sought for; all the rest were spontaneous expressions of respect and good-will from the societies named; but, after all, his best title was that of a true gentleman. All men spoke well of him. Although of humble birth, he never sought social distinctions; although born poor, he never coveted riches. In this respect he was very different from Sir Humphry Davy, who had vast ambition, and was eternally pining after rank. According to Sir Wm. Thomson, "Faraday had great kindness and unselfishness of disposition, clearness and singleness of purpose, brevity, simplicity, and discreetness—sympathy with his audience or his friend—perfect natural tact and good taste—thorough culture, and an indescribable quality of quickness and life."

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Do Locomotives Ever Die?

MESSRS. EDITORS:—From what I have seen I am led to believe that locomotives are kept in use till they are killed. Their weak and corroded shells are unable to withstand the pressure put upon them, and they finally explode, killing and wounding the attendants. Then the responsible parties are wont to put on an innocent and mysterious cast of countenance, and ejaculate "What an unaccountable mystery are these steam boiler explosions!" About three years ago a locomotive boiler exploded on the Richmond and Petersburg railroad. It had been in use *only* about eighteen years. Soon after one on the Virginia and Tennessee road *only* about sixteen years old. Two years ago I saw one within five minutes after it exploded, in Chattanooga, Tenn. The break was along the edge of the lap in the center sheet of the bonnet, and on the bottom at this point the iron was only about one eighth of an inch thick, with deep blotches of corrosion up to the water line, but deeper and clearer near the bottom. This boiler had been in use *only* about sixteen years. I have since seen another that exploded on the Virginia and Tennessee road. In this case the engineer refused to go longer on the machine knowing that it was unsafe. He was discharged and a green engineer put in his place. The result was that, within an hour, he and his fireman and the engine were torn into fragments. It is hardly necessary for me to write that the superintendent of motive power was not tried for murder, and this scrap heap was *only* about eighteen years old. Within a few weeks an engine exploded on the Chesapeake and Ohio road; the first point of rupture was along the edge of the longitudinal seam of the center sheet at the bottom of the bonnet; the piece taken out increased in width to the top, along the first point of rupture. The iron was not over the eighth of an inch thick, with deep blotches and furrows of corrosion; the boiler had been in use nearly eighteen years; the stay bolts were badly worn; the fire-box in none too good a shape; and yet the boiler is being repaired by putting a new bonnet to the old fire-box.

I hope others of your many readers will communicate the facts bearing on this subject, with a view to ascertain at what age of continuous use locomotive boilers are dangerous by reason of corrosion. E. A. DAYTON.

Richmond, Va.

Suggested Improvements in Sawing Lumber.

MESSRS. EDITORS:—The lumber system of the United States presents one of those curious problems that can only be accounted for by the bounteous provisions of nature, which has given us enough to use with a large surplus to waste. At least 25 per cent of the stuff after being "squared" goes into sawdust and shavings, making a direct waste of one fourth the timber, to say nothing of the cost of reducing it to shavings and sawdust.

Let us look into this system, and see if there is not some reform demanded, and where the remedy lies. In most other countries lumber is brought to market in squared logs or heavy planks, and, after seasoning, or partial seasoning, is reduced to special dimensions by re-sawing. In England, planing mills and all wood-working establishments, saw their stuff to order—forest-cut stuff of all sizes or thin boards is not known. Here lumber is sawed green, reduced to boards and stuff of all imaginable sizes, in the forest, and then brought to market to be worked on planers without seasoning. Let us consider the two systems, and see if there is not some way of saving stuff and reducing the cost of working it.

Under our American system, as before stated, the lumber is sawed into boards and scantlings when green, in the forest mills. An ordinary lumber mill makes a kerf one fourth inch wide, which in manufacturing inch boards, turns *one fifth* of the squared stick into sawdust. Then again to compensate for irregular seasoning and warping of the stuff, the deviation of the saws, etc., at least another tenth is wasted, making a total of three tenths of the stuff. This extra thickness mentioned has, with the exception of the shrinkage, to be planed off when the stuff is worked—planed off from a surface covered with grit, dust, and dirt of transportation. Stuff that has been rafted in our western rivers after being sawed into boards, almost defy the planing and other lumber-dressing machines, until the "crust is off."

Another evil of our lumber system is the large amount that our yards have to keep on hand to make an assortment; few of them have the appliances for "cutting out" a bill of stuff. Rafters, studding, joists, beams, etc.—in fact everything but the thinnest boards—have to be searched for among the forest-cut stuff. If a customer wants a lot of special pieces, his only resource is to go to the log mill, and get it green.

The attention of the writer was called to the difference between our own and the English plans of preparing lumber, by the character of the machines used for planing. While the English tools for re-sawing are much heavier than ours, their planers we would call toys, in fact, there are not made at this time in England any planers that would work our American lumber; the width of the belts (which may be taken as an exponent of their capacity) is about one half our standard, and yet they do all that is required of them; the secret being that they *saw* their stuff, we *plane* ours. To compare the two plans on a basis of economy in either material or power, would be superfluous. Their deal frames, as they are called, have gang saws of from 14 to 16 gage, making a kerf of about one-sixteenth inch in width; and the cost of re-sawing planks into deals or boards on their machines, is amply compensated for by the saving in the amount of timber consumed, to say nothing of what is gained in planing or shaping it afterwards.

The want of efficient machines for re-cutting, that could be set up in our planing mills, has been the great hindrance to re-sawing in this country. A reciprocating saw with a single blade (which is generally used) makes re-sawing expensive, while nothing but permanent earth foundations will prevent them from jarring the buildings. It is to be hoped that the band saw mill will take their place and fill this want, and that our forest mills will in time stop the manufacture of any kind of lumber but planks and squared beams from the green log.

Philadelphia, Pa. J. R.

A Magic Square.

MESSRS. EDITORS:—The accompanying magic square is sent to you, not because it is formed on any new plan, but because it is different in some particulars from the more ordinary magic squares, and may be of interest to your readers.

The numbers used are 1 to 100. The whole square is a magic square, having the number 505 as the sum of its lines,

90	14	12	100	84	93	4	96	10	2
16	66	36	37	63	22	80	81	19	85
92	39	61	60	42	75	25	24	78	9
7	59	41	40	62	23	77	76	26	94
88	38	64	65	35	82	20	21	79	13
18	55	50	54	43	27	73	72	30	83
86	45	52	48	57	70	32	33	67	15
3	44	53	49	56	34	68	69	31	98
6	58	47	51	46	71	29	28	74	95
99	87	89	1	17	8	97	5	91	11

files, and diagonals. If the margin is disregarded, as indicated by the continuous line, the square will still be a magic square, having now 404 as the sum of its various lines. And if this square be divided into quarters, as indicated by the double lines, the four resulting squares will each be magic squares, having 202 as the sum of their lines.

Philadelphia, Pa. PFEIL.

Free Rail Joints.

MESSRS. EDITORS:—I know not to what extent this method of laying railway track has been adopted, but I have certainly never seen a railway which had a more satisfactory appearance after an extended use, than that portion of the Nashua road which is constructed upon this plan.

No chair is used, and there is no sleeper directly under the rail joints; but in addition to the usual simple and strong four-bolted "fish joint," two broad faced sleepers are employed, close together, and so as to bring the ends of the abutting rails between them. This arrangement insures a free and open joint by allowing all dirt and clogging material to fall out, which of course leaves the opening free to its legitimate purpose, the expansion of the rails. The base of each rail is notched about midway for the reception of a spike to hold the track in its true longitudinal position, and to bring the expansion of the rail each way from its center.

One of the chief causes of the derangement of railway track is doubtless the clogging up of rail joints; rails will expand and contract, and whatever opposes such expansion and contraction sufficiently will throw the track out of line.

The mere action of sun and frost causes a variation of about three feet in the length of every mile of rail; hence the importance of this provision for the unobstructed play of the rails endwise.

If track is laid during very warm weather, one sixteenth of an inch at each joint is ample; but if laid in cold weather, three sixteenths of an inch is not too much to allow at each joint or for each rod of track. F. G. WOODWARD.

Australian Climate.

MESSRS. EDITORS:—I should be glad if you could give some information on the following subject. Perhaps Capt. Maury will explain it to us.

I am unable to understand the cause of the dry climate of extra-tropical Australia in its summer season. It is long since I read Maury's excellent book, the "Physical Geography of the Sea," but I think it omits an explanation of this; and I have never seen one, that I am aware of. On the Bay of Bengal, the China Sea, and the Pacific, off the Philippines, the dry northeast monsoon, which is equivalent to the moisture-absorbing northeast trade, blows from October to March. This, by Maury's theory, should rise about the equator and then blow, as an upper current of air, toward the southeast, above the southeast trade of the southern tropics. Then, as in the case of the trade winds, descending about the latitude of thirty degrees south, it ought to give summer rain, say, from November to April, in the southern half of the Australian continent.

I notice, however, in maps of physical geography that the northeast monsoon does not cease at the equator, but blows into the southern hemisphere, still as a surface wind, of course changing its direction and blowing from northwest. It rises and becomes an upper current only on reaching the latitude of the northern limits of Australia. Then, it may be, having gone so far south before rising, it does not again descend from the upper atmosphere and become a surface wind, till, in its southward course, it has passed the usual latitude of this change, or, till it is almost beyond the southern limits of the Australian continent. In this case it would only make the ocean region southwards of Australia rainy during its summer months.

But I notice by the maps that the southern parts of Australia are not included in the region of the southeast trades; and, I suppose, may therefore have northwest winds in their warmer months, which should be supplied by the moist air of the northeast monsoon from the East Indian and China seas.

In the case of the hot winds the air would seem to come from the central deserts. This must be replaced, one would think, by this wet upper current of air descending on these desert parts. They may be too hot to allow of its raining there, but on the wind going to the southwestward, in rear of the hot wind, it might rain.

Are the hot winds of southeast Australia thus followed by rain? Perhaps even the south of Australia is too warm in summer to condense this moisture. Should these suppositions be correct, it must follow that, during all the dry season, in the southern half of Australia the upper regions of its atmosphere must contain plenty of moisture, only prevented from descending by local peculiarities.

It may be the heated surface of Australia that draws the northeast monsoon as a surface wind across the equator, as the deserts of central Asia are supposed to cause the southwest monsoon during the other half of the year. Could the surface of the country be covered with any vegetation to prevent the reflection of heat from the bare ground—especially in the north and west central deserts—the monsoon might rise about the equator and descend again, about thirty degrees south, as a rain giving wind to all the land south of that.

But might not merely planting forests in the southern parts, to keep the ground and air cool, induce the moisture of the upper air to come down? Even in this wet district of Ceylon there seems a very evident difficulty for rain to begin to fall again after the ground has got well dried and hot. Could not the rain be brought down by any means in the shape of thunder showers? In this country, though the rain is mainly, and clearly, distributed in accordance with Maury's theory, still a great deal falls in the shape of thunder showers in the valleys in rear of the hills. Hills often, at this time, get less rain than the low valleys; the thunder showers seeming, in great measure, to avoid the hills. The moisture for these thunder showers seems to come down daily from the higher regions of the air.

I fear I have made this too long, and must stop at once. I would say that the great rains of Australia in winter are as much a puzzle to me as its dryness in summer. I should be glad to see an explanation of both by an able hand. If my explanation, so far as it goes, be wrong, I should be glad to see it corrected. J. TAYLOR.

Island of Ceylon.

The Darien Canal.

The New York *Journal of Commerce* enumerates the advantages of the proposed Darien Canal as follows:

As compared to the route *via* Cape Horn to Calcutta, there would be a saving of 9,600 miles; to Canton, 11,900 miles; to Shanghai, 11,600 miles; to Valparaiso, 8,100 miles; to Callao, 10,000 miles; to San Francisco, 14,000 miles; to Wellington, New Zealand, 2,620 miles; to Melbourne, Australia, 2,830 miles.

The saving, in comparison to the Cape of Good Hope route, would be, to Calcutta, 4,100 miles; to Canton, 8,900 miles; to Shanghai, 9,600 miles; to Wellington, 5,260 miles; to Melbourne, 3,340 miles.

For the English trade to India, the Suez Canal would offer better inducements, but the time and expense of English vessels to China, Japan, and Australia, would undoubtedly be abridged by the Darien Canal; at all events, the canal may be expected to take a share of England's traffic which now comes and goes through the Suez Canal. All American vessels trading with Japan, China, and Australia, and, of course, those bound to and from the Pacific coast, will seek the American Isthmus Canal. It advantageous effect upon American commerce and national prosperity would be immense.

IMPROVEMENTS IN LOCOMOTION.—Sir Joseph Whitworth, at a recent dinner of the Foremen Engineers, deprecated the use of horse tramways as unsuited to the times. He further intimated his opinion that "mechanical engineers have a right to enter their protest, considering the many obstructions there have been for many years past to the employment of road locomotives." Sir Joseph thinks it quite possible to produce a small, light locomotive, which would work quietly and effectively for use on roads; but, as a preparatory condition, he recommends that the roads should be better made, and kept in a proper state of surface by the use of steam-rollers, steam-sweeping machines, and other appliances.