INTERESTING CORRESPONDENCE.

WORKING STEAM EXPANSIVELY.

MESSRS. EDITORS :—Your correspondent, Warren Rowell, on page 183 of the present volume of the SCIENTIFIC AMERICAN, in reference to working steam expansively, says:—"When any one foolish enough to believe in the economy of working steam expansively can point to one single experiment in the history of the steam engine as fairly tried at one of the mills, and can show any saving, he will then have some grounds for his belief, and not otherwise." As your correspondent gives an extract from an English work on the economy of fuel, by T. S. Prideaux, as proof of the foolishness of using steam expansively, I beg to point to the following "experiment in the history of the steam engine," as given in a treatise on the steam engine, edited by John Bourne, C.E., (another English work). On page 12, the author says:—"A forty horse engine, constructed by Mr. Watt,, about the time of the introduction of his expansive principle, was found to require about 8½ lbs. of coal per horse power per hour, when working without expansion, and about 6¼ lbs. when the expansion was 1.518 times. The water evaporated from the boiler was, without expansion, .674 cubic feet per minute, and with the amount of expansion already mentioned, .501 cubic feet per minute." The above experiment (if any reliance is to be placed on it) clearly demonstrates a saving of 2¼ lbs. of coal per horse power, in favor of the expansive working of steam. Now, when we consider that the expansive working of steam, either theoretically or practically, was not an invention in itself, made with a view to the realization of an increased power from a given quantity of steam, but that the increased power was the unexpected result of cutting off steam for the purpose of diminishing the velocity of the piston in a single-acting engine, towards the end of the stroke, and that the above cited experiment appears to have been one of a series made by Watt, to determine or ascertain the precise amount of saving ; and the result in figures is there given, I, for one, am inclined to think it quite as much entitled to credit as a simple statement or mere assertion (unbacked by figures or any statement of the actual result) of T. S. Prideaux, so triumphantly brought forward by your correspondent: "that a better effect was obtained by using only two cylinders and cutting off at half stroke, than by using the same quantity of steam in four cylinders, and cutting off at quarter stroke." Practically, it appears the engineers on one of her Majesty's screw steamers have demonstrated that, with a given quantity of steam, the effect is inversely as the number of cylinders, down to two, cutting off at half stroke; but why, in the name of all that is comical, did they stop here? Why not pursue their experiments still further ; ? for if two cylinders, cutting off at half stroke, are better than four, cutting off at quarter stroke, then one cylinder, following full stroke, must be better still, and, theoretically, at least (if not practically), we arrive at the final and inevitable conclusion that *half a cylinder* and *compressed steam* would beat everything else "all tew thunder." Shade of the immortal Watt! in comparison with the "dazzling orbs" that have risen and now shine in the firmament of engineering science, what a "penny candle" wer't thou ; *now* may'st thou "hide thy diminished head ; " in short, consider thyself teetotally snuffed and forever extinguished.

Apropos of the above brilliant experiment and its equally brilliant result on an English steamer, I have lately read in the papers (and amongst others, in the SCIENTIFIC AMERICAN, I believe) an account of the engines being taken out of an English mail steamer, running to South America, and its being fitted with new ones constructed, as your correspondent says, "for the express purpose of better obtaining the economy due to a considerable extent of expansion ;" and the result was a saving of from one-third to one-half of the fuel formerly used ; in fact, the experiment was so eminently successful and satisfactory, that the company had decided to take out the engines in the whole line of steamers and replace them with others constructed like the experimental ones. Comparing this with the experiment cited by your correspondent, how are we to reconcile the two accounts ; and if such satisfactory results can be obtained from expansion, on a simple mail steamer, surely as good a result ought to be obtained by engineers having the honor of constructing for her Majesty's screw steamers, to say nothing of the advantages of graduating at the "circumlocution office," and an unlimited amount of "red tape."

For further experiments "in the history of the steam engine" (and "fairly tried" at that), I would refer your correspondent to pages 81–82 of the above-mentioned work, where he will find tables with explanations, showing the relative efficacy of different engines—both non-expansive and with different degrees of expansion—and where he will see that "the order in which the different engines stand, in respect of superiority of duty, is the same as in respect of the amount of expansion." Your correspondent further says:—"The proprietor of an extensive manufactory has told me, this very day, the result of the trial of a cut-off which he had on his engine ; he said it made no difference in the cost of the coal used whether he cut off at one-seventh of the stroke or one-half stroke." In reference to this broad assertion, I would say that there is a large engine now running within one hundred feet of the place where I now write, and working on the expansive principle, pure and simple—that is, by an automatic cut-off and no throttle valve. This engine will do its work and hold its proper speed with steam at 40 lbs. pressure and cutting off at half stroke, but to supply it with steam at that point requires a lavish expenditure of fuel and considerable exertion on the part of the fireman; but by simply raising the steam to 60 or 65 lbs., the engine then cuts off at about quarter stroke, or less, and the same work is done with about one-third less fuel. However non-expansionists may account for this, I think that people "foolish enough" to believe in expansion, would say that it is owing to the greater expansion of the steam.

Again, the engine in a large planing mill and building let out for mechanical purposes, up town, has lately been taken out and replaced with a new one. Cause, insufficiency of power and the difficulty of maintaining a pressure of steam high enough to do the work required. Cylinder of old engine, 16 inches diameter, 4 feet stroke; valves, the ordinary slide ; no cut-off, and regulated by a throttle valve ; pressure of steam, from 90 to 110 lbs.; 3 boilers, about 30 inches by 30 feet ; fuel made by planing machines and other wood-working machinery. The new arrangement is an engine with cylinder of 24 inches diameter, 4 feet stroke, and running at the average speed of the old one. An automatic cut-off and regulator, capable of admitting steam up to half stroke, or cutting off close to the commencement, as may be required, no alteration whatever to the boilers. Pressure of steam, from 45 to 55 lbs., cutting off from one-sixth to one-third of the stroke. Result, an abundance of power, coupled with a perfect regularity of speed, and a saving of at least one-third of the fuel. Non-expansionists and *sensible* people predicted a failure ; but, by some "hocus-pocus" or other, it did'nt fail ; neither did the "received notions," in this case, receive any damage.

When engines are made, that are perfectly steam-tight and can be run without friction, and waste no steam in ports and passages, *then* experiments similar to those described by your correspondent may be considered, to a certain extent, as "fairly tried," and, with all deference to the opinion of your correspondent, that engines with the ordinary slide valve and cut-off valve on the back, are constructed "in the most perfect form for using steam expansively," I would say, that some people are rather skeptical on that point ; for such engines, in addition to the above valves, are furnished with a regulating valve in the steam pipe, and, what with being strangled at the throttle valve, and strangled at the cut-off valve, and still further strangled in its efforts to get through the port into the cylinder, the steam (if I may be permitted an expression more forcible than scientific) is "just about strangled to death ; " and if the users of such engines would take away the cut-off valve from the slide valve, and diminish the strangling somewhat (for such engines, at best, are but mongrel combinations), in nine cases out of ten the result would be more likely to be beneficial than otherwise.

The experimenters at the Metropolitan Mills will have to make some new arrangements and try again, before they arrive at the relative merits of expansive and non-expansive engines. An engine working with a pressure of 90 lbs. of steam in the boiler, and having its action controlled so that it imparts a uniform pressure of from 20 to 40 lbs, per inch on the piston, *might* by a considerable stretch of the imagination, be considered a non-expansive engine, but I would respectfully say to your correspondent that such is not one of the "received notions ; " and further, I would say that it is quite possible the "error" found, at such great cost, by the proprietors of the Metropolitan Mills may be simply this, that while they were under the impression that their engines were constructed "in the most perfect form for using steam expansively," their experiments simply demonstrated that they are eminently adapted for *strangling steam.*

JOHN BROUGHTON.

New York, Sept. 25, 1860.

MESSRS. EDITORS:—Your correspondents who assert, and claim to have proved, that no saving is effected by working steam expansively, cannot reasonably expect to have much attention paid to them. Any one who should declare: "two and two do *not* make four ; it is no such thing ; I deny it," would probably be allowed to all the disputing in that *controversy* himself.

CHAS. T. PORTER.

235 West 13th street, New York, Sept. 26, 1860.

THE NATURE, ORIGIN AND COMPOSITION OF THE METALS.

MESSRS. EDITORS:—After some considerble investigation, I have arrived at the conclusion, deduced from the following facts, that all the common metals are compounds of iron, nickel and copper, having radical properties of which all the others are composed, in different proportions ; that when these metals combine, they do not always loose their original properties, but are still real atoms of iron, nickel or copper, attracted or combined with other atoms ; that such combination of separate atoms forms an individual atom of the new metal, and that all the original atoms have a common diameter, and that in the case where a metal is drawn into a wire, one class of atoms (say those of iron) form continuous wires or chains of atoms, and that the second class of atoms adhere to them, but have little or no cohesion together.

The following is a tabular statement of the tenacity of wires of 0.07875 inch diameter:—

	Tenacity.	Cal.	Thomson.	Vol. of atom.
Iron	551.37		551.37	43.5
Platinum	.50	275.68	275.63	56, wire 64
Silver	.33	183.79	187.46	128=43×3
Zinc	.20	110.26	110.25	56
Copper	302.00		302.00	44.4
Gold	.50	151.00	149.97	63.5=43×1½
Nickel	105.86		105.86	42.7
Tin	.33	35.28	35.28	99.8=56+43
Lead	.25	26.46	26.46	113.4=56×2

As I was unable to obtain the density of all the metals in the state of wire, these volumes are calculated by dividing the common density of the metals by the atomic weight.

It will be seen by the above table that the second class of metals, or those having a compound volume, have a tenacity of 1-2, 1-3, 1-4, or 1-5 of that of the radicals iron, nickel and copper, in quantities too exact to attribute it to accident ; thus, platinum wire has a tenacity just ½ that of iron ; it has also a compound volume, or a volume greater than that of iron, nickel or copper, whose volumes are nearly the same ; and the difference which occurs arises no doubt from the different densities the metals assume under various treatments, as will be seen from the following table:—

Names of bodies.	Density.
Platinum, coined	22.100
" wire	19.267
Copper, hammered	8.878
" fused	7.788
Iron, wrought	7.788

It will be observed by reference to table No. I, that the sum of the volume of all the atoms is made up of iron and of platinum ; thus, silver is equal to 3 of iron ; zinc, equal to platinum ; gold, 1½ that of iron ; tin, 1 of iron and 1 of platinum ; and lead, 2 of platinum; but it appears, by reference to table No. II, that this is not the correct volume for platinum, it being calculated from the ordinary density of the metal=22, when the density of the wire is only 19.267, which makes the volume of its atom just 1½ that of iron ; but the tenacity of platinum is just ½ that of iron ; the inference, therefore, is that platinum is composed of 1 atom of iron, which has the whole of the tenacity, and that to this atom of iron is attached a short atom of some other metal, which fills up the space but has no tenacity. This is further proved by the other metals ; gold has 1 volume and ½ volume,