention. Now the difficulty that that proposition presented to me was this: That I did not recollect of myself any case in which where a thing had been pronounced to be new and useful the question of whether it was an invention had been ever discussed, or even left to a jury for instance. It seemed to me in all previous cases it had been taken for granted that if the thing were new and useful there must have been an invention in order to arrive at a thing that can be so described, and I should say that in nine hundred and ninety-nine cases out of a thousand that must be so. I say if the thing is new and useful it is impossible to suppose there is not sufficient to make it an invention, but I do not think as a matter of law that could be predicated as an absolute rule of law, because I think it is possible, although a thing were new and useful, it might be, under certain circumstances, that there was no invention in it. However, in this case, I think, taking this to be a combination, there was so much invention that we cannot say as matter of law that it was not an invention, and nobody at the trial seems to have raised that question, or asked that it should be left to the jury as a separate question. Therefore, I think this machine so invented by the plaintiff, and claimed by him as a new machine combined with old parts, or apparatus, or commercial article, whichever you please to call it, is new, that it is claimed as new, and therefore that it is the subject matter of a good patent. I do not find that the learned judge at the trial in terms construed the specification, but I think that he, by the questions he left to the jury substantially construed it in the way I think it ought to be construed. Now I will take next the question of infringement, and I must say I feel rather pained upon this question, because I do not think it is an innocent infringement. The evidence seemed to me to show that the defendant's son had become acquainted with this machine whilst he was in the service of the plaintiff, and he had carried over that knowledge to the partnership of the other defendant. Now comes the question of the defendant's specification, which was hardly alluded to at the trial, and to my mind for the best of reasons, because it seems to me, with all deference, that that specification is drawn artfully, so as to be a mass of words that no one can understand, and drawn so as to conceal that which was about to be done. That seems to me to be the effect of it, but it is wholly immaterial whether what was done by the defendant was done in accordance with the terms of the specification or not, because the question is whether the defendant made articles which were an infringement of the plaintiff's patent. It seems to me that the articles made by the defendant and sold by the defendant are identical substantially with the article made and sold by the plaintiff. They are the plaintiff's machines with a notch cut into the glass, which notch has no effect upon the strength, and no optical effect whatever, but, in reality, is a real sham. Therefore, in my opinion, not only are the machines similar and sufficiently similar to be an infringement, but they are identical. Then the only remaining question is as to whether the judgment ought to be entered, as it is, upon the questions found by the jury. The first question left by my brother Hawkins seems to me to have been left out of caution, and in order to meet any difficulty which thereafter might be raised by the extreme ingenuity of counsel who were before him. It seems to me to be a question that he was asked practically to leave by Mr. Aston, and did leave in order to be cautious. It is a mere abstract question of a scientific proposition, and it is a question which to my mind is wholly immaterial, and has no effect. In my opinion it was only put by way of caution, which caution, I think, my brother Hawkins was right to use; but under the circumstances, I think it is a question which ought not to have been left as matter of law, and which can have no effect. The other two questions are material, and it seems to me, after the construction of the specification had been practically ruled, that the learned judge left the right questions to the jury, and the jury have found both questions in favour of plaintiff. Therefore both upon the questions left to the jury, which I think were substantially right, and upon the construction of this specification and the question of novelty and invention, it seems to me that this patent was a good one upon the part of the plaintiff, and that it was infringed by the defendant. I think the judgment was right in the result, and that this appeal ought to be dismissed.

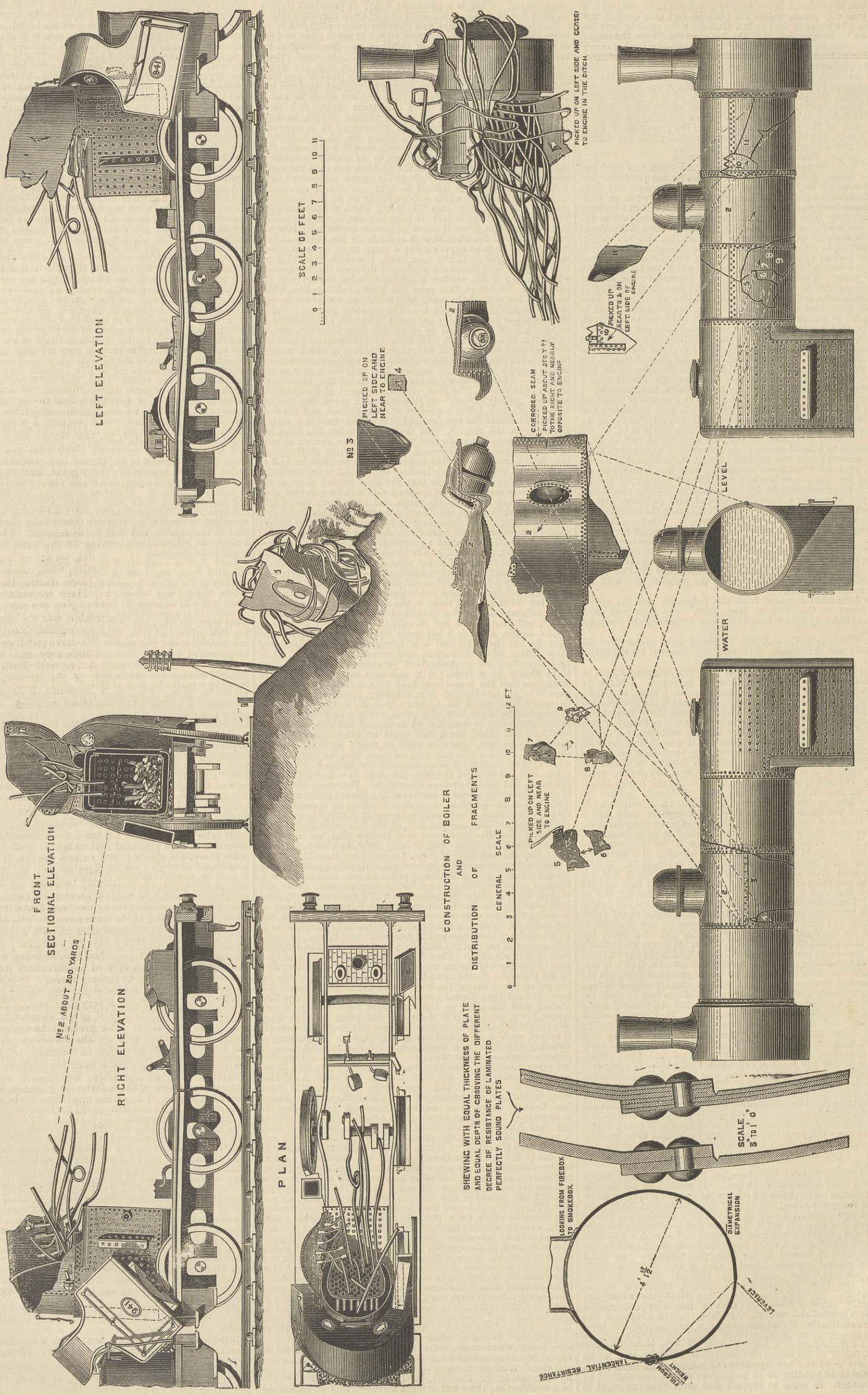
Lord Justice COTTON: I am of opinion that the judgment appealed from ought to be affirmed. The question as to the validity of the patent depends upon the construction of the specification, which I was not able to see quite so clearly as Lord Justice Brett seems to consider it; but in my opinion upon the true construction of the specification, the plaintiff's is a good patent. Now what is it? It was contended that it was a mere claim for inventing this prism, and if so, that would not be sufficient; but when one looks at it one sees that it is not so; it is for an improvement in pavement lights, a prism not being a pavement light, but only part of an apparatus called a pavement light, and in my opinion, what is claimed is this—an improvement in pavement lights by a particular form of glazing, that is to say, by substituting for the old glazing of less or greater thickness, which had been in use before, a glazing which would not be simply a prism, but a prism so constructed as to direct the light into any required direction; not always in the same direction, but in a direction which might be required, having regard to the depth below the pavement of the room, and the size of the room, and that I think is indicated sufficiently by the specification which has been read by my Lord Justice Brett, and I will not read it again. It is clearly stated that the object is to construct a pavement light with a prism so as to send the light in the direction required. My doubt was, when it was so pointed out, whether it was sufficiently explained by the specification what the plaintiff's invention was, and how it was to be done, but I think when one looks at the evidence, and to the words of the specification, it does. In my opinion he does sufficiently point out that which I think was his invention, namely, an apparatus called a pavement light, not only with glazing with a prism below, but with a prism, or such portion of the prism, so constructed as keeping the upper surface fixed to the pavement, as it must be, to send the light in the required direction. That, in my opinion, is not only a new union of things not found together in one apparatus before, but it is a union, an introduction of this in such a way as to obtain the required result, and therefore to constitute in the meaning of the words a combination; that is to say a new machine, and a putting together of the parts so as to constitute the subject of a valid patent, and therefore, in my opinion, this is a good patent which the plaintiff has taken out. I agree with the reasons given by Lord Justice Brett for saying that Darker's prism was not an anticipation of the invention which the plaintiff has claimed, and I do not go again through the reasons he has given for that. Then with regard to ships' deck lights, I hardly think it necessary to advert to it, but I may say there the prism was entirely different. No doubt in those cases it was a prism with an acute point cut off more or less, but it was not a prism in any way arranged or intended to throw the light into any given direction, though possibly it was to a great extent introduced for strength, and probably it had some effect in diffusing the light, but it was introduced in an entirely different way and for an entirely different purpose, and in my opinion did not anticipate the invention of the plaintiff. Then, as regards the infringement, really one has nothing to say about it, because it is, in my opinion, clear that this is an infringement. I do not say that it may not be some improvement on the original invention, but if the invention has been taken by the defendant he cannot use it so long as the plaintiff's patent lasts without infringing the plaintiff's patent, even although he may have done something which improves the original invention. I say that because I do not think we are in a position to decide whether the shaving off a portion of the one surface of the prism, that is to say, the transmitting surface, may not have an effect, and be an improvement upon that which the plaintiff originally patented. It is not necessary for us to decide that, but in my opinion the defendant has fixed into a pavement light, in other respects like that of the plaintiff, a prism, possibly with the transmitting side not always so perpendicular as in the plaintiff's, but with the two sides so arranged that the one side inclined at a greater angle shall reflect the light in the interior of the prism on to the transmitting surface. In my opinion, therefore, the defendant has infringed the plaintiff's patent. I may say that the son seems to have acted with his father in making these machines which are now held to be an infringement, and I think he was properly joined as a defendant, and that the judgment was right against him as well as against the other defendant.

An application was made on behalf of the defendant for a stay of proceedings under the judgment, pending appeal. The Lord Justice COTTON pointed out that, as a rule, the plaintiff was entitled to all his ruling immediately, unless the defendants could show good ground for a stay of execution. The application was therefore refused.

Solicitors for the plaintiff, Messrs. Wilson, Bristow, and Carpmael; for the defendants, Messrs. Ashurst, Morris, Crisp, and Co., and Messrs. John Vernon and Co.

# THE RAINTON BOILER EXPLOSION.

(*For description see page 408.*)



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A. G.—*The defect in your scheme is that you would double the cost and complication of the apparatus by combining the vacuum with the pressure system.*

J. P. (Harwood).—(1) *There is no special book on steam cultivation, but you will find a great deal of information on the subject in the Journal of the Royal Agricultural Society, and in the Transactions of the Society of Engineers for* 1868. *The volume in question is published by Messrs. Spon, Charing-cross.* (2) *Wilson's treatise on "Steam Boilers," last edition, will give you the information you require.* (3) *We do not understand this question.*

STUDENT.—*The evaporation from a water surface will depend very much upon wind as well as temperature. With a comparatively high temperature and no wind, evaporation will be slow as compared with even a lower temperature and considerable wind. Evaporation from a surface of water as measured over a period of twenty-two years is* 77·77 *per cent. of the total rainfall in the district of London. The greatest known descent of a water surface open to rainfall was probably in* 1868, *when the descent was* 10·5*in. in three months. In the hot months of the year—May, June, July, and August—it may be taken as about* 3·5*in. per month. For very full information on this subject consult the "Proceedings" of the Institution of Civil Engineers, vol. xlv.,* 1875-6, *Part III. See also vol. xxxix.,* 1874-5, *Part I.*

### STEEL SIEVES.

(*To the Editor of The Engineer.*)

SIR,—Can any of your correspondents oblige me with the name of any firm who manufacture machines for punching steel sheets up to $\frac{1}{16}$in. thick, 3ft. wide, for sieving purposes?

T. W.

Warrington, May 31st.

### BELL METAL SLIDE VALVES.

(*To the Editor of The Engineer.*)

SIR,—Being requested to replace a cast iron slide valve by one of bell metal, I beg to ask if "Foundryman," or any other of your able correspondents, would give me their opinion about it. The valve is the main slide valve of a high-pressure expansive engine. The face of the valve next to the cylinders and the cylinder face is badly grooved in some places to the depth of $\frac{1}{16}$in., although kept well lubricated. The top side of the valve or the face upon which work the cut-off plates is quite smooth and like a looking-glass. The valve itself is 2ft. 3in. long by 14in. broad, and weighs rather over 2½ cwt. The cost of this valve if made of bell metal would be three times that of cast iron, and I want to know if I adopt it will it cut up like the cast iron, provided both faces are properly planed and scraped?

ENGINEER.

Birmingham, May 30th.

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# THE ENGINEER.

*JUNE* 3, 1881.

## THE DESTRUCTION OF THE DOTEREL.

COMMANDER EVANS's report, which we publish in another page, probably supplies nearly all the information that will be obtained concerning the destruction of the Doterel. We can compare it with the statements made by other survivors of the catastrophe, and with them it substantially agrees. There are slight diversities in the various stories, but not more than were to be expected. Unless the diver employed to examine the remains of the ship, which lie in about 50ft. of water, can tell us something not now known, it is all but certain that theories of the cause of the destruction of the ship must be based on Commander Evans's report. It is altogether unlikely, in a word, that the sailors and others who escaped can say anything calculated to clear up the mystery. It will be readily conceded that the materials thus put before those who may wish to frame hypotheses to explain a frightful disaster are meagre in the extreme; and the more closely the whole subject is investigated the more puzzling does it become. We must not, therefore, be deterred from attempting to solve the problem, and it may yet be found possible to arrive at a tolerably consistent explanation of the event.

In another page will be found a sketch of so much of the internal arrangements of the ship as most concern us at this juncture, and this sketch should be examined by our readers before they proceed further. The Doterel was a perfectly new craft, on her first voyage. She was a small vessel, being 170ft. long, 36ft. beam, drew 14½ft. of water, and had a displacement of 1140 tons. On that draught, her upper deck was 6½ft. out of the water. She had compound engines which indicated 950-horse power. She was built of wood in two thicknesses of planking, secured to heavy iron frames but 20in. apart. Thus she was a very strong ship. She was rigged as a barque, and carried a large spread of sail. Indeed, the class to which the Doterel belonged may be regarded as intended to train seamen. She carried a crew of 140 men, and mounted two 90 cwt. guns and four 64-pounders on traversing arcs. Her bunkers stowed but 140 tons of coal, and she did little steaming, relying almost always on her sails for progression. Her three boilers, each 7ft. 9in. in diameter, stood fore and aft, nearly in the centre of the ship. There was nothing peculiar about them. They were separated from the fore magazine, first by a bunker right across the ship, then by the chain cable locker, and lastly by the water tanks. But the tops of the boilers were above the level of the deck in which was the hatch to the magazine, and the water tanks were stowed below this deck. Thus it would be possible for flame to flash along the deck from the upper part of the thwartship bunker to the magazine hatch without interfering with the chain cable locker or water tanks; but flame could not reach the magazine from the lower portion of the bunker or boiler-room without traversing the chain cable locker and the tank room.

There are several hypotheses available to account for the destruction of the ship. The first is that she was blown up by a torpedo. This may be at once rejected. Another is, that she had among her coal an infernal machine—that is to say, a block externally like coal, and filled inside with dynamite. This would be thrown into a furnace in the usual way, and would very soon blow a hole in a boiler. Unfortunately this theory is not without plausibility; and the putting of such a device on board would be quite consistent with Fenian ideas. We think, however, that this theory may also be rejected, for the present at least. Next we have the supposition that a boiler blew up, and ignited the fore magazine; and, lastly, comes the hypothesis that a gas explosion occurred in the bunkers. It is this last idea which commends itself to us as the most probable solution of the puzzle. It will be seen from the cross-section which we have given elsewhere, that coal was stowed right over the boilers. Such a position is always objectionable, but it could not be avoided in such a craft where the space is limited. The danger of carrying coal in this way is augmented by the long time during which it would be enclosed in the bunkers. In each of the bunkers were ventilating pipes leading to the funnel; and the engineers were instructed to take the bunker's temperature every four hours, and note it in the log. It is not difficult, however, to imagine that in spite of these precautions, gas might accumulate in the cross bunker. It is evident that the ship was to have been coaled at once, and the bunker lids would, therefore, have been taken off. Now close to the coaling scuttles stood the galley, and in this the fire was alight. All the conditions, therefore, were favourable to a gas explosion. The bunker was nearly, perhaps quite empty of coals. What was the nature of the coal carried we do not know, but it had been taken on board at Monte Video, and the chances are that it was gaseous. It might have been put on board wet, which would have promoted decomposition. We have no tangible argument against the assumption that the bunker contained an explosive mixture—air and gas—save that, according to the logs of the engineer, a high temperature had never been reached. It is, however, worth notice that the chief engineer had been off duty, under arrest, for some little time; and it is quite possible that the log is not strictly accurate. But in any case, the bare fact that there was a low temperature in the bunker is not evidence that coal gas could not be present. Let us assume, for the moment, that there was gas in the bunker and that it did explode, and let us consider whether it was or was not competent to secure the destruction of the ship.

The cross bunker had a capacity of about 1400 cubic feet, and assuming that there were 160 cubic feet of gas present, that would be sufficient to make a highly explosive mixture. The force of the explosion can only be arrived at by considering how much the heat produced would be equivalent to. On this point statements vary. According to Mr. Ross, London gas will give out on combustion 1466 units of heat per cubic foot. Thus, $160 \times 1466 \times 772 = 181{,}080{,}320$ foot pounds, or 81,022 foot-tons. Mr. Ross's is perhaps too high an estimate. It is not quite certain either how far the heat of combustion is utilised in a gas explosion. If we reckon up the force in a different way, we may say that 20ft. of gas represent 1-horse power for an hour; thus 160 cubic feet represented 8-horse power developed for an hour, or 1,584,000 foot-pounds, or 700 foot-tons. This latter estimate is based on the performance of gas engines. Which ever we take we may regard it as proved that there was quite sufficient force available to inflict very serious damage on the ship. Commander Evans, it will be seen, holds that the fore magazine blew up. We venture to doubt that it did anything of the kind. Not less than twenty or thirty seconds took place between the first and second explosion. What was taking place during this time? There was nothing, we understand, in the magazine but about four tons of gunpowder, all packed in sealed metallic cases. All the gun-cotton, fulminating primers, and such like, were stowed in the after magazine. If Commander Evans is right, the first exlosion must have driven in the side of the magazine—a stout, wrought iron box—and having burst some of the powder cases, then ignited them; but this is to suppose that the whole tank room and cable locker were demolished. We know that a portion of the side was blown out of the ship, and that her deck was lifted by the first explosion. Most of its force was expended in this way. But supposing that enough were left for the destruction of the magazine, how are we to account for the delay in the ignition of the powder? This is to us a great difficulty. Again, it appears from a couple of letters from eye witnesses, which appeared in the *Times* last Wednesday, that the Allen Gardiner, another vessel, was lying within two hundred yards of the Doterel, and yet suffered little or no injury. Other vessels and a lighter in close proximity were only slightly harmed by flying pieces of metal. The Regent's Canal explosion and the Clerkenwell explosion may be cited as examples of the tremendous havoc which comparatively small quantities of gunpowder can do when ignited. It would of course be absurd to pronounce a positive opinion; it is not too much, we think, to say that the evidence is against the explosion of the fore magazine. The second must, if we are right, have been a gas explosion.

Our readers will not be slow to trace a remarkable similarity between the case of the Doterel and the Tottenham-court-road explosions. In both cases distinct explosions followed each other, sensible intervals of time interposing between each two reports. On board the Doterel there were two explosions, the first severe enough to burst open the ship's side and force up the deck. The second explosion was more violent, because two bunkers of the ship were concerned in it. They would have a gross capacity of nearly 4000 cubic feet, and even if still half full of coal, they would contain 2000 cubic feet of explosive mixture, 200ft. of which would be gas, perhaps more. We shall not strain our argument in any way if, after making all necessary allowances, we assert that the ignition of an explosive mixture of gas and air in the main bunkers of the Doterell would have sufficed to have lifted her upper deck and sent it flying into the air. It would have been adequate to produce all the effects described by eye-witnesses. But we do not think that if four tons of gunpowder had exploded, anyone would have been left alive to tell the tale. Although there were many persons near who saw the explosion, no one was hurt, nor is the shock said to have been very great, and this is inconsistent with what is known of the effects of gunpowder explosions, but it is fair to add that the position of the powder below the water line may have had something to do with this. As to the hypothesis concerning the explosion of the boiler, we mention it to dismiss it. There is no reason to conclude that anything of the kind took place; and even if we assume that it did, we are no nearer than before to a solution of the difficulty, what caused the final explosion? What was taking place during the interval between the two explosions? Here we must leave the matter. We have endeavoured to give our readers all the information on the subject available, and we beg it clearly to be understood that we make no dogmatic assertion as to the cause of the catastrophe. We have put forward what we venture to think is a satisfactory and consistent hypothesis, and it would, perhaps, be well if the Court of Inquiry directed the attention of the witnesses to this hypothesis. But when all is in doubt, it is impossible to do more with propriety than make surmises.

## DESIGNING LARGE GIRDER BRIDGES.

OF the whole time occupied in designing a girder bridge, a very considerable proportion is employed in the tentative calculation and re-calculation of the strains, weights, and sectional areas, it being necessary to assume a weight for the main girders, platform, and secondary bracing, in order to make the first strain diagram. Having thus arrived at a preliminary value for all the chief strains, it becomes necessary to re-assign the necessary sectional areas, to re-calculate the weights, and again re-calculate the strains in accordance with the modified weight. Practically, the process is seldom repeated many times, an approximation to a proper relation between strains and weights being adopted. This approximation may be a near one, or it may err considerably on the side of excessive weight; but the calculation and re-calculation by the usual tentative method may be looked upon as an interminable process, which after great labour only secures after all only a more nearly exact approximation than may be obtained with less labour. Yet it is upon the care and trouble taken with these calculations that the details of construction influencing economy depend especially in long spans. It is therefore desirable that practical formulæ for the use of engineers should be devised by which a very near approximation to the weight of a girder bridge of given elementary dimensions may be arrived at. The problem has received the attention of several writers on the theory of strains and the strength of bridges; but no formulæ of sufficient comprehensiveness and at the same time simplicity have been devised, though formulæ for approximating to the weight of girders of some forms by expressions giving the weight as the function of the span have been prepared by several engineers, and have been a good deal used. These, however, employ constants involving an assumption based upon analogy, and are thus of limited application in the design of girder bridges not very similar to existing bridges. For beams and simple girders the methods of Rankine, Baker, Unwin, Stoney, Anderson, Winkler, Seefehlner, Engesser, and others give sufficiently accurate results; but in girder bridges, especially of the larger spans, the secondary and wind bracing form important elements in the total weight which are not taken into account in the formulæ given by most of these writers, and in none satisfactorily. Anderson's rule, for instance, for the proportion between the weight W of a bridge per lineal foot, and the weight carried is $W = c\,L$, L being the length and $c$ aconstant. A better form of the same rule, which has long been in use in Germany, is $W = c' + c'' \times L$, as given by Laissle and Schübler, Mr. Anderson's alteration consisting of merely striking out one of the constants.

An important paper dealing with this subject was read in February last, before the Institution of Civil Engineers, by Mr. M. am Ende. The author dealt more particularly with long span bridges, and especially of those with deep girders of large triangulation. The latter feature, of

course, involves great distances between the points of junction of the bracing; but in order that there should be no transverse strain in the flanges when the bridge is fully loaded, they are curved between these points to a radius, for which the author gave formulæ applicable to both top and bottom flanges, the former being of the parabolic form. By this method of construction the upper flange in compression is only subject to transverse strain when there is no load on the bridge, while the lower flange under tension is only subject to such strain when loaded. The plan of his investigation was to construct a formula for the weights, in which formulæ, to begin with, the weight of the bridge, the weight of the platform, and the weight of the moving load, the principal dimensions and a number of constants appear as undetermined quantities. Then the moving load, the weight of the platform, and the width of the bridge were assumed as functions of the span; and, finally, the constants were determined from ordinary practice in the construction of parts of bridges. The only difficulty in the way of a completely satisfactory solution of the problem relates to the secondary bracing, but even for this Mr. am Ende succeeded in devising convenient working formula, which will be useful to all engineers engaged in the design of large bridges. The secondary bracing does not receive its strains from either the load or from the wind pressure, if the bridge is of the proper strength for its load; and hence calculable strains do not provide a means of arriving at its weight as they do for the other parts. In order to arrive at the weight of this bracing, the author, therefore, designed a series of girder bridges up to 1500ft. span, some of the smaller having been executed, and from these derived the expressions which could not be obtained by reference to the smaller structure alone. From these designs the author arrives at formulæ, constants, and coefficients for the weight separately of flanges, verticals, diagonals, wind structure, and secondary bracing, which are in the end collected and somewhat simplified. The constants for loss by rivet holes, for rivet heads, cover plates, and inaccuracies in thickness, &c., are uniform with those generally in use in the practice of most engineers. It is needless to say that no formulæ for the purpose can be produced which will give a rough-and-ready answer to the questions as to weight which will present themselves at the ontset when the engineer is called on to design a girder bridge; but the formulæ, though somewhat lengthy, are of a simple order, and represent a very small portion of the labour which must be expended on the tentative method. It is necessary to mention here that these questions only form part of the paper referred to, the author's object being also to arrive at the limiting dimensions of girder bridges in iron, and to some extent in steel.

The claim to originality in Mr. am Ende's formulæ really rests on his separation of the various items constituting a large bridge structure as much as possible, instead of as little as possible, as is done, for instance, by Anderson in the expression given above, and even by Stoney and others in formulæ more comprehensive, but still so abbreviated as to leave some essential elements out of the calculation. By doing this Mr. am Ende renders himself as little dependent as possible on what may be termed factors of experience. Other writers have comprised the items for long struts, wind structure, and secondary bracing in one constant, whilst Mr. am Ende treats the wind structure as an entire bridge by itself, consisting of flanges, webs, and transverse girders, and for secondary bracing he makes a separate formula, in which are three constants derived from practice. Mr. am Ende's formulæ thus provide the means of determining the weight of a girder bridge of given principal dimensions and character, and it is worth drawing particular attention to his paper, because of the evident necessity for a practicable method of arriving at a satisfactorily close approximation to the relation between weight and strains. For the large spans which have become somewhat common in recent times, and are likely to be more common in the future, it is equally important that neither too much nor too little material should be put either into the chief or secondary parts. For this reason every means of simplifying or abreviating that which is a long and often laborious process, if thoroughly carried out is a desirable acquisition; and though the formulæ to which we have referred are more strictly applicable to large girder bridges of one class, the principle might be usefully carried out with reference to all. It is not our purpose to reproduce Mr. am Ende's formulæ here, as with the reasoning employed in its development it would occupy too much space. When, however, we look round and observe the very different proportions adopted by engineers in bridges for similar purposes, and which might be cited as examples, it is evident that slight differences of opinion as to the necessary factors of safety cannot account for the difference in scantlings, and of course it must be assumed that for any particular bridge girder the strains as calculated by different engineers must be the same, even though ascertained by different methods. It is not necessary that a bridge should be heavy to be strong, and a heavy bridge may be a weak one. There is much room for more uniformity in the practice of English engineers in the distribution of material. Too often it is plain that very few figures have been employed on some details, and that the judgment of the practical bridge designer may err considerably in assigning dimensions by analogy. It is not only that too much material is thus often used, but the appearance of a bridge is marred; and here it might be mentioned that careful investigation of the strains, disposition of parts, and assignment of weights in bridge work, which has in recent years characterised the work of railway engineers in Germany, has resulted in a number of bridges which have an appearance of lightness only to be seen in a very few instances in this country. We are not here dealing with large roofs, but the above remark applies equally to these; and it is especially desirable that large roofs should not indicate design by rule-of-thumb and construction by weight.

### THE INSTITUTION OF CIVIL ENGINEERS.

ON Tuesday night terminated the sixty-third session of the Institution of Civil Engineers. No institution resembling it in character can boast of a similar antiquity. Its founders set an example which has been followed at a greater or lesser distance all over the world. It will not be out of place to add that on the same evening Mr. James Forrest, the secretary, completed twenty-five years of active duty in the interests of the Institution. For seven years previously he had given much of his time to its service, and we do not think we say too much when we assert that for its present prosperity the body is indebted in some degree to Mr. Forrest. The duties which a secretary has to discharge are not only arduous and exacting, but they require to be carried out with much tact. A secretary is to a great degree the mouthpiece of the Council; and if he prove incompetent, he can to a very large extent hamper and trouble the action of the officers of the Institution; while on the other hand, if he has tact and ability he can aid the Council at every turn in ways which are more felt than seen. In nothing, however, has Mr. Forrest been more prominently successful than in his editing of the "Transactions," which now appear four times yearly, and are beyond all question the best things of the kind printed.

During the last twenty-five years the Institution has had, in many respects, a chequered existence, and it has not escaped without internal troubles and dissensions. These were all due, more or less, to the intensely conservative element which had existence within it, and which effectually arrested all progress for a long time. In 1856 there were 800 members of all classes; there are now 4000 in round numbers. Then the "Transactions" were by no means well produced, and were in arrear; now four admirable volumes are issued every year, sharp up to date. In every respect the Institution has progressed and grown, but its advancement has been largely due to that influx of new men whom, at one time, a short-sighted policy thought it expedient to exclude. The Institution was founded to advance mechanical science, and the word "civil," as applied to engineers, was no doubt intended by the founders of the body to draw a distinction between engineers engaged in military pursuits and engineers cultivating the arts of peace. But it was not long until another distinction was drawn, and the word civil was employed to distinguish between the man who made a railway, and he who built a locomotive to run on it. This was, we think, a great mistake, and the Institution never acted more wisely than when it virtually abolished a distinction always invidiously employed, and sanctioned the election to its ranks of men who did not make or plan bridges, or docks, or railways, but who are none the less engineers in the fullest sense of the word. Another eminently prudent step was the creation of the student class. It must never be forgotten that these are the men who will sooner or later constitute the Institution of Civil Engineers, and nothing can be more advantageous to its future than the presence among its members of a majority trained in its traditions, versed in its history, loving it from association, and proud to belong to it. We need scarcely say that twenty-five years ago there was no student class in the Institution, and that the presence of a young man within its walls was a thing to be tolerated, not encouraged.

There can hardly be a doubt that the Institution will grow year by year in influence and in value, but in order that this end should be secured, it is more than ever necessary that the policy which guides its movements should be large and liberal. We do not advocate radical changes; we believe that the maintenance of a strong conservative element is essential to its continued popularity; but it is one thing to change, another to advance with the speed of the age and modify, renew, and strengthen by change. Many things have taken place in the conduct of the affairs of the Institution, which no doubt gave pain to earnest men, who saw the old things departing and giving place to new. But we imagine that there are very few members of the Institution who can look back with memories yet keen and unblunted on the greater portion of the sixty-three sessions which have passed away, and who will not admit that on the whole change has done good. No doubt the establishment of the class of Associate Members was a sore trial to many. The idea that a man could become a member of an honoured, we had almost said an ancient guild, although he had not carried on for five years civil engineering work of his own, certainly afflicted some worthy men; but there must be very few left who will dispute that the influx of the large number of engineers who have joined its ranks since a relaxation was made in the character of the qualification for election, has been an unmixed good to the Institution; or will deny that at the present moment its wealth, prosperity, and influence, have been very cheaply purchased at the price paid for them.

The president's conversazione takes place to-night at South Kensington. It will be impossible to look at the crowd which will be collected in the museum at South Kensington without recalling how cosmopolitan is the influence wielded by the Institution. Men of more or less renown, power, and wealth, will be found there, and each and all will be indebted for something, perhaps for a great deal, to the engineer. The engineer is the great apostle of civilisation; in his track follows all of material prosperity that the world knows. It would but cover hackneyed ground did we point to ships, railways, telegraphs, roads, harbours, mines, and associate them with the word engineer. Those who can read a crowd as a book; those who can recognise each unit, realise its importance, and account for its presence, will best understand us when we say that the visitors to the conversazione of the president of the Institution of Civil Engineers, indicate accurately what the influence of that Institution is. It has never been greater than it is at the present moment.

### CRUDE IRON PRICES.

VERY rarely in the history of the iron trade has there been so low a range of prices for pig iron as now prevails. For sixteen years the price of Cleveland pig iron did not fall below £2 per ton, and it was only in 1878 that that low rate was passed and prices fell at the close of that year to £1 15s. per ton, a rate from which there was the further descent which gave place to the rapid rise during the prevalence of the American "boom." Prices of Scottish pig have shown more fluctuation. About thirty years ago the rate was under £2 per ton, but from that time there has been a higher rate generally prevailing, £3 per ton being reached in 1852; and £4 in the following year; whilst before the middle of 1855, £3 per ton was reached; and in 1859 there was a period when less than £2 10s. per ton was the price; but with occasional bounds upwards, there was comparative steadiness at nearly £3 per ton for some years, and after the immense increase of nine years ago there was a retreat until the minimum was reached before the outburst of the United States demand; and it is remarkable that throughout the greater period there has been a very great similarity between the proportions of the prices in these two great districts. But with a brief exception it is long since the prices in Cleveland and Scotland were so low as they now are. It is worthy of notice that the periods of low prices do not long prevail, but it is questionable whether there is not a tendency when prices are falling to keep back orders, and thus when the rise comes and consumers see that it is vain to wait longer, these come in and run up prices rapidly. At the present time it can scarcely be said that the prices that prevail in the two great pig iron producing districts are generally remunerative, and hence it is evident that there must be speedily a reduction of the output, and that without any combination of the makers. In both the districts it needs to be borne in mind that there is now a very large production of hematite and other steel-making irons, the quantity made in Cleveland being about one-fifth of the total; and as this is sold at higher rates and is believed to yield a larger profit, it may improve the position of the makers who produce it. But allowing for this, the production of iron from native ironstone cannot be said to be fairly remunerative, and as this fact must eventually cause the output to be reduced, it may be hoped that it will bring about an improvement in the prices. It is somewhat singular that the falling off in the sales of crude iron in the two districts as compared with last year is traceable chiefly to the quantities exported; but probably this is due to the fact that there is usually a decline in this demand in the period when rates are descending. The most profitable branch of the demand —that for iron for local consumption—continues to be as large as last year, even larger for some uses, and there is in that part of the demand which is for the steel manufacture a marked increase. Unless some unexpected requirement shows itself, the increase in the stocks would point to a further, if slight, reduction in prices, and this would hasten the reflex action by enlarging the demand, and by sooner enforcing the reduction of the output in the case of manifestly unprofitable furnaces. Some little consolation may be found in the fact that the production of iron is not increasing. It is evident that to reduction of production we have to look now for an increase in prices; and the present position of the trade, and the largeness of the stocks, induce the hope that it cannot now be far off.

### THE TONNAGE RATES FOR COAL FROM SOUTH YORKSHIRE.

SOON after the decision of the Railway Commissioners respecting the action taken by the Denaby Main Colliery Company, which, together with several appeal decisions, were against the railway company, the Manchester, Sheffield, and Lincolnshire Railway Company imposed a mileage rate, instead of the uniform tariff on the collieries which had been in existence for several years. So serious was the change to several colliery proprietors that a committee was formed for the purpose of negotiating with the railway authorities to get the rate reduced. The matter has been brought under the notice of the directors, and many colliery owners and other people who forward coal and coke to Hull, Grimsby, and other parts of the country, have only paid on account, or in other words, they have struck out the extra charges. It would, however, appear that some understanding has been come to between the Coalowners' Committee and the railway company, as the former body has just issued a circular advising the coalowners to pay the rate in full, with an understanding that the matter should be left to the directors, and a new and more favourable rate issued. This in some instances has been done, and the company has made a liberal allowance, and will doubtless issue a new rate shortly. The change, coming as it did without notice sufficient to enable coalowners and coke makers to take into account the extra charge, has operated seriously on many firms in the district.

## LITERATURE.

*The Rudiments of Civil Engineering.* By HENRY LAW, M.I.C.E. *Including a Treatise on Hydraulic Engineering.* By GEORGE BURNELL, M.I.C.E. Sixth edition, revised, with many large additions, by D. KINNEAR CLARK, M.I.C.E. London: Crosby Lockwood and Co. 1881.

A PORTION of the contents of this volume appeared in Weale's Series many years ago; the first edition was published in 1848, the second appeared in 1851. The fact that Mr. Law's book should have keep its hold on the public for thirty years is high testimony to its merits. We do not say a word too much when we state that the original volume was without exception the best treatise of its kind ever written. In fact, there was nothing at all like it published before, and we are certain that nothing equally good has appeared since from the pens of other authors. For years Mr. Law's treatise retained a unique position. It possessed the inestimable advantage that it was not only accurate as far as it went, but that it went a very long way; and to this moment no better book can be put into the hands of a young man wavering as to whether he will or will not become a civil engineer. The book will explain to him what civil engineering is, and will supply a standard by which he can gauge his powers, and a test by which he can ascertain whether he has or has not a love for the science and practice of engineering. But the popularity of such a work could not last for ever. Much of the matter which it contained became old, as, for instance, the description of Hungerford Suspension Bridge, which has long since been taken down, altered, and re-erected at Clifton, near Bristol. Various new editions, with additions and emendations, came out from time to time, and now at last Mr. Clark has taken the matter in hand, and produced the book before us, to which we willingly award a great deal of praise. It is a small octavo, like the first and second editions; but whereas the second edition contained but 152 pages, and the second part, published in 1852, but 126 pages, or in all 278 pages, the sixth edition has no fewer than 638

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

(*From our own Correspondent.*)

THE mills and forges are mostly better employed this week than last. An improvement in the Australian trade in galvanised sheets—the fine weather affording extra facilities for out-of-door work—and a demand from the United States for certain products of the mill, combine to occasion the improvement.

Sheets ruled about 5s. higher than last week for most kinds required by the galvanisers, who were not reluctant to give that advance for good qualities of which they were in need; and there were to-day—Thursday—in Birmingham and yesterday in Wolverhampton, several such consumers who complained that they were not receiving deliveries as fast as they wished. It was difficult to get high-class galvanising singles at under £7 10s.; doubles, £8 5s.; and latens, £9 5s. to £9 10s. Makers were mostly indifferent to new business; and there were more who reported themselves full of sheet orders for two months ahead than were in that state of activity a week since.

Two additional sheet mills were re-started yesterday evening. They are the sheet mills at the Darlaston Green Works, which have now been taken by Messrs. Mason and Hill. No difficulty has been experienced in getting orders to start with; for there are some makers of galvanised corrugated roofing sheets who have this week booked orders from 500 to 1000 tons of sheets direct and from exporting merchants.

A strip mill was also yesterday set on at the same works. Relating to this class of iron likewise there were new orders offered which the chief strip firms were unable to accept. They related to completed ties for baling cotton in the Southern States of America. There was one cotton tie merchant about who had come direct from the Southern States to buy in England. He sought to supply his wants at from £7 5s. to £7 10s. f.o.b. Liverpool. The price would not be accepted; and 10s. to 15s. per ton more was generally asked, for there are hereabouts several mill and forge proprietors who have laid themselves out to stamp out the buckles and attach them to the japanned and otherwise prepared strips, so that they may be got into America at an *ad valorem* instead of at the specific duty charged upon unmanufactured iron. A larger number of firms was prepared to make the strip, and such men to-day quoted £6 5s. at the works. But they were not eager to secure the orders, remembering as they do the fatal tendency which U.S. buyers manifest to repudiate orders when the market goes against them. The baling strips this week newly demanded are, however, needed for prompt delivery. On account of the purchases of the chief Liverpool buyer of this iron, there are strip mills here that are filled up into September.

Tank plates are in better demand this week, for despatch *viâ* London and Liverpool. Most of those shipped *viâ* Liverpool are going to the United States, and some of them are of a gauge as thick as 1in. Many are sent out punched, with channel iron similarly treated, in the expectation that in that shape they will be let in as the baling strip, at the *ad valorem* duty. But there is room to fear that the vigilance of the American plate firms will prevent a continuance of the business. On the 17th of May ironmasters from Pittsburgh and U.S. iron-making centres, who employ 10,000 workmen, waited upon Secretary Windom, at Washington, representing that, in this colourable way, unmanufactured iron was being got into the States, at a loss of duty, and seriously to the detriment of the United States' masters and men. For it was affirmed that, whilst the mills were not fully employed, United States orders for 20,000 tons of the iron indicated were being withheld, awaiting the Secretary's decision upon their appeal. But the importers themselves were a few days afterwards, too, seeking an interview with the Secretary.

Slightly more was doing in bar iron. The two firms who had declined to sell marked bars under £7 10s. adhered to their prices in the quotations given to inquirers who approached the makers direct or through the makers' acknowledged agents. But neither such firms nor those who quote £7 12s. 6d., or even £7, are doing half work in their bar mills. More is, however, being done in bars which can be sold at from £5 15s. to £6 10s., and the demand from London for such iron for smithy and engineering use is increasing. It was possible to buy an inferior sort of iron, in rare instances, at £5 12s. 6d., but hurdle makers were in such cases the chief buyers. Nail rods were selling a little better upon the week, and were procurable at under the low figure last quoted.

The pig makers have done fairly well this week. Hematite and Derbyshire, Northamptonshire and Lincolnshire iron are being tolerably well mixed when the hematites can be got at only 20s. per ton advance upon the other sorts, and there was one brand of hematite offered to-day in which this was the difference. In other cases, prices for hematite pigs ranged from £3 5s. to £3 7s. 6d., and London hematites were withdrawn from the market at £3 10s. per ton. All-mine pigs were to be had at from £3 to £3 5s.; and cinder pigs were to be had at under £1 17s. 6d.

Coal suitable for general forge purposes was offered to-day at from 5s. 9d. to 6s. 3d., into boats at Cannock Chase. In such cases the weights were mostly up to 24 cwt. to the ton.

In North Staffordshire although the manufactured iron trade must, on the whole, be reported as dull, plates for girder and boiler making are selling pretty well at from £7 10s. to £8 per ton, according to quality. Merchant iron is in tolerable demand on colonial and foreign account. Hoops figure prominently in this connection, the price for which is about £6 10s. per ton. Crown bars are in as good output as at any time during the quarter, though that is not saying a great deal. From £6 10s. to £7 per ton is quoted for this quality of iron, while about £6 per ton is the price got by the bulk of the bar makers, and common qualities are selling as low as £5 12s. 6d. per ton. Angles are quoted at £6. Pig iron sells very slowly, and prices are decidedly low. No more than £2 15s. per ton can be got for best qualities, and common sorts may he had at as low as £1 15s. per ton.

The rivet makers in the Rowley, Blackheath, and Old Hill districts remain out on strike for an advance of wages. The officers of the Operative Nut and Bolt Makers' Association are just now seeking to induce an increased number of workmen around Darlaston to join the society, and they are urging them on by promising to help the men in resisting attempts which they allege are now being made to reduce wages.

A further conference between representative mining engineers and representative colliery delegates has taken place since my last, at Dudley, upon the proposed scheme of mutual insurance. The men, however, are not prepared to contribute in the proportion which the masters think is fair, and the meeting stands adjourned until the 22nd inst.

The reduction of 10 per cent. made a few weeks ago in the wages of North Staffordshire miners has, the men declare, reduced the wages to such a starvation point that they cannot possibly live unless it be withdrawn. Therefore, at an influential meeting of the North Staffordshire Amalgamated Association of Miners, held at Hanley, on Monday last, it was decided to ask the employers for an advance of 10 per cent. on the present wages.

## NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

*Manchester.*—So far as trade matters are concerned, I can only again report a very depressed tone throughout this district, both as regards iron and coal, with a downward tendency in prices, and the production far in excess of the demand.

In the iron trade there is very little buying going on, although here and there I hear that more inquiries are coming in. Consumers, when they secure new orders, cover them at once at the present low prices, but the requirements in this direction are extremely limited in quantity, whilst buyers who are prepared to purchase on speculation want deliveries over very long periods at the lowest possible present prices. Lancashire makers of pig iron are still only securing a few small orders, whilst their old contracts are fast running off. For delivery into the Manchester district their quoted prices remain at 43s. for No. 4 forge, and 44s. for No. 3 foundry, less 2½, at which figures small parcels are being sold, but for good orders makers are open to offers. Very low figures are still quoted for some of the outside brands coming into this district, and a few transactions in low-priced Lincolnshire foundry iron are reported, but the amount of business doing all through is very small. Derbyshire makers, who are reported to have secured fair orders in Staffordshire, are holding a little more firmly in this market, but the quoted prices all through are without material change from last week.

Finished iron continues only in dull demand, and any new inquiries of importance coming into the market are mostly for export. Prices are much the same as last week, bars delivered into the Manchester district being quoted at £5 12s. 6d. to £5 15s. per ton, with other descriptions of finished iron in proportion.

In the coal trade business is very quiet. Stocks are accumulating rapidly where the pits are working anything like full time; but in many cases they are not running more than three to four days a week, and, as a fact, the orders coming in are not sufficient to keep them going more than half time. Round coals for house-fire, steam, and iron-making purposes, are all through in very poor demand, and prices generally are easier to the extent of 3d. and 6d. per ton, as compared with last month. House coals range from about 6s. and 6s. 6d. up to 8s. 6d. and 9s., according to quality; and steam and forge coals, about 5s. to 5s. 9d. per ton. There is a fair inquiry for gas coals, but there are not many contracts at present being placed, and low quotations are being made. Screened gas coal can be bought at the pit mouth at 5s. 3d., and good average qualities range from 6s. to 7s. per ton. Engine classes of fuel are in moderate demand, but there is no pressure, except for good slack, for which, in some cases, rather higher prices are being asked. Burgy averages about 4s. 3d. to 5s.; ordinary slack, 3s. 9d. to 4s.; and best sorts, 4s. 3d. to 4s. 6d. per ton, at the pit.

During the week I have had an opportunity of inspecting a sample plant which Messrs. Wren and Hopkinson, of Manchester, have just put down at their engineering works for moulding by a new process small castings of high quality. This process is an improvement upon a German patent by Sebold, and, briefly described, the apparatus consists of a pair of moulding machines, a setting table, and moulding boxes in two halves as usual. The moulding machine carries at the highest point a falling pressure plate and sand box inclined forward, underneath which is a turn-over table carrying the pattern to be moulded, upwards. The moulding box is placed on the turn-over table, where it is secured by cotters, and, the sand having been filled in, the pressure plate is pulled down and locked. The turntable is then forced upwards by a ram until the moulding box comes in contact with the pressure plate, and the sand is brought under powerful pressure, equal throughout. The ram is then lowered, the table carrying the pattern is turned over, and the mould deposited reverse side upwards on a wagon underneath, from which it is taken to the setting table, where it is placed by hand on the bottom half of the mould, which has been manipulated in a similar manner on the second machine. The correct fixing of the two halves is ensured by means of template holes, and the two boxes are secured together by independent cotter pins, after which they are ready for removal to the foundry. The machines are actuated by very simple gearing worked by hand-power; but hydraulic or steam power can be readily applied if necessary. The advantage claimed for this process is that the moulds are turned out with a sharpness and cleanness throughout, which is so essential in producing small machine castings, and the samples both of moulds and castings which I saw were certainly in every way excellent.

I have previously referred in my notes to the scheme, which for some time past has been under the consideration of the Iron Trades Employers Association, whose central offices are in Manchester, for the formation of a mutual insurance fund to provide against claims under the Employers' Liability Act. This scheme, which has been based upon reliable statistics collected from all parts of Great Britain, was, I am informed, under consideration at a meeting of the committee of management held in London last week. The rates of premium decided upon to cover the employers' liability have been calculated from the tables drawn up from the returns received from all parts of the country, and these prove that the risks to workmen in the various branches of the iron trade have been very much overrated. I am not in a position at present to give full details of the respective risks in the different branches of trade of the scheme of insurance which it is proposed to adopt, but I understand that in a few days it will be in the hands of the members of the association, and will show that for a comparatively small sum of money they can mutually protect themselves against any claim which may arise under the clauses of the Act, the premiums asked being as much as 200 per cent. below those quoted by some of the ordinary insurance associations.

*Barrow.*—The hematite pig iron trade has undergone no change in the way of improvement during the last week, nor so far as I can see does there appear to be much hope of any immediate change for the better. At the various works throughout this district the output is kept at its highest rate, and as an inevitable result, when the demand is so very low, stocks are accumulating much faster than they ought to do. I am aware that a few inquiries have been made from America, but very little disposition is shown to do business either by buyers or makers of metal. There is no mistaking the fact that neither American nor continental demands are anything like what they were expected to be, and the calculations made on the part of producers of pig have been upset to a serious extent. Prices remain much about the same, and any advance in this direction cannot be looked for for some time to come, even should the demand show a very material increase. Bessemer qualities are selling at 56s. 6d. per ton at works, and forge qualities, all round samples, 56s. The steel mills are very well employed, and I believe there is no lack of orders, though even in this department low prices rule, and makers do not care to contract heavily. Iron ore is in good request. Engineers are well employed, as are also ironfounders, boiler-makers, and others. Iron shipbuilders are busily employed, good orders being held. Shipping moderate.

Last week the amount of ore shipped from Millom was 8000 tons.

Boring operations for iron are going on at Egremont. The royalty is a new one, and is likely to prove a very lucrative one.

The creditors of Messrs. Griffiths, of the Derwent Tin-plate Works, who failed a short time since, met at Carlisle last week. The liabilities are put down at £20,897, the assets at only £2611.

## THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

BESSEMER ingots and rails continue in brisk demand, the call for the former for the United States having again revived. In rails there are sufficient orders in hand to keep the principal firms engaged up to the end of the year. This fact will not be lost sight of by the great railway companies when their representatives appear to give evidence before the Commission on Railway Rates; but the manufacturers have an excellent answer to that argument if it is advanced.

I find that the engineers are well employed in the principal departments. Advantage is being taken of the low prices of fuel and iron to get a good deal of work done; and this accounts for the improvement in the leading departments of the engineering houses. In the iron trade there seems to be increasing languor, and with the exception of rails, armour-plates, and boiler and ship plates, all the leading branches are depressed. A considerable quantity of crucible steel is being sent to the United States and South American markets, as well as to the colonies. There is less call from the Continent, and the same remark applies to the home markets.

A better demand is noted for files, though the Russian market is very quiet, owing to the keenness of continental competition. There is a capital demand for razors, the makers being busy on orders from nearly all leading foreign customers, as well as on home account. An immense quantity of razors has recently been sent to the States. I hear of a change for the better in the case of one or two of the plating firms, who have received good lines from the watering places, which are now filling up in consequence of the fine, settled weather.

Stove-grate makers report that they are receiving better orders from abroad. This trade has undergone a great deal of change of late years owing to the use of encaustic tiles. An attempt to re-introduce the old style of carved wood mantels seems to have been attended with indifferent success.

Messrs. Brown, Bayley, Dixon, and Co., Limited—the new name of the old firm, Brown, Bayley, and Dixon—does not seem to be favourably received by the shareholders. A new paid-up capital of £56,000 is required, and it was decided that the new shares should first be offered to the shareholders in the old company. The time allowed for the receipt of applications from old shareholders expired on Monday. Under one-half the required number of shares have been asked for, and it has now been decided to offer the rest of the stock to the general public. The scheme for the reconstruction of the company seemed a feasible one, and it was certainly the only means by which the old shareholders could hope to save a portion of their money; but it is evident that the general public must show more faith in the future of the concern than the old proprietary, otherwise the new company cannot be launched.

The Hallamshire Steel and File Company, Limited, held its eighth annual meeting on Tuesday. Much satisfaction was expressed with the result of the year's trading. A dividend of 7½ per cent. was declared. The Sheffield Steel and Manufacturing Company, Limited, has also held its eighth annual meeting. The balance-sheet showed a profit on the year's transactions.

Another serious trade outrage has occurred at Hackenthorpe, near Sheffield. There has been a dispute at Messrs. Staniforth's Sickle Works, owing to the introduction of machinery, and repeated attempts have been made to blow up the premises. Last Sunday morning two men were caught in the act, and since then a third has been apprehended.

## THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE tone of the Middlesbrough iron market was a little more cheerful on Tuesday than it has been for some time past. There was, perhaps, no very substantial reason for this, except that the steady stagnation which seemed to have taken hold of the trade had apparently given way to a quick succession of oscillations in price. In this Cleveland has, as usual, simply followed Glasgow, there being no cause of any sort, south of the Tweed, to account for any change whatever. In Glasgow it was reported that certain furnaces were about to be put out of blast, owing to their owners being thrown into difficulties by the lowness of current prices. This report, however, has been contradicted; and it would appear as though the close struggle between firm and firm, and district and district, was likely to be continued until circumstances shall determine which is the fittest to survive. In Cleveland most smelters are now willing, and even anxious, to sell to the end of the year at present prices; and warrant holders are competing strongly with them for orders. The price of No. 3. for prompt delivery was about 36s. 6d. per ton, f.o.t. Middlesbrough. Warrants were from 6d. to 9d. more, and forge quality 9d. less. Shipments have been somewhat better during the last week, but the total for the month is not expected to exceed 80,000 tons. The stocks for June 1st will be known by the end of the week; they are expected to have accumulated about 10,000 tons. The bridge-building yards are decidedly busy. The Tees Iron and Engineering Company have a quantity of work on hand; and Head, Wrightson, and Co., of Stockton, are so full they cannot take further orders at the moment. Ironfoundry is not nearly so brisk, and there is the keenest competition for all work inquired for.

The manufactured iron trade keeps steady, but the hot weather and the drawing away of many of the ironworkers to serve in the militia is causing some irregularity in production. Plates are selling at about £6 per ton delivered at the ship yards from Tyne to Tees; angles and bars are 12s. 6d. per ton less. At Eston enormous outputs of rails continue to be made, 3600 tons being reported as having been made in one mill in one week. Of this quantity one-third was from Cleveland iron. Mr. Muller's Erimus works are being slowly prepared for active work. In about two months it is expected they will be ready, and will commence operations. Their speciality will be ingots, blooms, bars, and angles. The schemes for resuscitating the North Yorkshire Works at South Stockton, and the Walker Ironworks on the Tyne, seem quite to have collapsed. The great fall in the value of manufactured iron during the last three months has no doubt contributed to this end. At all events, it was found impossible to raise the necessary amount of capital to float the companies.

The Imperial Ironworks, lately Jackson, Gill and Co., Limited, were put up to auction in the Exchange Board Room, Middlesbrough, on Tuesday, by Mr. Charles Wilman, auctioneer, Mayor of the town. The reserve price was £28,000, but not a bid of any amount could be obtained. Very few persons were present and very little interest was manifested in the proceedings. It will be remembered that these works went into liquidation about two years since. The accounts at that time showed 15s. to 20s. in the pound for the creditors. But by foolishly continuing to manufacture under a trustee and committee, the whole of the above assets are believed now to have disappeared, and a stoppage has become absolutely unavoidable.

The death of Mr. Henry Pease has caused great sorrow throughout the whole district. He was largely interested in several of the most important local industries, and though he had practically retired from active business life for some time, still he was well-known to all and highly respected everywhere.

The last meeting for the session of the Cleveland Institution of Engineers was held at Middlesbrough on the 22nd inst.; Mr. E. W. Richards occupied the chair. Colonel Beaumont, R.E., described his compressed air locomotive. He said he advocated a pressure of 1000 lb. per square inch, and with one cubic foot of air so compressed had taken on an ordinary railway three tons a distance of one mile, or half as much on an ordinary tramway. He considered a tramway engine should be able to go ten miles at one charge, and did not think that could be accomplished with a low initial pressure. He did not agree with a remark made at a previous meeting to the effect that air engines would cost in fuel five times as much as steam engines. He thought the ratio 6 to 5 would about express the difference, and there were other advantages in the way of convenience in favour of air. He had no great faith in electric railways, and thought air motors better. A vote of thanks to Colonel Beaumont concluded the meeting.

## NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE Scotch iron trade has been without much change this week. The shipments were expected to be about 13,000 tons, but they amounted to only 11,943, which is about 1000 tons below those of the same week of last year. Transactions in the warrant market have been less numerous and important than in the preceding week, and those that have taken place have been for the most part of a purely speculative nature. This will continue to be so until the demand is large enough to carry off the output, a result which is hardly looked for unless the production should by some means be curtailed. Rumours, out of which some capital has been made, were industriously circulated within the past week to

the effect that a small proportion of the furnaces were about to be extinguished, but, in the meantime, there is little else than rumour in this matter. The Monkland Iron Company having now gone into liquidation, it is believed that the liquidators will keep the furnaces going at least until efforts have been made to form a new company or dispose of the works. There are now 121 furnaces in blast—one having been put out at Calder for repairs—as against 116 at the same date last year, and of these six are employed in the manufacture of hematite. The latest advices from America and the Continent as to the demand for Scotch pig iron are unsatisfactory, but there are still hopes that an improvement may be experienced in the next few weeks. Stocks in Messrs. Connal and Co.'s stores have increased by 1260 tons in the course of the week, and now amount to upwards of 560,000 tons. The arrivals of pig iron from Middlesbrough have been larger, but those of iron ore from abroad not quite so great. A number of cargoes are, however, expected from Spain during the next few days.

Business was done in the warrant market on Friday forenoon at 45s. 8d. to 45s. ten days; also 45s. 10d. to 46s. 1d. one month; the afternoon prices being 45s. 11d. to 46s. 4d. cash, and 46s. to 46s. 6d. one month. On Monday transactions were effected in the morning at from 46s. 4d. to 45s. 10d. cash, and 46s. 6d. to 46s. one month. In the afternoon business was done at 45s. 10½d. to 45s. 10d. cash, and 46s. to 45s. 11½d. one month. On Wednesday business was done up to 46s. 5d. cash, and 46s. 7d. one month. To-day—Thursday—the market opened at these figures, but receded to 46s. 3½d. cash.

The following are the prices of makers' iron as given by merchants:—Gartsherrie, No, 1, f.o.b. at Glasgow, per ton, 55s. 6d.; No. 3, 48s.; Coltness, 55s. 6d. and 48s.; Langloan, 56s. and 48s.; Summerlee, 55s. and 47s.; Calder, 55s. 6d. and 47s.; Carnbroe, 51s. 6d. and 46s. 6d.; Clyde, 48s. 6d. and 45s. 6d.; Monkland, 47s. and 45s.; Quarter, 47s. and 45s.; Govan, at Broomielaw, No. 1, 47s.; No. 3, 45s.; Shotts, at Leith, No. 1, 56s.; No. 3, 49s. 6d.; Carron, at Grangemouth, 52s. 6d.; ditto, specially selected, 56s.; and No. 3, 51s. 6d.; Kinneil, at Bo'ness, 47s. and 45s.; Glengarnock, at Ardrossan, 51s. 6d. and 47s.; Eglinton, 47s. and 44s. 6d.; Dalmellington, 47s. and 44s. 6d. In some cases transactions have been effected slightly under these rates.

The malleable trade is well employed, but new orders do not come is so readily as of late. Ironfounders are also busy, and there are at present some fresh orders in the market. A large quantity of machinery and railway plant is being manufactured for abroad, and last week shipments of iron manufactures from the Clyde embraced £16,000 worth of machinery, of which £6600 was sugar-making for Trinidad, £4700 ditto for Ilo Ilo, £2200 for Bombay, and £1300 for Boston; locomotives and tenders, five of 300 tons, £12,700, and £3500 railway materials for Bombay; £22,253 miscellaneous articles, of which £10,500 went to Rangoon, £4000 to Bombay, £3000 to Ilo Ilo, £1300 to Dunkirk, and £1200 to Montreal; £3500 sewing machines, of which £1500 went to France and £1450 to Montreal.

A special meeting of the Monkland Iron and Coal Company, Limited, was held in Glasgow on Monday, when it was resolved to place the concern in liquidation.

The Steel Company of Scotland locked out 800 men at their Blochairn works on Saturday, so that both these works and those belonging to the same company at Newton are now idle. The men desire an advance of wages, and the company met them by proposing a reduction.

The coal trade does not appear to be quite so active this week. At the ports, and especially in Fife, there is a fair business doing in shipping; but the inland trade has become very slack, and the output is much too large for the demand, except in the case of some of the ironmasters' pits, where a scarcity of miners has of late been experienced. Prices are low except for the best steam coals, which still command good figures.

The shipbuilding trade of the Clyde continues very brisk, and the work put out during the past month has been among the largest on record. There were launched twenty-eight vessels, with an aggregate tonnage of 36,753, as compared with twenty-four vessels of 17,000 tons in the same month of 1880. For the five months the vessels launched number eighty-eight, with a tonnage of 126,788, as against ninety-six vessels and 89,280 tons in the corresponding period of last year.

## WALES & ADJOINING COUNTIES.

(*From our own Correspondent.*)

AUTHORITIES on the iron and steel trade of the principality have long maintained that the future site of ironworks is on the sea shore. In this view they are supported by very cogent facts, such as the disuse of the Welsh ore, the lessened freight on Bilbao, and about equal rates for coal. Yet it is rather singular that the iron trade is gradually becoming less important the nearer one gets to the sea shore. A company near Penarth is winding up; a tin-plate works at Llantrissant closed; De Bergue's Works still remain idle; Bookers are going to the hammer both at Melingriffith and Pentrych; the works of Taffs Well remain untaken; Treforest (Fothergills) rusting away, and Brown and Lennox only partially employed.

Then the higher one goes up the hills, the greater the vigour. Dowlais is doing a brisk trade, Tredegar is going into the steel branch forthwith, and will erect the neccessary mills, &c., near the office, and Ebbw Vale and Blaenavon are busy. One hopeful fact for the old iron establishments such as Cyfarthfa, is the continuance there of an old population who can live more cheaply than in new districts. With respect to Cyfarthfa, all Ynysfach furnaces are now out and several at Cyfarthfa, and the entire place is beginning to assume the character it wore eighteen months ago, when the stoppage existed. No sign of any movement in steel has been made, but I am assured, on excellent authority, that the plans are maturing. Mr. Davy, of Sheffield, and Mr. Edward Williams, of Middlesbrough, will probably carry out details.

Various surmises have been given as to expense, but probably the closest estimate—well known in the trade—is £60,000, for supplying necessary engines, converters, mills, cupolas, &c.

Now that Tredegar has resolved to go into steel, there will certainly be no curtailment of outlay in getting a thoroughly compact works. The company is composed of the first men in the iron and steel world, and Tredegar, Dowlais and Treforest are sufficient proof of skilful vigour.

Mr. Wm. Evans, formerly of Rhymney, and late of Dowlais, has accepted an important position in the North of England. He has done admirable service at both establishments, and is an excellent representative of the able body of men known as the Dowlais School.

Arguments in favour of the Miners' Permanent Fund continue to crowd upon the people in the form of serious and fatal accidents to colliers who are without any fund, and where accidents are such as to make recourse to the Employers' Liability Act impossible.

The iron and steel trade continues moderately active, prices low, and the tendency of demand thoroughly in the direction of steel.

There was a colliers' delegate meeting at Ystrad, Rhondda, to consider the best means of separating the house and steam coal men. I regard the movement as an insidious one against the sliding scale; but there is another, working like an undercurrent, which may, about July or August, bring masters and men into conflict. I have heard that certain masters who are not in the sliding scale are disposed, if prices continue fairly level as they are now for another month or two, to give their men an advance. If one master does this, and the regulations of the sliding scale, based in all equity, do not permit it, we may expect trouble. I give warning, that some means may be taken to counteract what I consider a dangerous and mischievous policy.

## THE PATENT JOURNAL.

*Condensed from the Journal of the Commissioners of Patents.*

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

### Applications for Letters Patent.

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

*24th May*, 1880.

2249. HEATING, C. L. Friedländer, Sweden.
2250. ICE, P. Westfield, Lewisham.
2251. BREECH-LOADING, G. Quick, Buxted, Uckfield.
2252. ANNEALING FURNACES, E. James, Tipton, and E. Hanley, Birmingham.
2253. SIGNALS, W. Morgan-Brown.—(*G. H. Roth, U.S.*)
2254. BRICK-PRESSING MACHINES, H. Wedekind.—(*O. Hoffman and H. Dueberg, Berlin.*)
2255. HACKETS, &c., G. Hookham, Birmingham.
2250. SUPPORTING STRUCTURES, W. R. Lake.—(*W. C. Allison, Philadelphia, U.S.*
2257. REVOLVING STANDS, J. S. Kirwan, London.
2258. TRICYCLES, H. J. Haddan.—(*J. McKenzie, U.S.*)
2259. FOG-HORN, H. Haddan.—(*O. C. Hansen, Norway.*)
2260. PHOSPHOR LEAD BRONZE, W. L. Wise.—(*K. H. Kuhne, Loebtau, near Dresden.*)
2261. PERMANENT WAY, J. Livesey, Westminster.
2262. RAILWAY SWITCHES, W. Lake.—(W. Martien, U.S.)
2263. ELECTRICAL MEASUREMENTS, J. C. Cuff, London.
2264. CABLES, W. C. Barney, London.
2265. TRANSMITTING, J. Gent and H. Ellery, Leicester.
2266. SPINNING, E. and L. J. Crossley and W. Sutcliffe, Halifax.
2267. DYEING HATS, W. E. Carrington and W. Torkington, Stockport.
2268. ROADWAYS, W. Lake.—(*P. Kiss, Hungary.*)
2269. SPINNING, E. Smith, I. Cuttler, & W. Shaw, York.
2270. SPINNING, W. T. Emmott.—(*E. Appenzeller, Mulhausen, Germany.*)
2271. GAUGES, A. Budenberg.—(*C. F. Budenberg and B. A. Schaeffer, Buckau, Germany.*)
2272. SECONDARY BATTERIES, J. W. Swan, Newcastle-on-Tyne.
2273. PROPELLING, E. C. Healey, London.
2274. DYE COLOURS, W. G. and, R. White, Crayford.
2275. REAPING, A. C. Bamlett, Thirsk.
2276. KITCHEN RANGES, J. M. Shaw, Glasgow.
2277. SEWING BOOKS, D. M. Smith, Hartford.
2278. COUPLINGS, A. Verity, Bramley, near Leeds.
2279. DIGGING LAND, W. Crosby and A. Carey, Essex.
2280. GAS ENGINES, S. Ford, South Lambeth.
2281. VENTILATORS, J. Ellison & H. Fourness, Leeds.
2282. DECORATING WALLS, A. M. Clark.—(*A. Letorey, Paris.*)
2283. WIRE FABRICS, A. M. Clark.—(*W. C. Edge, U.S.*)

*25th May*, 1881.

2284. STEAM GENERATORS, G. Allibon, T. Turton, and J. Jones, Liverpool.
2285. CHEESE COVERS, H. J. Allison.—(*P. F. Chardemitte, France.*)
2286. SELF-ACTING LATCH, W. Bevitt, Romford.
2287. LAMPS, H. E. Preen, Kidderminster.
2288. WEAVING GAUZE, W. Strang, Glasgow.
2289. SELF-FILLING BUCKETS, G. Allix, London.
2290. CORRUGATING TUBES, H. Moore, Liverpool.
2291. PROPELLERS, J. Niel and J. L. Corbett, Glasgow.
2292. LAYING GAS, &c., PIPES, D. Nichols, Leeds.
2293. PISTON VALVE MUSICAL INSTRUMENTS, B. J. B. Mills.—(*C. G. Conn, Elkhardt, U.S.*)
2294. REGULATING SUPPLY OF GAS, A. Pope, Slough.
2295. TREATING REFUSE MATTER, A. B. von Podewils, Munich, Bavaria.
2296. RING FRAME BOBBINS, J. W. Wilson, Barnsley.
2297. RAILWAY SIGNALLING, R. A. Stanley and R. Stanley, Manchester.
2298. FASTENING BUTTONS, A. Wright, Birmingham.
2299. CLEANING SCREENS, W. H. Price, Wrexham.
2300. COTS, &c., T. Hansell, St. Albans.
2301. SKIRTS, O. F. Viola, London.
2302. EXPLOSIVE COMPOUND, S. H. Hinde.—(*R. F. Sjöberg, Stockholm.*)
2303. FLUID METERS, A. M. Clark.—(*B. Holly, U.S.*)
2304. ELECTRIC LIGHT, W. Crookes, London.
2335. WEAVERS' HARNESS, W. R. Lake.—(*Kendrick Loom Harness Company, Providence, U.S.*)
2306. MANURE, W. R. Lake.—(*E. Koch, Paris.*)

*26th May*, 1881.

2307. ARM-PIT DRESS SHIELDS, I. A. Canfield, U.S.
2308. RAILWAY SIGNALLING, J. King, Pinxton.
2309. MULTIPLE COLOUR PRINTING MACHINES, J. Smale, Southwark.
2310. BLEACHING COTTON, &c., W. Mather, Manchester.
2311. PAPER-CUTTING MACHINES, J. Kenyon and W. Ainsworth, Blackburn.
2312. PIPE JOINTS, E. Cooman and P. Dallard, Paris.
2313. WOVEN FABRICS, F. McCance, Belfast.
2314. PRESERVING BUTTER, G. M. Allender, London.
2315. KNITTING MACHINES, B. F. Shaw, London.
2316. COLLECTING LEAVES, A. Smith, Goudhurst.
2317. PURIFYING GASES, R. Good, Carshalton, and T. Dean, Croydon.
2318. COUNTERACTING EXPANSION, &c., H. Whitehead, Bucknall, and T. Dodd, Winsford.
2319. PLOUGHS, S. Pitt.—(*S. Seegmiller and R. Ransford, Canada.*)
2320. FININGS, G. W. Ewens, Bedminster.
2321. RAISING, &c., WEIGHTS, J. T. Donald, Glasgow.
2322. ABDOMINAL BELTS, M. P. Browne, London.
2323. ELECTRIC BATTERIES, J. H. Johnson.—(*La Société La Force et la Lumière Société Générale d'Electricité, Brussels.*)
2324. BOXES, &c., W. I. Palmer, Reading.
2325. CRUSHING ORES, A. Clark.—(*W. Howland, U.S.*)
2326. ASH-PANS, A. M. Clark.—(*M. O'Niel, Nova Scotia.*)

*27th May*, 1881.

2327. SWIMMING, J. Overton, Coventry.
2328. FIGURES, F. F. Bastier, Paris.
2329. FASTENING LACES, T. Green, Northampton.
2330. FRICTIONLESS CASTORS, A. C. Fontaine, London.
2331. HYDRAULIC TELEGRAPH, C. C. de Montblanc and L. Gaulard, Paris.
2332. CEILINGS, &c., J. W. Gray, Birmingham.
2333. VESSELS, J. F. Jaques.—(*W. Atwood, Troy.*)
2334. FURNACES, A. M. Clark.—(*J. Garnier, Paris.*)
2335. SEATS, J. Hamlyn, Newtown, Exeter.
2336. LAMP ADJUSTMENTS, H. J. Haddan.—(*J. T. Morel, Paris.*)
2337. GRATERS, L. Field, Birmingham.
2338. BOTTLE STOPPERS, J. S. Davison, Sunderland.
2339. SHIPS' WATER-CLOSETS, W. Fraser, Liverpool.
2340. SCREW PROPELLERS, T. Turton and G. Allibon, Liverpool.
2341. WHITE, &c., YARNS, H. Empis, Paris.
2342. BRICK-MAKING, F. J. and E. Firth, Dewsbury.
2343. GAS REGULATORS, W. Carter, Oldham.
2344. ELECTRICAL LIGHTING, P. L. M. Gadot, Paris.
2345. DISINFECTING FECAL, &c., MATTER W. R. Lake.—(*F. Petri, Berlin.*)

*28th May*, 1881.

2346. LOOMS, J. Bottomley, Buttershaw.
2347. PERMANENT WAY, A. J. H. Smythe, Ireland.
2348. VALVES, A. Pegler and T. J. Watson, Retford.
2249. CEILINGS, &c., W. Goodhall, Liverpool.
2350. ROTATORY HEELS, W. Clegg, London.
2351. AFFIXING STEPS, T. A. Brockelbank, London.
2352. SPRING BOTTOMS for BEDS, H. A. Dalrymple, U.S.
2353. COOL CHAMBERS, J. Gwynne, London.
2354. PETROLEUM LAMPS, B. B. Schneider.—(*W. Dette, Berlin.*)
2355. DOUBLING WOOL, &c., T. Robinson, Leeds.
2356. WASHING COAL, &c., T. Bell, jun., Salton-by-the-Sea, and W. Ramsey, Durham.
2357. SCREW PROPELLERS, G. Peacock, Starcross.
2358. ARRANGING ORCHESTRAS, H. J. Murcott, London.
2359. FILTERING, J. F. N. Macay, London.

*30th May*, 1881.

2360. STOPPING MOTION, W. Walker, Radcliffe Bridge.
2361. DISINFECTANT, T. F. Scott, London.
2362. PAPER CUTTING MACHINES, R. Greig, Edinburgh.
2363. CLEANING MILK VESSELS, S. J. Pocock, London.
2364. POCKET KNIFE, G. Roe, Roscrea, Ireland.
2365. MOTIVE POWER ENGINE, J. Neil, Glasgow, and J. Kerr, Greenock.
2366. SEWING MACHINES, F. H. F. Engel.—(*Guhl and Harbeck, Hamburg.*)
2367. WATER METERS, J. Denner & G. Lind, Prussia.
2368. HAND CARTS, A. Specht.—(*O. Schumann, Dresden.*)
2369. ELECTRIC LAMPS, S. Cohné, London.
2370. WORKING SLIDE VALVES, H. E. Newton.—(*A. Nathan, Milan, Italy.*)
2371. STRAINER PLATES, J. Annandale, Lasswade.
2372. ACTUATING SIGNALS, B. C. Scott, London.
2373. COMBING MACHINES, S. C. Lister, Manningham.
2374. GAS BURNERS, G. E. Webster, Nottingham.

### Inventions Protected for Six Months on deposit of Complete Specifications.

2226. NITRO-GLYCERINE COMPOUNDS, G. S. Dean, San Francisco, U.S.—21*st May*, 1881.
2234. AXLE-BOXES, W. G. Raoul, Macon, U.S.—21*st May*, 1881.
2256. SUPPORTING ELECTRIC WIRES, &c., W. R. Lake, Southampton-buildings, London.—A communication from W. C. Allison, Philadelphia, U.S.—24*th May*, 1881.
2283. WIRE FABRICS, A. M. Clark, Chancery-lane, London.—A communication from W. C. Edge, Newark, U.S.—24*th May*, 1881.
2295. TREATING REFUSE MATTER, A. B. von Podewils, Munich.—25*th May*, 1881.
2303. FLUID METERS, A. M. Clark, Chancery-lane, London.—A communication from B. Holly, Stockport, U.S.—25*th May*, 1881.
2307. ARM-PIT DRESS SHIELDS, I. A. Canfield, Middleton.—26*th May*, 1881.
2328. HUMAN and other FIGURES, F. F. Bastier, Paris.—27*th May*, 1881.

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

2082. ORNAMENTING NET FABRICS, P. J. Tuquet, Paris.—24*th May*, 1878.
2182. PHOSPHORIC ACID, F. Wirth, Frankfort-on-the-Maine.—31*st May* 1878.
2203. CAUSTIC ALKALIES, E. W. Parnell and J. Simpson, Liverpool.—1*st June*, 1878.
2228. FITTINGS of WATER-CLOSETS, J. J. Tylor and W. A. Tylor, London.—4*th June*, 1878.
2375. RULING PAPER, A. M. Clark, London.—14*th June*, 1878.
2322. WATER, &c., PIPE, F. Holt, Alverston.—11*th June*, 1878.
2130. CARBONATE of SODA, S. Pitt, Sutton.—28*th May*, 1878.
2157. WINDLASSES, J. Waters, Port Isaac.—29*th May*, 1878.
2191. COMBING, &c., SILK, S. C. Lister, Manningham.—31*st May*, 1878.
2192. ROLLER BEARINGS, &c., W. R. Lake, London.—31*st May*, 1878.
2282. MOUNTING GUNS, G. W. Rendel, Newcastle-on-Tyne.—7*th June*, 1878.
2408. TORPEDO BOATS, W. R. Lake, London.—17*th June*, 1878.
2423. GUNS, &c., A. Noble, Newcastle-on-Tyne.—18*th June*, 1878.
2177. TREATING QUINONS, E. Ullrich, London.—31*st May*, 1878.
2285. ROTARY ENGINES, &c., A. Vacherot, Battersea.—7*th June*, 1878.
2396. TELEPHONES, T. A. Edison, Menlo Park, U.S.—15*th June*, 1878.

### Patents on which the Stamp Duty of £100 has been paid.

2034. MAKING CLAY RETORTS, W. D. Cliff, Wortley.—11*th June*, 1874.
1859. DRESSING MACHINES, T. Stanier, Manchester.—28*th May*, 1874.
1894. TELL-TALE SIGNALS, J. Ford, Reading.—30*th May*, 1874.
1937. CRUSHING ORES, H. R. Marsden, Leeds.—4*th June*, 1874.

### Notices of Intention to Proceed with Applications.

*Last day for filing opposition*, 17*th June*, 1881.

5503. STRETCHERS for UMBRELLAS, J. C. Smith, Birmingham.—31*st December*, 1880.
264. PRODUCING LIGHT, A. Apps, Strand, London.—21*st January*, 1881.
268. VELVETS, &c., H. Lister, Ashbrow Mills, near Huddersfield.—21*st January*, 1881.
285. SIZING MACHINES, H. Livesay, jun., Greenbank, Blackburn.—22*nd January*, 1881.
302. SELVAGE for WOVEN FABRICS, H. H. Lake, London.—Com. from L. Frobeen.—22*nd February*, 1881.
308. CORDS for BINDING FODDER, J. Wetter, London.—Com. from M. L. Rollier.—24*th January*, 1881.
311. ORNAMENTING SURFACES. H. E. Newton, London.—Com. from E. A. Batonnier.—24*th January*, 1881.
313. CLOSING, &c., WINDOWS, H. Skerrett, Sparkbrook, near Birmingham.—24*th January*, 1881.
335. GAS STOVES, T. Fletcher, Warrington.—25*th January*, 1881.
337. FASTENINGS for BELTS, &c., J. Hincks and T. Hooper, Birmingham.—25*th January*, 1881.
366. AERATED LIQUIDS, F. Wirth, Germany.—Com. from H. and J. F. Beins.—27*th January*, 1881.
416. SAFETY VALVE, &c., G. Wilson, Old Kent-road, London.—31*st January*, 1881.
433. LAMPS, W. H. Bulpitt, Birmingham.—1*st February*, 1881.
501. TURNING OVER LEAVES of MUSIC, R. H. Padbury London.—5*th February*, 1881.
544. WORKING, &c., METALS, D. Adamson, Dukinfield.—9*th February*, 1881.
573. TRANSCRIBING MUSICAL COMPOSITIONS, A. P. Hodgson, Paris.—10*th February*, 1881.
629. FEED APPARATUS, A. M. Clark, London.—Com. from A. L. Dudoüy.—14*th February*, 1881.
701. MAGNESIA, A. M. Clark, London.—Com. from J. B. M. P. Closson.—17*th February*, 1881.
712. THRASHING MACHINES, A. M. Clark, London.—Com. from A. L. Dudoüy.—18*th February*, 1881.
760. TELEPHONES, E. W. Anderson, Washington.—Com. from J. Goodman.—23*rd February*, 1881.
943. ROASTING COFFEE, H. Faulder, Stockport.—5*th March*, 1881.
951. FASTENINGS for BRACELETS, J. M. Banks, Birmingham.—5*th March*, 1881.
1003. CONDENSING MILK, F. Wirth, Frankfort-on-the-Maine.—Com. from P. Gaupp.—9*th March*, 1881.
1334. SNOW, F. N. Mackay, Liverpool.—25*th March*, 1881.
1522. TRIMMINGS for SOLES of BOOTS, &c., W. R. Lake, London.—Com. from D. Knowlton.—7*th April*, 1881.
1641. LIQUID METERS, J. H. Blum, Bienne, Switzerland.—14*th April*, 1881.
1649. SIGNALS, A. J. Boult, London.—A communication from W. C. Seaton.—14*th April*, 1881.
1661. VELOCIPEDES, W. Hillman, Coventry.—14*th April*, 1881.
1696. TELEGRAPHY, S. Pitt, Sutton.—A communication from O. Lugo.—19*th April*, 1881.
1719. BENDING, &c., GLASS, D. Thompson and W. H. Thompson, London.—20*th April*, 1881.
1795. GLASS, &c., C. A. W. Schön, Hamburg.—A communication from G. Leuffgen.—26*th April*, 1881.
1820. MAGNESIA, S. Pitt, Sutton.—A communication from T. Schloesing.—27*th April*, 1881.
1936. CUTTING CHEESE, &c., J. Richardson, Gainsborough.—4*th May*, 1881.
1964. DOOR KNOBS, A. Heath and R. F. Heath, Birmingham.—5*th May*, 1881.
1974. CONDENSING the FUMES of PYRITES, H. N. Lay, Rumleigh, and H. Bulford, Calstock.—6*th May*, 1881.
2016. ENGRAVING on GLASS, J. H. Johnson, London.—Com. from S. H. Crocker.—9*th May*, 1881.
2043. CONVEYING HEAT, &c., to a DISTANCE, W. W. Whiteman, London.—A communication from J. Newton.—10*th May*, 1881.
2206. MAKING CIGARS, A. M. Clark, London.—Com. from O. Hammerstein.—20*th May*, 1881.
2226. NITRO-GLYCERINE COMPOUNDS, G. S. Dean, San Francisco, U.S.—21*st May*, 1881.

*Last day for filing opposition*, 21*st June*, 1881.

322. SHIPS, &c., C. Cullen, Rosherville.—25*th January*, 1881.
334. WASHING, &c., ORES, D. Burns, Brookside.—25*th January*, 1881.
350. REGULATING the SPEED of STEAM ENGINES, R. J. Smith, Sunderland.—26*th January*, 1881.
352. RAILWAY WHEELS, J. W. Howard, London, and D. H. O'Neale Neale, Woodford.—26*th January*, 1881.
361. SADDLES, A. Scholefield, Halifax.—27*th January*, 1881.
365. ACID for VINEGAR, W. J. Cooper, Westminster.—27*th January*, 1881.
372. RAISING SUNKEN SHIPS, O. Wolff, Dresden.—Com. from A. Lehmann.—27*th January*, 1881.
377. SAFETY VALVES, &c., E. Field and F. M. Cotton, London.—27*th January*, 1881.
378. SHOEING HORSES, J. Offord, London.—28*th January*, 1881.
382. BRAKES, J. Lansley, Basingstoke.—28*th January*, 1881.
397. BREECH-LOADING FIRE-ARMS, J. T. Rogers and J. Rogers, Birmingham.—29*th January*, 1881.
398. SCALES, H. J. Haddan, London.—A communication from L. Colassot.—29*th January*, 1881.
406. PREVENTING FORMATION of ICE, J. Hopkinson, Manchester.—29*th January*, 1881.
411. SPINNING, &c., COTTON, J. Hodgkinson, Bolton.—31*st January*, 1881.
414. REFRACTORY COMPOSITION, H. H. Lake, London.—A communication from J. B. M. Fillon and C. L. de Capitani.—31*st January*, 1881.
417. RAILWAY SIGNALLING, J. N. Maskelyne, London.—31*st January*, 1881.
436. TRANSFERRING DESIGNS to FABRICS, C. Poirson, London.—2*nd February*, 1881.
437. DECORATING SOAP CAKES, P. Chapelain, Paris.—2*nd February*, 1881.
651. SHEEP-SHEARS, A. M. Clark, London.—Com. from C. Benavides and J. P. Arthur.—15*th February*, 1881.
754. BICYCLES, G. Singer, Coventry, and A. W. Metcalfe, Clifton.—22*nd February*, 1881.
1195. BALLOONS, E. G. Brewer, London.—A communication from A. Debayeux.—18*th March*, 1881.
1272. COTTON-COVERED WIRE, W. R. Lake, London.—Com. from H. Splitdorf.—22*nd March*, 1881.
1350. PICKLING, &c., IRON PLATES, J. Williams and G. L. Morris, Landore.—26*th March*, 1881.
1363. GAS MOTOR ENGINES, S. Bickerton and H. N. Bickerton, Ashton-under-Lyne.—28*th March*, 1881.
1486. CHAIRS, C. H. Chadburn, Liverpool.—5*th April*, 1881.
1574. MEDICINAL COMPOUND, E. Harris, London.—11*th April*, 1881.
1734. CENTRIFUGAL MACHINES, B. H. Remmers, Glasgow.—Com. from W. Angele.—22*nd April*, 1881.
1761. STEAM COOKING VESSELS, M. von Zyka-Radvánsky, G. Liedman, and F. W. Scharrath, Berlin.—23*rd April*, 1881.
1796. RAILWAY SIGNALLING, H. Morris, Manchester.—26*th April*, 1881.
1904. ORNAMENTING WOOD, A. Martin, London.—3*rd May*, 1881.
1937. BLEACHING, C. T. Jacoby and W. Jennings, Nottingham.—4*th May*, 1881.
2027. RINKS, H. Langsford, Islington, London.—10*th May*, 1881.
2042. ROOT-CUTTING MACHINES, J. Hornsby and J. Money, Grantham.—10*th May*, 1881.
2050. TRAM RAILS, W. Sterling, Rusholme.—11*th May*, 1881.
2051. FELT HATS, J. H. Neave, Macclesfield.—11*th May*, 1881.
2127. LIFE-PRESERVING GARMENT, F. W. Brewster, London.—16*th May*, 1881.
2217. ELECTRICAL CABLES, W. R. Lake, London.—Com. from P. B. Delany.—20*th May*, 1881.
2234. AXLE-BOXES, W. G. Raoul, Macou, U.S.—21*st May*, 1881.
2283. WIRE FABRICS, A. M. Clark, London.—A communication from W. C. Edge.—24*th May*, 1881.
2303. FLUID METERS, A. M. Clark, London.—A communication from P. Holly.—25*th May*, 1881.
2328. HUMAN FIGURES, &c., F. F. Bastier, Paris.—27*th May*, 1881.

## Patents Sealed.

*List of Letters Patent which passed the Great Seal on the 27th May, 1881.)*

4954. FACING, &c., BILLIARD CUES, C. F. Hengst, Forest Gate.—*29th November*, 1880.
4962. CHESTS, &c., W. T. Eades, Birmingham.—*29th November*, 1880.
4964. VELOCIPEDES, J. C. Garrood, Fakenham, Norfolk.—*29th November*, 1880.
4965. HEEL-STIFFENERS, &c., H. H. Lake, Southampton-buildings, London.—*29th November*, 1880.
4969. DRAWING LIQUIDS, A. Specht, Hamburg.—*29th November*, 1880.
4974. PUMPING, &c., ENGINES, T. and G. Wilson, Glasgow.—*30th November*, 1880.
4982. UMBRELLA CLOTHS, W. Critchley, Bradford.—*30th November*, 1880.
4990. OPENING CASEMENTS, &c., J. Bruce, Summer-road, Birmingham.—*30th November*, 1880.
4996. COCKS and TAPS, J. Walker, Lower Clapton, London.—*1st December*, 1880.
4997. MAKING DOORWAYS, W. Morgan-Brown, London.—*1st December*, 1880.
4998. PURIFYING, &c., GAS, W. J. B. Symes, Oxford-street, London.—*1st December*, 1880.
5003. MIXING, &c., SUBSTANCES, P. Pfleiderer, Farringdon-street, London.—*1st December*, 1880.
5017. CARRYING LIVE-STOCK, W. Morgan-Brown, London.—*2nd December*, 1880.
5021. DRIVING GEAR, T. Bradford, London.—*2nd December*, 1880.
5025. CLEANING FLUES of STEAM BOILERS, R. Sutcliffe, Castle Mills, Idle.—*2nd December*, 1880.
5026. SPIRIT LEVELS, R. Sutcliffe, Castle Mills, Idle.—*2nd December*, 1880.
5027. FIRE, &c., PROOF SAFES, R. Sutcliffe, Castle Mills, Idle.—*2nd December*, 1880.
5042. WEAVING GAUZE LENO, G. Hargreaves and T. Bracewell, Shipley.—*3rd December*, 1880.
5054. DIVIDING CARD SURFACES, P. Pingard, La Claire, France.—*4th December*, 1880.
5055. SYPHONS, J. Delord, Nimes, France.—*4th December*, 1880.
5093. SCREW PROPELLERS, W. Cooke & D. Mylchreest, Liverpool.—*7th December*, 1880.
5121. GAS BURNERS, C. Defries, Houndsditch, London.—*8th December*, 1880.
5140. PROVISION BOXES, F. S. Colas, Paris.—*9th December*, 1880.
5197. DIES for SHAPING METALS, J. T. Andrews, Handsworth.—*11th December*, 1880.
5209. SHIRTS, W. Benger and G. Benger, Stuttgart.—*13th December*, 1880.
5214. PREPARING, &c., SILK, J. C. Mewburn, London.—*13th December*, 1880.
5241. BRUSHES, J. Worrall, J. Lawrence, and J. Lea, Eccles.—*14th December*, 1880.
5282. VANILINE, G. de Laire, Paris.—*16th December*, 1880.
5293. FURNACES, E. P. Alexander, London.—*17th December*, 1880.
5304. SEWING MACHINES, W. L. Bigelow, London.—*17th December*, 1880.
5362. REGULATING the SUPPLY of STEAM, J. D. Churchill, London.—*21st December*, 1880.
5504. SULPHATE of AMMONIA, W. L. Wise, London.—*31st December*, 1880.
355. TREATING RAGS, C. W. Smith, Aston.—*26th January*, 1881.
461. SKATES, H. Dobson, Hull.—*3rd February*, 1881.
680. SECURING the HEADS of various ARTICLES, N. Thompson, London.—*16th February*, 1881.
858. TREATING DREDGED MATERIAL, F. A. Bishop, San Francisco, U.S.—*1st March*, 1881.
933. CUTTING WOOD LETTERS, &c., F. W. Ventris, Manchester.—*4th March*, 1881.
969. GRATES, &c., R. Crane, Stockwell-park-road, London.—*7th March*, 1881.
983. TREATMENT of CELLULOSE, A. Parkes, Gravelly-hill.—*8th March*, 1881.
1110. FASTENINGS for BINDERS, R. J. Jenkins, London.—*15th March*, 1881.
1176. WELDED IRON, &c., TUBES, J. C. Johnson, Wednesbury.—*17th March*, 1881.
1216. LAMPS, J. D. Rippingille, Aston-juxta-Birmingham.—*19th March*, 1881.
1296. COATING, &c., STEEL SHIPS, W. Welch, Portsmouth.—*23rd March*, 1881.
1395. ELECTRICAL APPARATUS, W. R. Lake, London.—*29th March*, 1881.
1451. LIQUEFIABLE GAS, J. C. Mewburn, London.—*2nd April*, 1881.

*(List of Letters Patent which passed the Great Seal on the 31st May, 1881.)*

5006. SPINNING, H. B. Arundel, Cheetham, Manchester.—*1st December*, 1880.
5018. REFINING, &c., PULP, G. Tidcombe, sen., and G. Tidcombe, jun., Watford.—*2nd December*, 1880.
5023. WIRE ROPES, &c., A. S. Hallidie, California.—*2nd December*, 1880.
5034. STEAMSHIPS, J. S. White, East Cowes, Isle of Wight.—*3rd December*, 1880.
5035. GRAIN-BRUISING, &c., MACHINE, F. T. Turner, Kenninghall.—*3rd December*, 1880.
5036. PREVENTING INCRUSTRATION in BOILERS, A. Jay, Kingswood Hill.—*3rd December*, 1880.
5040. GAS REGULATORS, H. Devine, Manchester.—*3rd December*, 1880.
5048. STOCKINGS, H. J. Griswold, London.—*3rd December*, 1880.
5050. BOILERS, W. H. Mirfin and E. Nield, Oldham.—*4th December*, 1880.
5058. TELEPHONIC, &c., COMMUNICATION, J. N. Culbertson and J. W. Brown, London.—*6th December*, 1880.
5074. MINERS' SAFETY LAMPS, E. Robathan, Risca.—*6th December*, 1880.
5076. TOOTH-GEARING, H. J. Haddan, Strand, London.—*6th December*, 1880.
5082. VELOCIPEDES, A. Kirby, Harpur-place, Bedford.—*6th December*, 1880.
5083. CABLES, E. Berthoud, Cortaillod, and F. Borel, Boudry.—*6th December*, 1880.
5095. BED-COVERING, W. Mitchell, Waterfoot.—*7th December*, 1880.
5137. DYNAMO-ELECTRIC, &c., MACHINERY, W. T. Henley.—*9th December*, 1880.
5147. LAMPS, T. Rolfe, Birmingham.—*9th December*, 1880.
5163. LETTING-OFF MOTION for LOOMS, J. Williamson, and J. and G. Swindells, Lancaster.—*10th December*, 1880.
5173. ARTIFICIAL MANURES, F. J. Bolton and J. A. Wanklyn, London.—*10th December*, 1880.
5179. SPINNING, &c., FIBROUS MATERIALS, T. Coulthard, Preston, and J. M. Hetherington, Manchester.—*10th December*, 1880.
5191. TREATING FATS and OILS, C. A. Bughardt, Manchester.—*11th December*, 1880.
5193. FOOTSTEPS for SPINDLES, &c., J. Greenwood, jun., G. A. Helliwell, W. Hammond, and S. Holt, Todmorden.—*11th December*, 1880.
5196. SCREW CLAMPS, H. Metham, Church-street, Deptford.—*11th December*, 1880.
5210. SKIRTS and DRAWERS, W. and G. Benger, Stuttgart.—*13th December*, 1880.
5212. ASH-PANS, B. Banks, Leeds.—*13th December*, 1880.
5215. SEWERS and DRAINS, W. Edes, Dover.—*13th December*, 1880.
5244. STOPPERING VESSELS, H. Smith, Brixton-road, London.—*14th December*, 1880.
5253. GUN CARRIAGES, F. C. Glaser, Berlin.—*15th December*, 1880.
5265. COVERING, &c., METAL BUSKS, W. R. Lake, London.—*15th December*, 1880.
5277. CHURNS, E. Ahlborn, Hildesheim, Hanover.—*16th December*, 1880.
5288. IRON, P. S. Justice, Southampton-buildings, London.—*17th December*, 1880.
5300. IRON and STEEL, S. Pitt, Sutton.—*17th December*, 1880.
5334. BURNISHING HEELS of BOOTS, H. J. Haddan, Strand, London.—*20th December*, 1880.
5383. VESSELS, J. Tangye, Birmingham, and J. Cunnack, Cornwall.—*22nd December*, 1880.
223. GLAZING RICE, &c., H. J. Haddan, Strand, London.—*18th January*, 1881.
327. SUPPLYING AIR to FURNACES, C. Haupt, Breig, Germany.—*25th January*, 1881.
343. FIRE-BARS, &c., E. G. Brewer, Chancery-lane, London.—*26th January*, 1881.
360. VENTILATING MINES, &c., J. S. Davidson, C. R. Steele, & J. Leon, Whitehaven.—*27th January*, 1881.
471. ICE, H. J. Haddan, Strand, London.—*4th February*, 1881.
622. COAST DEFENCES, T. R. Timby, Nyack, U.S.—*14th February*, 1881.
650. LOOMS, A. M. Clark, Chancery-lane, London.—*15th February*, 1881.
886. LOCOMOTIVE CARS, F. E. B. Beaumont, Victoria-street, London.—*2nd March*, 1881.
995. ARTIFICIAL FUEL, G. Walters, Frome, and W. Morgans, Bristol.—*8th March*, 1881.
1018. COMPOUND PACKING MATERIAL, J. A. Turner, Nutsford Vale, West Gorton.—*9th March*, 1881.
1224. ORNAMENTAL GLASS, J. Couper, jun., and L. Elcock, Glasgow.—*21st March*, 1881.
1240. DYNAMO, &c., MACHINES, E. G. Brewer, London.—*21st March*, 1881.
1299. MAKING up PACKETS, G. Pritchard, Seaforth, near Liverpool.—*23rd March*, 1881.
1357. HOT-AIR ENGINES, W. H. Bailey, Oldfield-road, Salford.—*26th March*, 1881.
1372. IRON and STEEL, W. J. Clapp, Nantiglo, and T. Griffiths, Blaenavon.—*28th March*, 1881.
1389. CALORIC ENGINES, M. P. W. Boulton, Tew Park, *29th March*, 1881.
1410. WASHING MACHINES, G. Collier, Newcastle-on-Tyne.—*31st March*, 1881.
1424. ACETATE of SODA, &c., W. G. Forster, Streatham Common, London.—*31st March*, 1881.
1447. DYNAMO-ELECTRIC, &c., MACHINES, C. W. Siemens, Queen Anne's-gate, London.—*1st April*, 1881.
1537. LOCKS and STAPLES, H. J. Haddan, Strand, London.—*8th April*, 1881.

## List of Specifications published during the week ending May 28th, 1881.

2545, 6d.; 3229, 2d.; 3759, 6d.; 3992, 8d.; 4014, 4d.; 4040, 4d.; 4122, 6d.; 4124, 6d.; 4150, 1s. 4d.; 4155, 6d.; 4165, 6d.; 4166, 6d.; 4176, 6d.; 4182, 8d.; 4184, 6d.; 4185, 6d.; 4190, 6d.; 4191, 6d.; 4193, 10d.; 4197, 6d.; 4198, 8d.; 4209, 6d.; 4224, 6d.; 4242, 6d.; 4244, 10d.; 4256, 6d.; 4257, 8d.; 4258, 6d.; 4263, 8d.; 4265, 6d.; 4270, 6d.; 4273, 6d.; 4274, 6d.; 4276, 6d.; 4281, 10d.; 4290, 6d.; 4291, 8d.; 4293, 8d.; 4297, 6d.; 4302, 6d.; 4304, 4d.; 4305, 1s.; 4310, 6d.; 4313, 6d.; 4327, 6d.; 4331, 6d.; 4332, 8d.; 4333, 6d.; 4339, 2d.; 4342, 2d.; 4343, 2d.; 4347, 6d.; 4350, 2d.; 4355, 2d.; 4356, 4d.; 4357, 2d.; 4360, 2d.; 4361, 6d.; 4364, 6d.; 4366, 2d.; 4371, 2d.; 4374, 4d.; 4375, 2d.; 4376, 4d.; 4381, 2d.; 4385, 2d.; 4387, 6d.; 4392, 6d.; 4399, 6d.; 4400, 2d.; 4402, 2d.; 4405, 2d.; 4407, 4d.; 4408, 2d.; 4410, 2d.; 4413, 6d.; 4414, 2d., 4417, 2d.; 4418, 2d.; 4423, 2d.; 4427, 2d.; 4428, 4d.; 4431, 2d.; 4438, 2d.; 4439, 4d.; 4440, 2d.; 4441, 2d.; 4442, 2d.; 4450, 4d.; 4451, 2d.; 4454, 4d.; 4455, 2d.; 4457, 4d.; 4460, 2d.; 4462, 2d.; 4463, 4d.; 4469, 4d.; 4498, 6d.; 4570, 4d.; 5184, 8d.

*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane, London.

# ABSTRACTS OF SPECIFICATIONS.

*Prepared by ourselves expressly for* THE ENGINEER *at the office of Her Majesty's Commissioners of Patents.*

**2545.** VISITOR'S TABLET, *A. E. Scott.—Dated 23rd June*, 1880. *6d.*

This relates to a portable visitor's tablet by which it may at once be readily perceived whether a person is at home or out, and if absent when he will return.

**3229.** FIRE-LIGHTERS, *J. Batchelor.—Dated 7th August*, 1880.—(*Not proceeded with.*) *2d.*

This relates to the peculiar construction of fire-lighters, whereby their combustion is facilitated by affording a more free access of air thereto, their construction is simplified, and great economy of material is effected.

**3759.** LIGHTING BUILDINGS, SHIPS, &c., *C. W. Kitto and W. H. Thompson.—Dated 16th September*, 1880. *6d.*

The oil is stored in tanks or other suitable reservoirs placed outside the dwelling-house, and in the case of ships in the hold, or on the deck, or in any convenient position, and the oil is led from the same by means of tubes or pipes to the apparatus in which it is to be used. These pipes are connected to a pump or pumps, attached to or in connection with the tank or reservoir, and on actuating the pump or pumps the oil is caused to pass through the pipes to the apparatus where it is to be burnt.

**3992.** PILED FABRICS, *D. Scott.—Dated 2nd October*, 1880. *8d.*

This consists in the method of forming the figure by removing the weft pile (after being cut) from those portions of the cloth where the "ground" is intended to appear; and, Secondly, in the methods of weaving the fabric, so as to facilitate the removal of the pile from such portions of the fabric.

**4014.** PRESERVING ANIMAL AND VEGETABLE SUBSTANCES, *H. A. Bonneville.—Dated 4th October*, 1880.—(*A communication from A. Robert.*)—(*Not proceeded with.*) *2d.*

This consists in not allowing the air to penetrate into the jars or other vessels containing the substances, except by causing it to pass through some matter or substance, such as cotton, asbestos, or other suitable matter or substance, proper to sift it, free it of, intercept the passage, or prevent the introduction of, germs of fermentation contained in this air into the jars or other vessels.

**4040.** HOLDING THE FLIGHT FEATHERS OF BIRDS, *M. Arnold.—Dated 5th October*, 1880.—(*A communication from P. Voitellier.*) *4d.*

This consists in the plan or method of binding the wing to the wing within itself to prevent flight, instead as heretofore the wing to the body.

**4122.** CHAMBERS FOR PRESERVING ARTICLES OF FOOD IN SHIPS, &c., *S. H. Linn.—Dated 11th October*, 1880. *6d.*

This relates, First, to the construction of the chambers for storing articles of food so that they may be as little affected by outward temperature as possible; Secondly, to means and method of circulating the air through the chambers; Thirdly, to the drying, cooling, and in certain cases warming, the air to be circulated through the chambers.

**4124.** VENTILATING SEWERS, &c., *T. H. Mitchell.—Dated 11th October*, 1880. *6d.*

Suitable pipe connections from the sewers, cesspools, or drains are made to the chimneys of houses, and to the ashpits of furnaces in factories, whereby the noxious gases are drawn from the drains and carried to the chimneys, and from thence pass harmlessly into the atmosphere.

**4134.** AUTOMATIC SIGNALLING APPARATUS FOR RAILWAYS, *E. Guende.—Dated 12th October*, 1880. *6d.*

This relates to apparatus which acts by the gravity of a locomotive in motion, and is composed of a series of signalling apparatus, actuated by the weight of the locomotive and connecting wires. An iron rail is placed outside the line, and of sufficient length to receive at least two wheels of the engine. The rail is supported by springs, and to it is attached an arm, under which is a lever, the end of which acts upon a lever keyed to a shaft, on which are mounted a weighted lever, a signal rod, and a disc. The lever carries a pawl gearing with a wheel, also an arm, the toothed end of which can take into a slot upon another pawl. The latter is fixed outside the wheel, and acts upon it and the arm. The wheel is loose on its shaft, and is double cogged, and gears with the pawls, and with a chain passing over over the cogs of wheel, and, on the other hand, is connected by a wire and a coiled spring P with the pawl of the next preceding apparatus.

**4150.** LOOMS, *W. R. Lake.—Dated 12th October*, 1880.—(*A communication from C. E. Skinner and E. Tymeson.*) *1s. 4d.*

The First part relates to the devices which co-operate with the weft-carrying needle in that class of power looms known as needle looms; Secondly, one feature consists in the combination with the spool frames or carriages and the transferring devices which have a motion sideways or crosswise of the loom, of hooks which enter and pass through the spaces between the warp yarns from below the same, and return for the purpose of drawing the tuft yarns through the warp. Another part relates to the mechanism for operating the transferring arms.

**4155.** STEAM GENERATOR AND ENGINE, *H. J. Haddan.—Dated 13th October*, 1880.—(*A communication from W. von Pittler.*) *6d.*

This relates to a combined steam generator and engine, and consists in generating steam by pumping sufficient water into the vessel A for each stroke of the engine, the vessel being heated to red heat so as to immediately evaporate the water and convert it into high-pressure steam. The water is drawn from the

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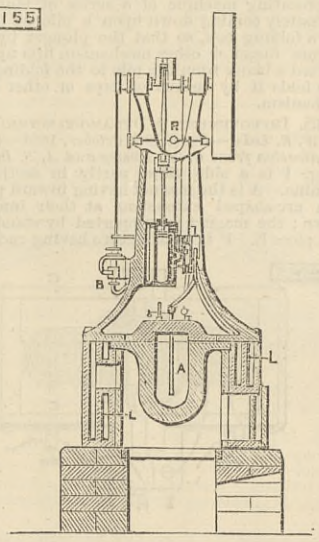


space L surrounding the grate and vessel A, and is supplied from a high level reservoir. The feed pump B has two barrels and pistons driven from the same connecting rod and crosshead, either piston being capable of being set in action while the other serves as a reserve piston. The governor R acts simultaneously as a steam valve and a feed water valve, its pendulous arms moving a conical slide along the shaft, thereby actuating a lever connected with the steam valve and also with the feed water valve.

**4165.** CRUSHING AND ELIMINATING DIAMONDIFEROUS CONGLOMERATES, *W. Hartnell.—Dated 13th October*, 1880.—(*A communication from S. Stonestreet.*) *6d.*

The blue diamondiferous conglomerate is tipped from a truck into a feeder, in which it is passed through one or more pairs of rollers, which may be ribbed for the purpose of breaking or reducing the material to a suitable gauge and evenly. The material is then conducted to a reducing machine, consisting of a circular pan and rollers. In connection with the pan a scoop, plough, or elevator is employed, which being fixed so that it faces the pan, the contents thereof are received by the scoop or plough, and conducted into a puddler or mixer. A hopper is provided, having a shoot in connection therewith for conducting muddy water from the mixer through perforated tubing.

**4166.** DYEING AND WASHING TEXTILE FABRICS, *M. Sella and F. Cerruti.—Dated 13th October*, 1880. *6d.*

This relates to apparatus consisting of a vessel having a perforated plate, upon which the materials to be treated are placed and remain, and central tubes and injectors so arranged that a continuous and regular current of dyeing, bleaching, or other liquid is made to traverse and circulate through the materials to be treated.

**4176.** TUBES FOR RAILWAY BRAKES, *C. Moseley.—Dated 14th October*, 1880. *6d.*

This consists in the use and application for vacuum and other brakes of seamless flexible india-rubber tubes.

**4182.** FURNACES AND BOILERS, &c., *J. Neil.—Dated 14th October*, 1880. *8d.*

This has reference to the construction and arrangement of fittings or apparatus, or the combination of the parts of apparatus for feeding or supplying and heating crude or refined mineral oils, for the production of gas for combustion in the furnaces of steam boilers, instead of coal or other solid fuel. The apparatus comprises a special close supply feeding vessel, erected at some distance above the furnace and kept supplied with the oil to a suitable level or height through a pipe from the supply stowage tanks by air pressure within the tanks or by a pump. This vessel may be fitted with a sight or gauge glass at one side to show the height or level of the oil within, and may be formed with a syphon feeding cup or tubes, rising to near the top of the vessel, fitted with as many capillary

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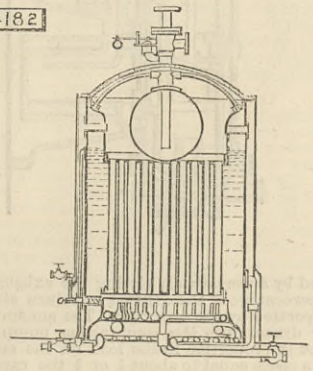

cotton or other wicks as required, leading into one common discharge feeding tube through the bottom, controlled by a tap outside, as well as the inlet or supply tube. The said discharge tube from all the wicks feeds or drops the oil within and through a close filter-shaped glass vessel into a tube led from its lower end direct to the one side or end of a shallow, close, flat, and nearly level oil heating or boiling vessel or retort for converting the oil into gas as it flows in a thin layer along the inner bottom surface, placed near the lower part of the furnace or combustion chamber. The drawing is a vertical section of a vertical tubular steam boiler as fitted with one arrangement of the furnace.

**4184.** COMPRESSING AIR, *D. Greig and M. Eyth.—Dated 14th October*, 1880. *6d.*

This relates to air compressers for mining and similar purposes, and consists in avoiding the loss of power caused by the generation of heat in the air whilst the compression is going on. The compressing cylinder B is at one end provided with the air admission valves D, while its piston C carries another set of valves E opening towards the other end of the

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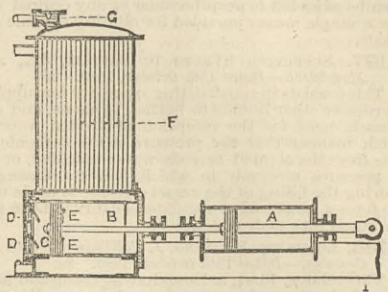


cylinder, which is open to a large receiver F containing a series of tubes surrounded by water so as to form a cooling surface. The air passes through the receiver and by the valve G to the working pipes. The compressing piston C is worked from the piston of the steam cylinder A.

**4185.** VALVE GEARING, *F. C. Marshall.—Dated 14th October*, 1880. *6d.*

The movement of the valve is derived from an excentric secured to—or by preference made solid with—the crank shaft, and having its excentricity virtually coincident with the crank. The strap embracing this excentric is made solid with or firmly secured to its rod, and constitutes the excentric lever. The working direction of this lever is at right angles to that of the valve's motion. The valve rod is attached to the extreme end, and at an intermediate point in its length the lever is suspended by a link to a pin or fulcrum in the other end of an arm on the reversing shaft, or the excentric being fixed with its excentricity virtually opposite the crank, the lever may be

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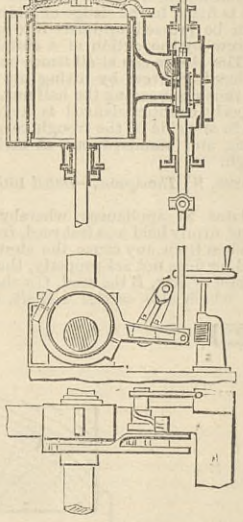

suspended to the arm on reversing shaft b its outer end, the valve rod being attached to an intermediate point. By moving this arm from one extreme to the other of its arc - about 60 deg.—the engine is reversed; when it is in its middle position the steam passages will only open the amount fixed upon as the "lead" opening, and the engine is free to move either back or forward, and by bringing the arm into any intermediate position—on either side of its middle position—either by hand direct, or by steam, or hydraulic power, actuated by hand or automatically by the governor—acting upon the valve gear of the reversing engine—any required degree of expansion may be obtained or the speed of the engine regulated.

**4190.** STOPPERING BOTTLES, *S. Wilkes.—Dated 15th October*, 1880. *6d.*

To the neck of the bottle is arranged a ring of wire or sheet metal, which is provided with two loops, one on each side. These loops carry a bowed lever by means of the ends working in the same. This lever is provided with two loops, one on each side, and carries an arched bow, which will pass over the mouth of the bottle when required, the ends of which also work in the last-named loops freely, and to this arched bow is arranged the stopper, which is constructed of a metallic cap upon its upper part with a bow or eye, the said arched bow passing through the same; this also has a free movement.

**4191.** IMPROVEMENTS IN ELECTRIC LAMPS, *G. P. Harding.—Dated 15th October*, 1880. *6d.*

The object of the invention is to assure the relative position of the electrodes in electric lamps, utilising

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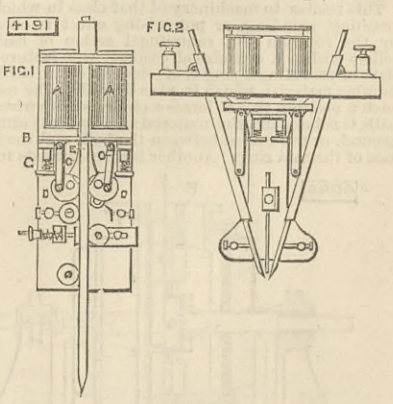



the effect of gravity and diverted portions of the current in connection with electro-magnets. In Fig. 1 assuming that the lamp is at rest, and carbon E not resting on lower carbon, as shown, directly connection is made from the machine to the lamp a portion of the current goes through the magnets A A, armature B is attracted, and actuates cams D which open and release the pressure on the carbon: the current now passing between the two carbons, the magnets become inactive, and the springs G G pull back the armature and actuate the cams in the contrary direction, causing them to close and lift the carbon a short distance and establish the arc. Fig. 2 shows another arrangement, with two carbons placed at an angle, a

third carbon being used to regulate the arc, this prevents the carbons descending too far, the arc being regulated by the thickness of the third carbon.

**4193.** FIRE ESCAPES, *H. J. Haddan.—Dated 15th October*, 1880.—(*A communication from F. W. Hofele.*) 10*d.*

This consists, First, in a continuous four-way telescopic ladder, with a series of one or more folding sections pivotted on the rungs of the telescopic sections, in such manner that one or more of them may be extended outward on either side at any desired angle, so as to form a platform for the fireman to work upon, as well as to enable persons to pass to or from the ladder to the building from any building in its line with perfect safety. It also consists in a novel method of bringing the lowest or main section of ladder to the truck in such manner that the ladder can be adjusted to perpendicular or any desired angle by a simple means provided for altering the line of its shaft.

**4197.** SUPPLYING SYRUPS TO BOTTLES, &c., *A. A. Mondollot.—Dated 15th October*, 1880. 6*d.*

This consists in constructing apparatus for supplying syrups or other liquids to bottles, syphons, and other vessels used for the reception of aërated waters in such manner that the pressure of the carbonic acid gas from the aërated or soda-water machine, or from a pressure reservoir in which the gas disengaged during the filling of the vessel collects, is made use of to force a measured or regulated quantity of the syrup or liquid into each vessel.

**4198.** LOOMS FOR WEAVING, *J. Hollingworth and A. B. Crossley.—Dated 15th October*, 1880. 8*d.*

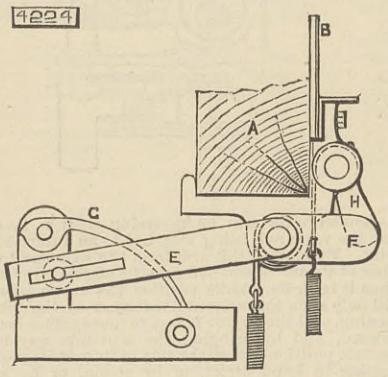
This relates, First, to looms having rising and falling shuttle-boxes, and consists in applying a pulley to the bottom box lever or other convenient place, over which a tape or cord is passed, held fast at one end and wound ted at the other. Inside this pulley a catch or other suitably shaped device is placed on an excentric, so arranged that when the shuttle boxes are rising the pulley is free, but when descending the pulley is brought into contact with the excentrically placed catch, which immediately stops the rotation of the pulley, whilst at the same time the upper box lever is prevented dropping suddenly by means of the frictional contact of the strap around the said pulley. It relates, Secondly, to a new combination and arrangement of parts for forming a joint for attaching or connecting together the jacks and jack hooks in actuating the shed.

**4209.** CUTTING TOBACCO, *S. P. Wilding.—Dated 15th October*, 1880.—(*A communication from G. A. Reiniger and C. Petri.*) 6*d.*

The apparatus consists of a sloping wooden trough supported on two frames. Upon this inclined trough is fitted a sledge or sliding trough of strong sheet iron which fits closely within the wooden trough and slides on suitable guides on the edge of the fixed trough. By the side of the fixed trough runs a leading screw carried in suitable bearings at each end of the trough. A half nut is fitted to the sledge or sliding trough, so that it can be pressed upwards into gear with the leading screw by the action of a suitable lever and weight. The sledge can at all times be disconnected from the leading screw by lifting up the weighted lever, and thus disengaging the half nut. The cutting knife properly counterbalanced is keyed to a shaft above, and to one side of the trough carried on a suitable bearing and standard, one at each end of the fixed trough.

**4224.** LOOMS, *W. Thompson.—Dated 16th October*, 1880 6*d.*

This relates to appliances whereby the reed is securely and firmly held as a fast reed, free from vibration, but when from any cause the shutter is caught in the shed, or does not act properly, the reed is loose. A is the beam or slay, B the reed, C a shaft carried by a bracket which also carries a shaft, on which are



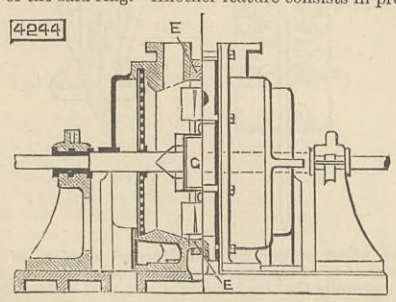

mounted the levers E and F. As the beam advances to the beat up a runner on lever E ascends the incline and by turning the said shaft the lever E by its stud releases itself from the lower end of the notched lever H, and so leaves the reed B loose and free to open in the event of obstruction. When the beam returns from the beat up the runner passes under the incline G.

**4242.** REGULATING GAS, &c., *W. R. Lake.—Dated 18th October*, 1880.—(*A communication from M. G. Wilder.*) 6*d.*

This relates to improvements on patent No. 171, dated 14th January, 1880. A check or float controls the outlet from the chamber to the tip, instead of the inlet into chamber from the service pipe, and its operation is to impede the delivery of the gas from the chamber to the tip, and thus increase the pressure or volume above the check in a similar manner to that in which, in the former case, it operated to increase the pressure or volume below the check.

**4244.** CRUSHING, GRINDING, PULVERISING, &c., MACHINERY, *R. Cook.—Dated 18th October*, 1880. 10*d.*

This relates to machinery of that class in which the crushing, grinding, or pulverising effect is obtained by the rotation and centrifugal action of balls or rollers within a cylindrical casing. One feature consists in providing a ring E of steel or other hard and durable material, which is placed within the case in such a position that it forms a circle, within which the balls G rotate, and the materials treated are crushed, ground, or pulverised between the balls and the inner face of the said ring. Another feature consists in pro-




viding improved means for attaching the balls or rollers to the driving shaft by means of a driver or propeller of improved construction. A third improvement consists in providing fans or stirrers of novel construction, which are carried by a central piece carrying the driver or propeller, and are arranged in such a position that the fans or stirrers project radially at right angles to the axis of the driving shaft, and are situated about midway and between the two balls or rollers, one of these fans being on one side of the driving shaft, and one on the opposite side thereof.

**4256.** ISSUING TICKETS, &c., *J. H. Betteley.—Dated 19th October*, 1880. 6*d.*

This consists in issuing tickets from strip paper from an apparatus within which a duplicate marking of the amount received is indicated on a separate strip of paper out of control of the person in charge to check and register the amount so received.

**4257.** VELOCIPEDES, *E. C. F. Otto.—Dated 19th October*, 1880. 8*d.*

This relates to patent No. 1274, dated 31st March, 1879. The object is to adapt the improvement therein described to a vehicle consisting of only one wheel, the rider being seated above it. For this purpose a comparatively small but light road wheel is employed, which is driven by pulleys and steel band or chain, or by tooth wheel or other gearing from two treadle crank spindles, fitted and working in each side of a lower continuation of the fork lever. On the inner side of each treadle crank spindle is fixed the pulley or tooth wheel, and on the road wheel, hub, or spindle is fixed the corresponding pulley or tooth wheel. In case tooth wheels are employed an intermediate wheel is used on each side, such wheel running on a gudgeon or pin fixed to inner side of the fork.

**4258.** LOCKING STOPPERS IN BOTTLES, &c., *G. Travis.—Dated 19th October*, 1880. 6*d.*

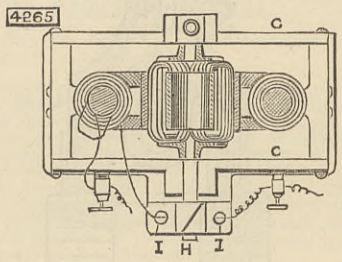
A lock is attached to the neck of the bottle and provided with projecting flange to catch the shoulder of the stopper, so that when locked the stopper is kept secure.

**4263.** MANUFACTURE OF ENVELOPES, *E. Hely.—Dated 19th October*, 1880. 1*s.*

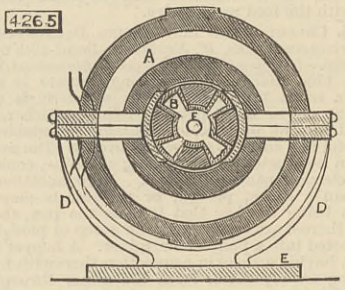
This relates to the combination in one rotary or reciprocating machine of a series of plungers, each alternately coming down upon a pile of blanks and into a folding box, so that the plunger by means of its gum finger or other mechanism lifts up or brings forward a blank from the pile to the folding box, and then folds it by means of flaps or other equivalent mechanism.

**4265.** IMPROVEMENTS IN DYNAMO-ELECTRIC MACHINES, *W. R. Lake.—Dated 19th October*, 1880.—(*A communication from C. A. Hussey and A. S. Dodd.*) 6*d.*

Fig. 1 is a side view, partly in section, of the machine. A is the magnet having inward projections with arc-shaped extensions at their inner end as shown; the magnet is supported by standards D on base piece E. F is an armature having radial projec-



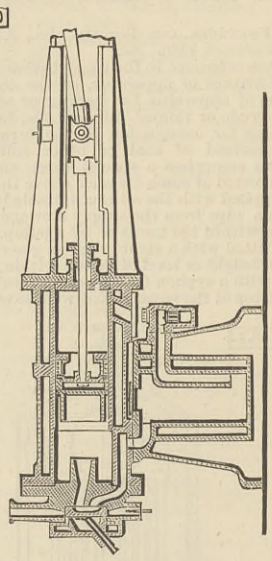

tions B, the wire being wound in intervening spaces C as shown; it has an opening from end to end through centre, and also openings from end to end through the radial projections, all of which are in communication; it is provided with journals which are attached to skeleton frames or end plates by screws or otherwise, see Fig. 2. These journals are supported in bearings G, H is the commutator with brushes I.




For this invention it is claimed that there is produced an effective machine by rotation of the armature before the poles of the magnet, and before the whole length of the magnet, and the wire surrounding it all at the same time, and thus throughout the entire field of force.

**4270.** GAS MOTOR ENGINES, *C. G. Beechey.—Dated 20th October*, 1880. 6*d.*

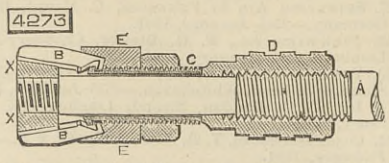
The object of the invention is to so construct the engines that the amount of gas and air expended at each explosion is automatically dependent upon the work the engine is doing, for which purpose the engine is governed and the force of each explosion




regulated by automatically closing the exhaust valve at any percentage of the exhaust or return stroke by a cam operated by the governor. The amount of gas and air drawn into the compression pump is also regulated in proportion to the load on the engine by leaving a space equal to about ½ or ¼ the capacity of the pump between the pump piston and the delivery valve.

**4273.** BORING TOOLS, *W. Timms.—Dated 20th October*, 1880. 6*d.*

This relates to tools for boring and finishing holes in metal, and consists in making them adjustable, so that one size of tool may be able to cut a range of sizes of holes, whilst the wearing parts or cutters are easily renewed. It consists of a central screwed spindle A with a boss X screwed on to one end, the other end being inserted in the drill spindle of the machine. The boss has tapered longitudinal grooves to receive a number of small steel cutters B, which are retained by notches cut near their inner ends to catch on a collar formed on the sleeve C. This sleeve slides on the spindle, so as to force the cutters outwards by



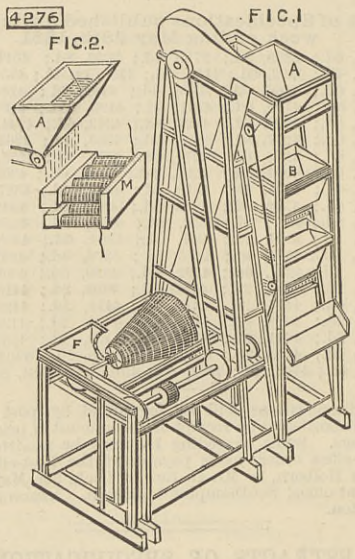

sliding along the tapered grooves. The nut D keeps the sleeve C and cutters B from sliding back, while the cutters are firmly held in their grooves by the cap E fitted on the sleeve C.

**4274.** IMPREGNATING AND RAISING AND THROWING WATER OR OTHER LIQUIDS BY MEANS OF LIQUID CARBONIC ACID, &c., *C. Kesseler.—Dated 20th October*, 1880.—(*A communication from Dr. W. Raydt.*) 6*d.*

This consists, First, in impregnating water with carbonic acid in a gaseous form by means of liquid carbonic acid, and raising and throwing it, or similarly impregnating beer, and raising and drawing it off. Secondly, of an apparatus consisting of a carbonic acid container in combination with pressure and reducing valve appliance, a vessel containing the water or beer to be raised, and a pipe conveying the carbonic acid into the last-named vessel.

**4276.** IMPROVEMENTS IN THE MODE OF AND APPARATUS FOR SEPARATING IMPURITIES FROM AURIFEROUS ORES, AND IN THE TREATMENT OF SUCH ORES, *E. G. Brewer.—Dated 20th October*, 1880.—(*A communication from T. A. Edison.*) 6*d.*

The material to be treated is fed into hopper F, whence it passes into a sieve. An elevator conveys the material to the hopper A of the first separator, whence it falls in front of magnet M. Below M is a




hopper B receiving the non-magnetic portion and passing it before a second magnet, the magnetic portion falling into a receptacle for the purpose, and thence to a waste shoot. This construction is repeated until as many separators as may be desired are arranged in series.

**4281.** HORSESHOE NAILS, *L. W. Boynton.—Dated 20th October*, 1880. 10*d.*

This consists, First, in four series of rotating dies, arranged and working in planes at right angles to each other, in such a manner that a space is left at the point where these planes intersect each other, in which space the metal is compressed, and thereby the nail shanks are formed and the heads partially formed. Secondly, the novel construction of the frame of the machine. Thirdly, the combination of two rolls or cylinders, one of which is provided with holders wherein the shanks of the nails are held while their heads are presented to and shaped by the dies in the other roll. Fourthly, grooved guides arranged in combination with the rolls or cylinders, and with weighing apparatus.

**4290.** CASTING ARTICLES IN COPPER, BRONZE, &c., *P. M. Parsons.—Dated 21st October*, 1880. 6*d.*

This consists in the construction of the moulds to be used in combination with a plunger forced into the mouth of the moulds while the metal is in a fluid or soft state.

**4291.** BREECH-LOADING SMALL-ARMS, *J. F. Swinburn.—Dated 21st October*, 1880. 8*d.*

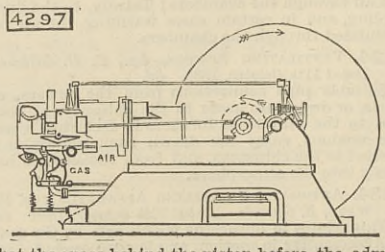
This relates, First, to breech-loading small-arms called drop-down guns, in which the breech ends of the barrels are locked down for firing the guns by means of a bolt or bolts, which said bolts are withdrawn for unlocking the barrels by the action of a spring lever on the tang of the break-off; Secondly, to the fore end fasteners of drop-down guns; Thirdly, to safety apparatus for preventing the accidental discharge of drop-down guns.

**4293.** GAS APPARATUS FOR COOKING, &c., *W. R. Lake. Dated 21st October*, 1880.—(*A communication from A. W. Morton.*) 8*d.*

This comprises a novel combination with an oven of a heat-radiating bottom, through which heat is transmitted to the interior of the oven from any suitable heat-giving device external thereto, and a system of naked gas jets arranged in the top of the oven to provide a practically continuous sheet of the naked flame in the upper part of the said oven, so that the article to be baked or cooked is subjected simultaneously to the heat radiated or transmitted from the bottom, and to the action of the naked flames of the gas jets at the top, and a more efficient cooking of the articles being by this means secured, and also a greatly increased browning effect upon the upper parts of said articles.

**4297.** GAS MOTOR ENGINES, *F. W. Crossley.—Dated 21st October*, 1880. 6*d.*

This relates to gas motor engines of the kind described in patent No. 2081, dated 17th May, 1876, and consists, First, in forcing air into the cylinder while the products of combustion are being expelled,




so that the space behind the piston before the admission of the combustible charge may be mostly occupied by air; Secondly, the combination with the engine and its exhaust valves of an air compressing pump, and valve and gear for working it, so as to introduce air into the cylinder during the expelling stroke of the piston; Thirdly, the use for regulating the engine power or speed of a revolving drum having various numbers of cam projections for opening the gas supply valve arranged in sets, so that according as one or another of these sets is brought into action, the engine is caused to make idle strokes at greater or less intervals.

**4302.** LOCKS FOR FIRE-ARMS, *M. Kaufmann.—Dated 21st October*, 1880. 6*d.*

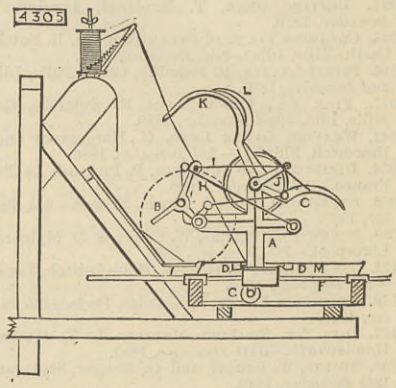
A main spring effects the rebound of the hammer, and actuates the trigger through the medium of a central lever.

**4304.** LOCKS OR LATCHES, &c., *W. White.—Dated 21st October*, 1880. 4*d.*

This consists, First, in locks and latches of a pivotted balance fitted for operation on the bolt as a substitute for springs; Secondly, in the means for attaching knobs to spindles consisting of a nut combined with a threaded spindle and aperture knob.

**4305.** BINDING CUT CROPS INTO SHEAVES, *R. C. Ransomes.—Dated 21st October*, 1880.—(*A communication from J. Ferrier, jun.*) 1*s.*

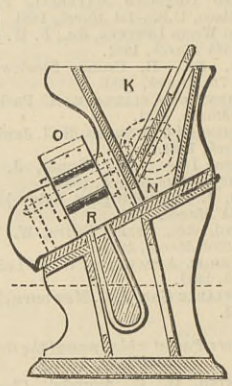
This relates to apparatus for binding cut crops into bundles with string bands, and for tying the ends of the bands, and it is applicable to all machines in which provision is made to supply the cut crop in regular order to the table of the apparatus. The standard A is set on a box supported at one end on a




tube F and at the other on a roller G. The standard is worked to and fro by a rod H, and on one end is a stud on which swivels a V-shaped arm B connected at one end by a rod I with a crank arm J on one end of a tubular shaft, the other end of which carries the string-carrying arm K, and a subsidiary string-carrying arm L is provided; C is the compressing arm worked from the arm B. Tappet pieces D are fixed one on each side of the standard and serve to operate excentrics on a cam plate M which actuates the knot-tying contrivances.

**4310.** AN IMPROVED MAGNETIC APPARATUS FOR SEPARATING OR REMOVING PARTICLES OF IRON FROM GRAIN, *W. R. Lake.—Dated 22nd October*, 1880.—(*A communication from S Howes, N. Babcock, and C. Ewell.*) 6*d.*

The grain to be treated is conveyed into the hopper K, from which it flows upon and over the zinc plate N, being discharged over its lower edge. The particles



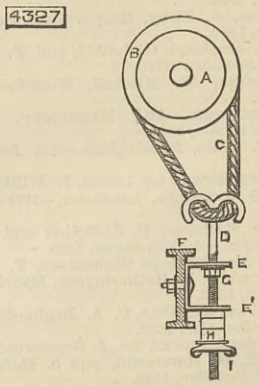

of iron mixed with the grain are subjected to the action of magnets on the other side of N, and are held while the grain passes on. At certain intervals the wiper O traverses N, and sweeps up the particles of metal, discharging them through R into any suitable receptacle.

**4313.** SEWING MACHINES, *J. Warwick.—Dated 22nd October*, 1880. 6*d.*

This consists in driving a revolving shuttle at a varying speed by a driving shaft made in two parts.

**4327.** LOOMS, &c., *J. Cook and W. L. Heaton.—Dated 23rd October*, 1880. 6*d.*

This is particularly applicable to the letting off motion of the yarn beam of looms, and consists in dispensing with the weights and levers connected therewith and in the use of apparatus whereby the requisite tension and elasticity are obtained. A is the yarn beam, and B is a pulley or annular casting in which is a groove for the endless rope C, which is attached to hooks on the screwed rod D passing through the brackets E E¹ fixed to the cross rail F.



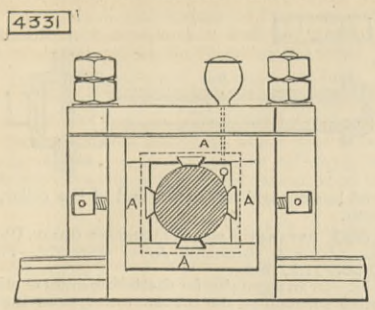

Screwed on the rod D is the nut G, and on the rod D below the lower side of the bracket marked E¹ are india-rubber washers H and the nut I. To obtain the requisite tension, the nut G is tightened against the side of the bracket marked E. The nut I is then tightened until the washers H are sufficiently compressed and the nut G is then loosened; the required tension and elasticity are thus obtained.

**4332.** BRICKS AND TILES, *P. Bawden.—Dated 23rd October*, 1880. 8*d.*

The machine consists essentially of an endless series of moulds open at each end, and supplied in a regulated manner with clay from the pug mill, the said moulds being supplied with palette boards automatically or otherwise, operating in combination with a self-acting wire-cutting frame, and with a page, which receives the moulded bricks or form on the palette boards, the empty moulds being then washed by revolving brushes and passed through dry sand,

**4331.** BEARINGS OF REVOLVING SHAFTS AND AXLES, *C. F. Parsons.—Dated 23rd October*, 1880. *6d.*

This relates to the reduction of friction in bearings,




and consists in keys or strips A of hard material fitted into grooves in the side walls, the bottom and cap of the bearing, so that the axles only touch such keys or strips.

**4333.** KILNS, *P. Montagné.—Dated 23rd October*, 1880. *6d.*

For lime a kiln is employed with a continuous fire, and preferably of a curved form in the interior, in such a manner that the material being placed in at the top can egress laterally at the bottom. The fire is at the upper part, and the lime which is produced falls out from its weight assisted by means of several rollers provided with channels or teeth, and turned by any suitable mechanical contrivance.

**4339.** GUNPOWDER MILLS, *C. Pieper.—Dated 25th October*, 1880.—*(A communication from L. Schwartzkopff.)—(Not proceeded with.)* 2*d.*

This relates to mills with vertical runners used in the manufacture of gunpowder, and in which the axle of the runners is suspended by rods to a crosshead fixed to the vertical main shaft for the purpose of keeping the runners at the certain small distance from the table against which they operate.

**4342.** STRAW SHAKERS, *C. Kesseler.—Dated 25th October*, 1880.—*(A communication from H. Meier.)—(Not proceeded with.)* 2*d.*

A number of long chests or troughs are united together side by side, which are operated by a crank shaft or shafts. These shaking troughs are provided with triangular cross-pieces or battens, both on their upper and under sides. Below these shaking troughs is the fixed plain bottom of the apparatus, which at its lower end is formed into a sieve. At the side or near this sieve is fixed in a slanting position shovel-shaped boards for conveying the broken pieces of straw and other rubbish away, either at the end or side ways.

**4343.** DIGGING POTATOES, *T. Turner.—Dated 25th October*, 1880.—*(Not proceeded with.)* 2*d.*

Instead of the revolving forks or ploughs now in use, the forks are placed in stout chains or bands, so as to form elevators.

**4347.** TUNNELLING MACHINERY, *T. English.—Dated 25th October*, 1880. *6d.*

This consists, First, in constructing the framing of the apparatus in two parts, a bed and an upper framing, the one fitted to slide longitudinally along the other, so that the apparatus can be advanced step by step as the process proceeds; Secondly, advancing the boring head and upper frame while the bed is stationary, and advancing the bed while the upper frame is stationary, by hydraulic pressure acting on a piston fitted to work within the tubular shaft of the boring head.

**4350.** AUTOMATIC GAS LIGHTING AND EXTINGUISHING APPARATUS, *F. Wirth.—Dated 25th October*, 1880.—*(A communication from S. Dukas.)—(Not proceeded with.)* 2*d.*

A constant electric battery is employed for operating the apparatus, the battery being of sufficient power to heat to red heat a suitably placed platinum wire, the gas pipes serving as the conductors of the electric current to the said platinum wire, the return of the current being effected by the electro-magnet employed and the other pole of the battery. An anchor is held raised by means of suitable springs, and to the anchor is attached a pawl or catch pressed by a spring against a ratchet wheel, into the teeth of which the pawl gears, so as to turn the wheel one-eighth of a revolution each time the pawl is drawn down by the anchor, and the said wheel being attached to a four-way cock, this latter will be alternately opened and closed. A second cock is provided in an opening leading from the gas passage for allowing the gas to issue under the red-hot platinum wire at each downward motion of the anchor.

**4355.** PRODUCING IN GLASS AN IMITATION OF TORTOISE SHELL, *S. A. Wittman.—Dated 25th October*, 1880.—*(A communication from F. Pohl.)—(Not proceeded with.)* 2*d.*

A bulb of dark brown glass is blown and also one of light brown colour, which are broken into fragments. A bulb of plain glass is then blown, and the upper part is cut off from the lower part which adheres to the blow pipe. While the plain glass bulb is being blown another blower blows another bulb of plain glass, and dips it in and rolls it amongst the fragments of broken glass. This bulb with the fragments adhering thereto is then inserted in the cut-off portion of the first-named plain glass bulb, and the two are blown together. The whole is then rewarmed, and swung, and drawn out as one bulb and treated in the manner ordinarily practised in preparing glass for the manufacture therefrom of vessels and other articles, and the required vessels or articles are formed from the bulb so prepared in the ordinary manner.

**4356.** AERATED BEVERAGES, *L. Shapter.—Dated 25th October*, 1880. *4d.*

This consists in the manufacture of aërated beverages by the combination of citrate of thein, or thëin or other salt of thëin with water charged with carbonic acid gas, and with in addition, if desired, suitable sweetening or flavouring materials.

**4357.** BAGS, SACKS, &c., *J. Moore.—Dated 26th October*, 1880.—*(Not proceeded with.)* 2*d.*

The object is to make the bags or sacks without seams.

**4360.** PRINTING AND COLOURING PHOTOGRAPHS ON GLASS, *N. Schnorrenburg.—Dated 26th October*, 1880.—*(A communication from W. Grune.)—(Not proceeded with.)* 2*d.*

A print is obtained from the negative on pigment paper, the print is then transferred directly in cold water by the aid of the usual or other suitable appliances to a clean glass plate. In about five minutes the picture is developed in hot water till the high lights are clean. The picture is then dried and a thin coating of varnish applied to its surface, and afterwards powdered pigments of any desired colour or tint.

**4364.** CUTTING PAPER, &c., *A. W. L. Reddie.—Dated 26th October*, 1880.—*(A communication from J. A. H. Meyer.)* 6*d.*

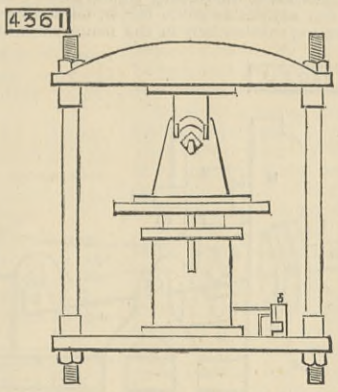
The machine consists of two upright pillars or frames standing up from a horizontal base plate, and provided with two parallel oblique guides in which the knife beam and knife may be caused to move up and down.

**4366.** DRAUGHT PREVENTERS, &c., *J. Amson.—Dated 26th October*, 1880.—*(Not proceeded with.)* 2*d.*

This consists in a method of causing a lath or strip of wood, metal, or other suitable material being forced forwards so as to occupy the space between doors or windows, their casings or frames, when the doors or windows are closed, in order that the admission of draught may be prevented or regulated, and wet may be impeded.

**4361.** MACHINERY FOR WELDING GAS, STEAM, AND WATER-PIPE FITTINGS, *J. C. Johnson.—Dated 26th October*, 1880. *6d.*

The machinery consists essentially of a rising and falling steam mandril worked by hydraulic or other motive power, the acting face of the said mandril having a figure the counterpart of the interior of the parts of the fitting to be welded together, and a fixed




tool, the lower acting surface of which has a figure the counterpart of that of the exterior of the parts of the fitting to be welded together, the fitting to be welded raised to a welding heat and supported upon the steel mandril, being carried by the motion of the said mandril against the fixed tool, the heated edges compressed forcibly between the said mandril and fixed tool and securely welded together.

**4371.** COMPRESSED AIR ENGINES, &c., *G. D. Bishopp.—Dated 26th October*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to the boiler of locomotives or traction engines worked by steam, and to the reservoirs of air engines, which parts are constructed in such a manner that they furnish a mode or method of economising and using to great advantage the pressure of the compressed air or the elastic fluid.

**4374.** TABLE CLOTHS, &c., *S. Ogden and J. Western.—Dated 26th October*, 1880. *4d.*

This consists in the manufacture of table toilet or other covers having one surface thereof baized or prepared in imitation of leather, woods, prints, bronzes, or mosaics, and the other surface composed of a woven or printed fabric.

**4375.** CONTINUOUS KILNS FOR BURNING BRICKS, &c., *P. Balmer—Dated 27th October*, 1880.—*(Not proceeded with.)* 2*d.*

The kiln is designed so as to enable the rectangular principle to be used, and to save the space in the centre usually wasted over flues and chimney, and to use the chimney more conveniently for other purposes.

**4376.** RAILWAYS, *D. Macnee.—Dated 27th October*, 1880. *4d.*

This consists in supporting and securing flanged rails on wooden sleepers by means of chair plates constructed and applied in combination with trenails and clip-headed spikes.

**4381.** COMPOSITION OR CEMENT, *W. Forsyth—Dated 27th October*, 1880. *2d.*

The cement is composed of a combination of litharge and glycerine, with or without colouring material or materials.

**4385.** FILTER PRESS, *C. Dickenson and J. W. Robson.—Dated 27th October*, 1880.—*(Not proceeded with.)* 2*d.*

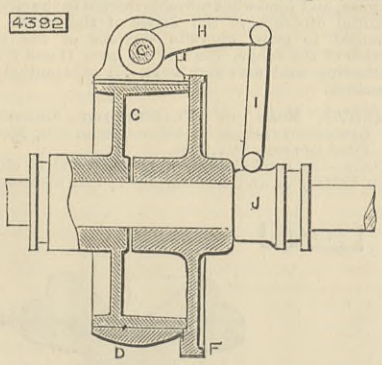
This relates to apparatus for purifying and filtering saccharum, sugar, yeast, and other analogous materials.

**4387.** FASTENINGS FOR CRAVATS AND NECKTIES, *J. Hinks, T. Hooper, and F. R. Baker.—Dated 27th October*, 1880. *6d.*

According to one improvement a pointed tongue is pierced from a thin sheet plate of steel, and is joined at its base to the plate. Its pointed end is bent at right angles to the plane of the plate. A lever jointed to the plate engages under the tongue, and when the lever is raised it lifts the pointed tongue, the said tongue tending to return to its normal position by its elasticity. The plate is attached by sewing to the underside of the piece of millboard behind the front of the cravat, between which millboard and the front of the cravat the free end of the neck band is passed, the lever passing through the covering of the millboard.

**4392.** FRICTION COUPLING, *W. Mather.—Dated 27th October*, 1880.—*(A communication from J. Hunter and Son.)* 6*d.*

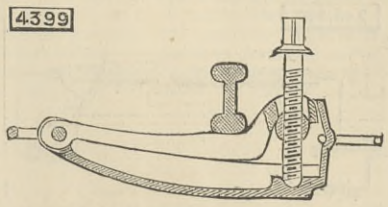
As applied to the coupling of two shafts in line with each other a friction pulley C is free to slide on a feather on one shaft, and an annular clamp or friction band D is fixed to a flanged boss F keyed to the other shaft. The band D does not form a complete circle,




and has at each end a lug to receive a screwed stud G with right and left handed threads. To this stud is fixed a lever H, the other end of which is connected by lever I to a boss J sliding on the second shaft. To couple the shafts the friction pulley is moved into the band D, and the boss J is moved towards the flanged boss F, thus through the levers, turning the screw G, and thereby tightening the band D on the friction pulley.

**4399.** INSTRUMENTS FOR USE IN PACKING THE PERMANENT WAY OF RAILWAYS, *F. Jackson and E. R. Austin.—Dated 28th October*, 1880. *6d.*

This relates to improvements on patent No. 83, dated 12th January, 1867, in which the screw employed




for lifting the rails was screwed through the end of the lever, and as the latter was raised the screw assumed a more and more inclined position, causing increased friction in rotating it, and became less able to sustain the load and more liable to become bent, especially if a train passed over the permanent way while the instrument was being used. The improvements consist in combining the parts of the instrument so that the screw will pass through a nut arranged to swivel in or under the end of the lever as it lifts, and so that the end of the screw will fit and rotate in a footstep in the base plate or casting.

**4400.** OBTAINING COLOURS ON COTTON, &c., *T. Holliday.—Dated 28th October*, 1880. *2d.*

This consists in obtaining various colours on cotton and other textile fibre by impregnating the said fibre with phenols or diazo compounds, so as to produce azo colour directly in or upon the fibre.

**4402.** CONSOLIDATING EXTRACT OF MALT, *C. Morfit.—Dated 28th October*, 1880.—*(Not proceeded with.)* 2*d.*

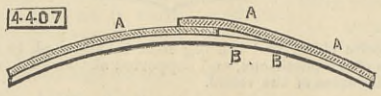
Irish moss or other edible seaweed of that nature is boiled in water, and to it is added (when preferred) a portion of gelatine dissolved in water. Enough glycerine is added to sweeten the liquor. The whole is then heated to fluidity and homogeneousness, and left to cool down to about 118 deg. Fah., at which time and temperature the intended charge of the aqueous extract of malt must be stirred in; the whole is poured into cooling pans.

**4405.** UTILISING RESIDUARY PRODUCTS OBTAINED WHEN PRODUCING COLOURS ON COTTON, &c., *T. Holliday.—Dated 28th October*, 1880. *2d.*

When producing azo colours direct upon cotton or other textile fibre a certain amount of precipitated colour is formed which is not united in the fibre. Such precipitated colour can be recovered by filtration of the remaining colour liquid, or of the colour liquid obtained in washing the coloured fibres. These precipitated and filtered residues can be washed and dried, then made into sulpho compounds by heating with concentrated or fuming sulphuric acid, or by other suitable known method for the preparation of organic sulpho acids. These sulpho compounds, or the alkali salts of which sulpho compounds can be employed as dyes.

**4407.** STEAM BOILERS, *J. Humphrys.—Dated 28th October*, 1880. *4d.*

This consists in the method of joining the shell plates and other plates of boilers. The end of each plate A is formed with two tail pieces B, one on each side of the end of the plate, such pieces being of wedge




shape. The plate $A^1$ coming over the tail pieces B at the joint forms a neat and even joint, the wedge tail pieces B filling up the space usually left, and which can never be properly caulked tight.

**4408.** PHOTOMETERS, *G. W. von Nawrocki.—Dated 28th October*, 1880.—*(A communication from Dr. W. S. Limbeck.)—(Not proceeded with.)* 2*d.*

A plate of selenium is exposed to the light of the rays to be measured, and is connected with a conducting wire through which flows the utmost possible and constant current, such wire being also connected with an instrument (galvanometer) for measuring the electric current.

**4410.** YARN WINDING FRAMES, *J. A. Bennett.—Dated 28th October*, 1880.—*(Not proceeded with.)* 2*d.*

The reed is attached directly to the lifting rail of the machine, so that the reed rises and falls with it.

**4413.** FEEDING BOTTLE, *E. O. Day.—Dated 28th October*, 1880. *6d.*

This consists of a feeding bottle provided with a stopper, which has the flexible tube formed in one piece therewith, or otherwise immovably and tightly fixed thereon, and also provided with special means for the admission of air.

**4414.** STUD FASTENING FOR GARMENTS, *C. D. Saunders, sen., J. F. H. Shepherd, and L. Saunders.—Dated 28th October*, 1880.—*(Not proceeded with.)* 2*d.*

The stud fastenings are constructed in two parts; the head with the shank forms one part, and the foot with a socket upon it to receive the shank forms the other part.

**4417.** ABSORBING AND UTILISING ACID GASES AND FUMES, *C. Winkler.—Dated 29th October*, 1880.—*(Not proceeded with.)* 2*d.*

The gas fumes or vapour which it is desired to deprive of its acid constituents is passed through chambers, towers, or other suitable closed spaces which contain a suitable metal in any convenient form or quality, over which water is made to trickle, and which serves to absorb the said acid constituents of the gas or vapour.

**4418.** SAVING LIFE AT SEA, *W. Balch.—Dated 29th October*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to the use, in conjunction with a life-buoy or raft, of means whereby not only is a light shown above the surface of the water, but also discharges are caused to take place at intervals, so as to produce flashes of light or stars that ascend in the air and denote the whereabouts of the apparatus.

**4423.** TOBACCO PIPE, *J. Brindle.—Dated 29th October*, 1880.—*(Not proceeded with.)* 2*d.*

The pipe bowl is formed open and with an inner recess at each end, the size of the top and bottom openings and recesses being the same. The bottom or breech end of the pipe is filled with a closing piece or plug, which has a bottom flange slightly exceeding the size of the outside of the bottom of the pipe, so that it can be readily taken hold of and the whole plug removed, and with an inner flange which exactly fits the recesses in the ends of the bowl, and centrally from which flange a conical extension rises, the base of which is of smaller area than the inside of the pipe, and by means of which a gutter is formed in which the nicotine and deleterious juice or moisture from the tobacco and the saliva from the smoker all collect, and can be easily emptied away upon the plug being removed in order that the pipe may be refilled or for any other purpose.

**4427.** CASES, FRAMES, OR BOOKS FOR EXHIBITING PHOTOGRAPHS, *P. F. Rossini, W. Snell and J. J. Fisher.—Dated 29th October*, 1880.—*(Not proceeded with.)* 2*d.*

A box or case is provided within which is arranged a series of plates of flat pieces of cardboard, thin metal, wood, or similar material, in such a manner that they may be rotated or otherwise moved, so as to present one at a time to an opening in one end or side of the case or at the top thereof.

**4428.** IMPROVEMENTS IN ELECTRIC LAMPS, *J. H. Johnson.—Dated 29th October*, 1880.—*(A communication from A. Berjot.—(Not proceeded with.)* 4*d.*

The inventor employs a regulating apparatus arranged in the form of a parallelogram with flexible joints in combination with a number of pairs of carbons which are consumed in succession, the current being automatically diverted into a fresh pair when the pair in use are consumed. The inventor further provides against the loss of weight consequent on the consumption of the carbons automatically, there is also an arrangement for shutting off the current when the last pair of carbons has been consumed, and an electro selenoid or device for regulating the length of the arc when several apparatus are working on one circuit.

**4431.** STANDS OR FRAMES FOR LIQUOR BOTTLES, *J. S. Williams.—Dated 29th October*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to means for preventing or permitting the removal of the bottles or vessels from the stand or frame.

**4438.** ARTIFICIAL FUEL, *J. R. Leaver.—Dated 30th October*, 1880. *2d.*

This consists in the application and use of compressed heated air in lieu of steam in the manufacture of artificial fuel for heating the mixture or compound of which compressed artificial fuel is made.

**4439.** STRINGS OF VIOLINS, &c., *R. Holliday.—Dated 30th October*, 1880.—*(Partly a communication from V. Campiglia.)* 4*d.*

This relates, First, to forming the strings of metallic wire; Secondly, to the mode of attaching the metallic strings to violins and other instruments played with a bow, consisting in stretching the main string tight and twisting the end round it in a spiral, preferably gradually decreasing in pitch to the end.

**4440.** REGULATING SUPPLY OF STEAM TO STEAM ENGINES, *W. Parker and L. Ogden.—Dated 30th October*, 1880.—*(Not proceeded with.)* 2*d.*

The engine to be controlled is caused to drive a screw working in a chamber containing water or other fluid, and by its thrust in opposition to a spring keeps the throttle valve open until the speed increases, when the throttle valve closes.

**4441.** ALARM AND INDICATING APPARATUS FOR BOILERS, CISTERNS, &c., *F. King and G. Green.—Dated 30th October*, 1880.—*(Not proceeded with.)* 2*d.*

A float or buoy is employed, which is connected to a fixed or other suitably arranged conductor connected to a battery, so as to ring an electric bell, or pneumatic, hydraulic, or other means may be employed.

**4442.** BRUSH-MAKERS' SHEARS, *J. Kinley.—Dated 30th October*, 1880.—*(Not proceeded with.)* 2*d.*

The lower or working blade is at the back, so that while shearing it does not come between the brush and the cutting edge, whereby the bristles are not pressed aside, and they are cut evenly.

**4450.** UNHAIRING OR DEPILATING SKINS, *V. Lesage. Dated 1st November*, 1880.—*(A communication from E. Chesnay.)* 4*d.*

This consists in the employment of a bath of sulphite of ammonia, composed of a mixture of liquid ammonia, sulphuric acid, and water, more or less concentrated.

**4451.** PURIFYING PRODUCTS OF COMBUSTION FROM FIRES, *F. J. Bramwell.—Dated 1st November*, 1880.—*(Not proceeded with.)* 2*d.*

This relates to a method and apparatus for purifying the products of combustion from domestic and other fires by separating from the products matters suspended in them.

**4454.** APPLYING THE CONDENSING OR COMPOUND SYSTEM TO STEAM ENGINES, *J. A. Thompson.—Dated 1st November*, 1880. *4d.*

The engines are fitted with, First, the necessary steam condenser or condensers, in number and position as required or allowed by the arrangements of the steam engine. The condensers are of the jet or surface type. The usual pumps, &c., as customarily fitted to all condensing or compound engines to be fitted; Secondly, small tank or tanks for containing condensing medium, preferably water; Thirdly, a cold air machine with necessary pipes and surfaces, over or about which on one side flows the hot condenser discharge, and over or about the other side of which passes the cold air from the cold air machine, which machine is driven by main engine or any part of the structure thereof, according to facilities offered by arrangements.

**4455.** STEAMSHIPS, &c., *N. Stick.—Dated 1st November*, 1880.—*(Not proceeded with.)* 2*d.*

The bow of the boat is that of an ordinary vessel, the boat continuing to be a single boat for a certain distance from the bow, varying according to the size and length of the vessel; from this point the vessel gradually becomes a double one, until it is altogether so, up to a trifle above the water line, having two distinct bottoms, two screw propellers, and two rudders, which are placed in precisely the same favourable position as in a vessel with a single screw and single keel, that is to say behind the stern posts.

**4457.** FURNITURE FOR UMBRELLAS AND PARASOLS, *H. Skerrett.—Dated 1st November*, 1880.—*(Not proceeded with.)* 4*d.*

This relates to the process of manufacturing the notch part and the barrel part of runners, and top notches.

**4460.** VELOCIPEDES, *L. O. Michael.—Dated 1st November*, 1880.—*(Not proceeded with.)* 2*d.*

This consists in a mechanical arrangement, in lieu of the ordinary crank motion, for converting the alternate motion of the treadles into continuous circular motion of the driving axle, whereby the dead points incident to the employment of a crank are avoided, and a ready means provided of temporarily obtaining increased power when going up hill.

**4462.** COUPLING APPARATUS FOR RAILWAY VEHICLES, *H. H. Lake.—Dated 1st November*, 1880.—*(A communication from A. Osterhout.—(Not proceeded with.* 2*d.*

The couplers or devices which interlock with each other between two vehicles have a wedge-shaped opening, being wider in front and tapering to the width of the shoulder on the hook. At this point the sides of the couplers unite in a square block, through the centre of which is a suitable hole for the insertion of the shank of the hook.

**4463.** ANTI-FOULING AND PRESERVATIVE COMPOSITION FOR SHIPS' BOTTOMS, &c., *W. Renney.—Dated 1st November*, 1880. *4d.*

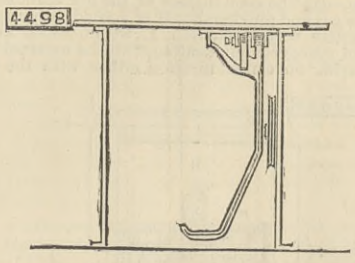
A primary composition is made of 8 parts garnet shellac, 2 parts gum sandrach, 50 methylated spirits, 50 venetian red. An anti-fouling composition is made of 15 parts garnet shellac, 4 parts gum sandrach, 55 parts methylated spirits, 21 parts venetian red, 2 parts chrome yellow, 1 part gum mastic, 1½ parts creosote, ½ part asafoetida.

**4469.** PREPARING AND PRESERVING NATURAL FLOWERS, PLANTS, &c., *E. C. H. Krueger.—Dated 2nd November*, 1880. *4d.*

This relates to preparing and preserving natural flowers, plants, and leaves, by imparting colours to them while in their fresh state, and fixing these colours by drying.

**4498.** TREADLES FOR SEWING MACHINES, *R. Steel, C. H. Binns, A. Steinmetz, jun., C. A. Spring, and W. A. Nichols.—Dated 3rd November*, 1880.—*(Complete.* 6*d.*

The nature of the invention consists in the combination of a treadle with the table top of a sewing machine by means of pivots on which it oscillates, and a coil or




other spring which assists during each revolution of the crank in returning the treadle from its backward to its forward position, and which holds it in the latter position when the machine is not at work.

**4570.** WATERPROOFING CLOTHS, PAPER, &c., *P. M. Justice.—Dated 6th November*, 1880.—*(A communication from J. M. Aulestia.)* 4*d.*

The process consists in first treating the materials to a solution of water, soap, and beeswax, and then to a solution of water and alum.

**5184.** SWEAT BANDS FOR HATS AND CAPS, *H. A Bonneville.—Dated 11th December*, 1880.—*(A communication from T. W. Bracher.)* 8*d.*

One feature consists in a peculiar arrangement of machine stitches for attaching the lining or reed cover to a sweat, whereby a whipped appearance is given to the edge of the sweat when it is put into a hat—also

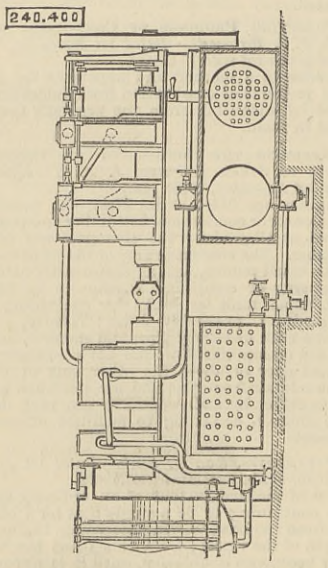
in a peculiar reed cover, and further in a certain novel method of stitching sweats for ornamental purposes. Various modifications are described, and also a sewing machine to be employed in the manufacture of the sweat bands.

## SELECTED AMERICAN PATENTS.

*From the United States Patent Office Official Gazette.*

**240,400.** THERMO-DYNAMIC ENGINE, *John Gamgee, London, England.—Filed February 26th*, 1881.

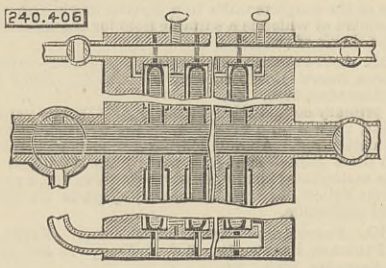
*Claim.*—(1) The method of condensing a liquefiable gas or vapour—the product of a liquid of low boiling-point—used as a motor fluid in a thermo-dynamic engine, which consists in working said gas or vapour expansively to the extent of more or less complete liquefaction in giving motion to the engine, substantially as hereinbefore set forth. (2) The method herein described of using a liquefiable gas or vapour—the product of a liquid of low boiling-point—as a motor fluid for engines, which consists in working said vapour or gas in the engine expansively to the extent of more or less complete liquefaction, then exhausting the vapour thus liquefied into a suitable receiver, thence conveying it to a boiler where it is subjected to the low degree of heat needed to bring it again to the condition of a motor gas or vapour, and thence returning it to the engine to again go through the same cycle of operations, substantially as hereinbefore set forth. (3) The combination of an engine proper, in which a liquefiable gas or vapour is worked expansively to the extent of liquefaction, so that said engine shall serve not only as motor, but as condenser,




a closed exhaust vessel which receives the liquefied gas or vapour from the engine cylinder, a boiler and means, substantially as described, for forcing the contents of said exhaust vessel directly to the boiler, the combination being and acting substantially as hereinbefore set forth. (4) In a thermo-dynamic engine in which a liquefiable gas is used as the motor fluid, substantially as specified, the combination, with the engine cylinder, of a closed liquefied gas receiver or exhaust vessel protected by a non-conducting covering from the heat of the environment. (5) In a thermo-dynamic engine, vessels accessory to the exhaust vessel in which a vacuum may be maintained or absorbents held for the purpose of relieving the exhaust vessel at any moment, or emptying any part of the machine, as circumstances may demand, substantia as set forth.

**240,406.** FILTER PRESS, *Alexander Gordon, Cincinnati, Ohio.—Filed March 5th*, 1881.

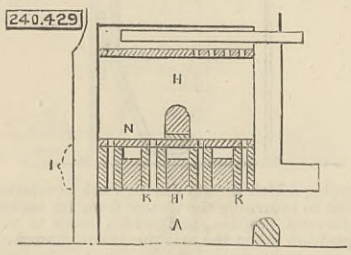
*Claim.*—(1) In filter presses, the combination, with a passage arranged to admit extracting liquid into the cells in pairs, as specified; of a passage communicating with all the cells, and having valves for closing communication between such passage and each alternate cell, substantially as specified. (2) In filter presses, the combination, with an outlet passage communicating with the cells inside the webs, of a steam passage communicating with the cells outside the




webs, substantially as specified. (3) In filter presses, the combination, with an inlet and outlet to the cells inside the webs, having valves or cocks for their control, of a passage communicating with the cells outside the webs and having an inlet for steam and an outlet for liquid, with cocks for controlling the same, substantially as specified.

**240,429.** PUDDLING AND HEATING FURNACE, *Bernard C. Lynth, Philadelphia, assignor of one-half to William Stubblebine, Bethlehem, Pa.—Filed December 14th*, 1880.

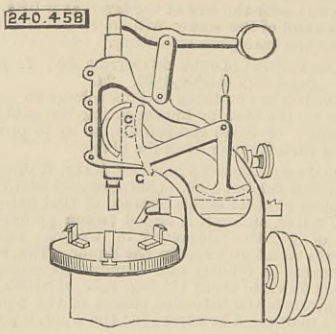
*Claim.*—(1) The combination of the fire chamber A and the gas and air chamber H of a puddling or heating furnace with a partition I, within which are a series of spaces communicating with the external air, but having no communication either with the fire




chamber or gas chamber, substantially as set forth. (2) The within-described perforated partition, consisting of long perforated bricks K, shorter bricks H[1], and a covering N, all being combined substantially as set forth.

**240,458.** BORING MACHINES, *Salmon W. Putnam, Fitchburg, Mass.—Filed December 9th*, 1880.

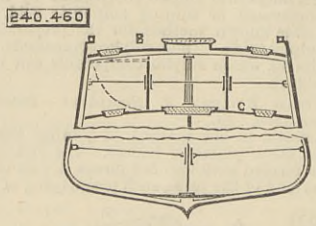
*Claim.*—(1) The combination of a boring spindle and facing spindle with the pinion C and segment gear G, substantially as and for the purpose described. (2) The combination of a boring spindle and facing spindle with the segment gear journalled on a revoluble excentric shaft, substantially as and for the purpose described. (3) The combination, in a machine having a rotary work-supporting table, of a boring tool and a planing tool carried respectively by a boring arbor




and a cutting stock, the latter operated by and simultaneously with the former, substantially as described.

**240,460.** FREIGHT VESSEL, *Frank W. Rainey and Thomas B. Rogers, New Orleans, La., assignors of one-tenth to Chas. A. Conrad, same place.—Filed October 11th*, 1880.

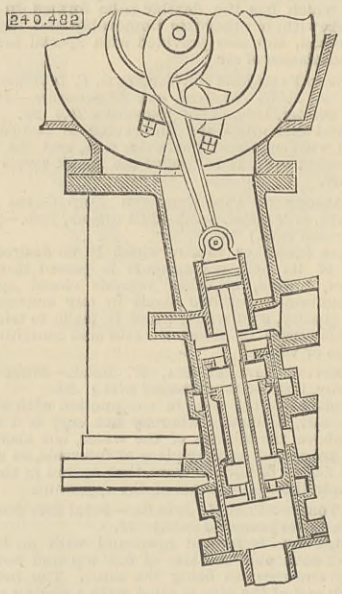
*Claim.*—In combination with the hull of a vessel having two or more deck frames or floors, removable longitudinal partition arranged vertically between the decks or floors, and provided with eyes B, arranged on




opposite sides, and bracing rods C, attached to the eyes of the partitions, and supported at the outer ends to the sides of the vessel.

**240,482.** STEAM ENGINE, *H. Herman Westinghouse, Pittsburg, Pa.—Filed February 15th*, 1881.

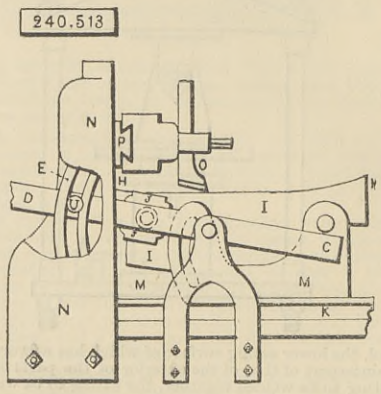
*Claim.*—(1) In a pair of single-acting engines, a series of exhaust ports in each cylinder of suitable area for effecting, when uncovered, a practically instantaneous exhaust, and ports leading therefrom to a common exhaust chamber in combination with a piston in each cylinder, having a length in excess of the length of stroke, and adapted to uncover such exhaust ports at or near the ends of their down strokes, and to cover the same at the end of their upstrokes, substantially as set forth. (2) The valve chamber bushing having a series of central supply ports formed between the bridge legs and two series of ports, and suitable passages thence to the upper ends of the two cylinders, such ports having through a part or the whole of their lengths an area practically equal to the inner circumference of the bushing multiplied by the lengths of the V-shaped bridges, substantially as set forth. (3) A series of ports, divided one from another by bridges, which latter are V-shaped or triangular in




form at one or both ends, having broad bearing surfaces through a part of their length, substantially as set forth. (4) A piston valve having at each end an open head of chilled iron or steel, and packing rings in combination with open central section, and perforated end plates, substantially as set forth. (5) In combination with two or more single-acting vertical engine cylinders, a valve chamber having steam passages leading therefrom to either end of each cylinder for supply and exhaust of steam, a piston in each cylinder adapted to uncover the lower or main exhaust ports or passages at the end of its operative stroke, and a valve in the valve chamber adapted to open and close steam supply to the upper or supply ports of the cylinders, and also to afford passage from such ports to an exhaust when the lower or main exhaust and the steam supply ports of any one cylinder are closed, substantially as set forth. (6) In combination with a pair of vertical single-acting steam cylinders, a crank shaft arranged to one side of the axial lines of such cylinders, with direct connection from each piston to the crank shaft, substantially as set forth.

**240,513.** PLANER CHUCK, *John H. Greenwood, Columbus, Ohio.—Filed April 19th*, 1880.

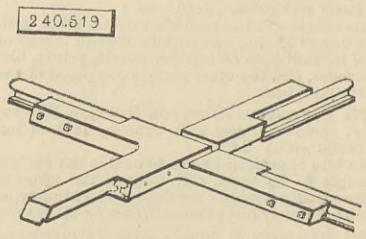
*Claim.*—(1) In a metal planer, the combination of a sliding bed K, rocking chuck I, tool O, head J, bar C D, arc E, and clamp screw U, all constructed, arranged, and operating in the manner described, for the pur poses set forth. (2) In a metal planer, a curve-cutting mechanism operated by the horizontal longitudinal movement of the reciprocating bed, in combination with the mechanism for producing the rocking movement of the chuck, substantially in the manner described. (3) In a metal planer, the combination, with a rocking chuck, of the pivotted side head J, the adjustable guide bar C D, and graduated arc E, for the purpose of enabling the machine to plane convex or concave curves of any desired radius, and also straight work, when necessary, all substantially as specified. (4) In a metal planer, the combination, with the frame of the rocking chuck, of one or more slotted graduated arcs, provided with clamping mechanism, to set the chuck, at any desired angle to plane inclined work, as desired. (5) The combination, in a metal planer, of a fixed tool, a bed plate having rectilinear motion in a horizontal plane, and a chuck having rocking motion in a vertical plane, all in the manner and for the purposes set forth. (6) In a metal planer, the combination of a hinged work-holder rocking in a longitudinal vertical plane, a horizontal and longitudinally reciprocating bed, a cutting bed provided with horizontal transverse and vertical adjustments, and guiding and adjusting mechanism for controlling the position and movement of the work-holder relatively to the planing tool, all constructed and operating substantially as described. (7) The combination of the sliding plate K, chuck frame M, chuck plates I, crosshead J, guide bar D, and segmentally slotted plate E, all constructed and operating substantially in the manner described. (8) The combination of the rocking chuck plates I, crosshead J, and adjustable guide bar D, all constructed and operating substantially in the manner described.




(9) The combination of the frame N, segmentally slotted plate E, guide bar D, and the bolts and nuts for securing the guide bar in position, all substantially as set forth. (10) The combination of the guide bar D, chuck plate I, and crosshead J, substantially in the manner specified.

**240,519.** RAILWAY CROSSING, *Henry Jeffrey, Aurora, Ind.—Filed January 22nd*, 1881.

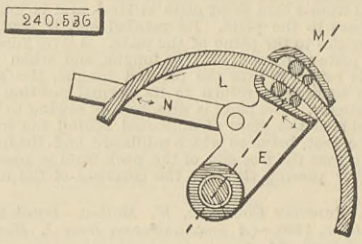
*Brief.*—A frog composed of one piece of metal and formed at any angle required, its crossing members being formed to serve as track rails and their ends as splice plates with the track rails. *Claim.*—A crossing




frog composed of one piece of metal, cast or forged, in the form of a cross, having the parts of its members at their intersection formed to serve as track rails, and their ends serving as splice plates with the track rails, in combination with the track rails, substantially as herein set forth.

**240,536.** DEVICE FOR CONVERTING VIBRATING INTO ROTARY MOTION, *Peter Peartree, Cohoes, assignor to Warren T. Kellogg, Lansingburg, N.Y.—Filed July 29th*, 1879.

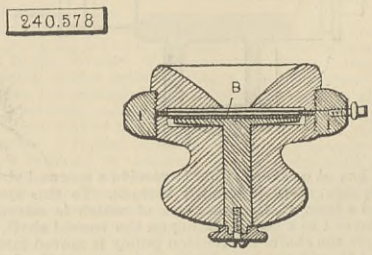
*Claim.*—(1) The combination, with the wheel having the concentric flange and the arm E, pivotted at the axis of the wheel, of two opposite lugs, fast on said arm, and having recesses and gripping pieces L M in the recesses, and somewhat movable therein in the direction of the circumference of the flange of the wheel, and arranged to gripe opposite surfaces of the same part of the flange, substantially as described.




(2) The combination, with the wheel having the concentric annular flange and the arm E, pivotted at the axis of the wheel, of two opposite lugs, fast on said arm, and having recesses and gripping pieces in the recesses, and somewhat movable therein in the circumferential direction of the flange of the wheel, and arranged to gripe opposite surfaces of the same portion of the flange, the driving lever O and rod N, connecting said arm and lever, all substantially as described.

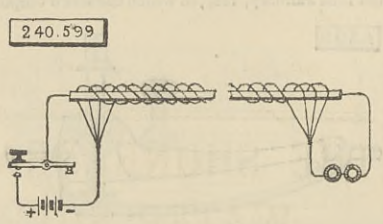
**240,578.** MODE OF TRANSMITTING SOUND BY ELECTRICITY, *Amos E. Dolbear, Somerville, Mass.—Filed February 24th*, 1881.

*Claim.*—In combination, a primary coil in circuit with battery B and transmitter T, and a secondary




coil with its enlarged terminal mounted in a case, and arranged near a plate, the plate being also mounted in a case, but not connected with the secondary coil, all substantially as described.

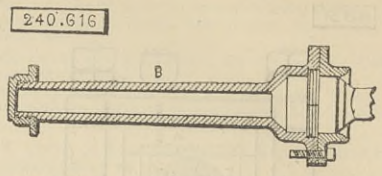
**240,599.** TELEGRAPH CIRCUIT, *Orazio Lugo, New York, N.Y.—Filed February 19th*, 1881.




*Claim.*—The electric telegraphic or telephonic conductor herein set forth, constituting a solenoid.

**240,616.** CARRIAGE AXLE, *Alfred E. Smith, Bronxville, N.Y.—Filed September 19th*, 1879.

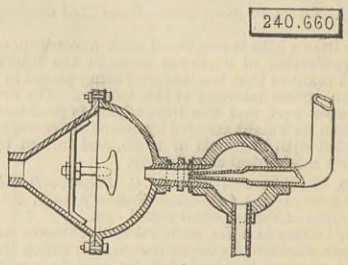
*Claim.*—The combination of an axle having three bearings, substantially as described, with an axle-box B, collar embedded partly in the axle and partly in the box, and a moon plate detachably secured to the




box and bearing against the rear end of the collar, as set forth.

**240,660.** APPARATUS FOR PULVERISING GRAIN, ORES, &c., *Lewis S. Chichester, Jersey City, N.J.—Filed October 11th*, 1880.

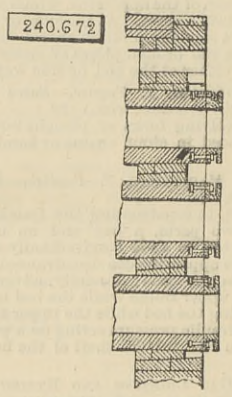
*Claim.*—In an apparatus for shattering grain or other frangible substances, the tubular conveyer having at the end an orifice that is long and narrow, in combination with a chamber for containing air under a high pressure, and a jet mouth for the issuing curren




of air adjacent to the end of the tubular conveyer, and a stationary anvil, substantially as set forth, whereby all the particles of matter to be pulverised receive the same, or nearly the same, velocity, as set forth.

**240,672.** FRONT WALL OF GAS-RETORT OVENS *Darius Davison, New York, N.J.—Filed September 17th*, 1878.

*Claim.*—The combination, with the retort, a mouth piece, and bolts securing the two together, of a front wall supporting said retort and constructed with




recesses or apertures in its outer side in close proximity to the said securing bolts, substantially as and for the purposes herein set forth.

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THE ENGINEER, June 3rd, 1881.



TO THE DERBY IN A BALLOON.—Mr. Josceline Bagot and Mr. Drummond, of the Grenadier Guards, accompanied by Mr. T. Wright, the winner of the International Balloon Contest, went up in a balloon from the Crystal Palace on Wednesday, at 1 p.m. When the ropes were loosed they ascended to the height of 5000ft., and travelled slowly in a south-westerly direction for the distance of about eight miles. The balloon then suddenly sank, but ballast being thrown out, it rose again to 8000ft., and traversed in the direction of Epsom