apparatus; making together, not less than six minutes delay between each pair of wagons, in addition to the time occupied in their ascent. The same kind of delay would occur to the descending wagons, with this additional disadvantage, that in order to raise the traveling apparatus between the descent of each pair of wagons, the engine must be kept in constant work; the same for downward as for upward traffic, causing thereby a considerable extra expense for coal and other requisites.

There are a few other inconveniences which would result from the change; but those which I have already pointed out, being of the greatest importance, and also quite sufficient to show that the application of the principle to our inclined planes, is, by no means, desirable, it is needless now to mention them.

From the preceding remarks it will, I think, appear evident, that the application of the atmospheric principle to our railway in its present state, so far from being any advantage, would, in fact, subject us not only to serious inconvenience, but to considerable additional expense, and that too, (so far as relates to our present traffic,) without any compensating benefit. It, however, by no means follows, that the principle cannot, under any circumstances, be applied with advantage; on the contrary, I am of opinion that it is peculiarly applicable to the circumstances of our railway, if properly carried out.

Railway Office, Cromford, July 1st, 1844.

Civ. Eng. and Arch. Journ.

A review of the circumstances which have affected the Consumption of Fuel in the Locomotive Engines of the Liverpool and Manchester Railway, from the opening to the present time. By EDWARD WOODS, C. E.

This is an excellent practical paper, probably the very best with which Mr. Weale's quarterly budget has yet furnished us. The importance of the inquiry to which it is devoted, is sufficiently attested by the simple fact, that it has for its object to give the why and wherefore, of the consumption of fuel on the Liverpool and Manchester line, having been reduced (with an increase rather than reduction of traffic,) from 12,604 tons in 1838, to 3103 (!) in 1843. Mainly, this has been owing to a progressive increase from $\frac{1}{16}$ th inch to 1 inch in the extent of the *lap*, (as it is technically called) or space by which the sliding valve overlaps at each end the steam ports (when placed exactly over them,) and to the greater rapidity with which the waste, or used, steam is thus enabled to escape from behind the piston. The *rationale* of this result is made exceedingly clear in the following extract:—

“Alternately to fill and empty the cylinder of its contents, are operations requiring *time*. The time allowed for the first operation, that of filling the cylinder with steam, necessarily corresponds with the duration of the stroke, whatever its duration may be. But this cannot be the case as regards the second operation, the emptying of

the cylinder. This ought to be performed in an instant, in the twinkling of an eye, in the minutest fraction of the duration of the stroke, otherwise the steam would continue pent up when it ought to be liberated,—when it ought to assume its minimum pressure, the pressure of the atmosphere,—and would exert an injurious counter pressure against the piston, tending to increase the resistance to be overcome.

“To effect the free and rapid discharge, it is necessary, not merely to open the communication to the exhausting pipe, but to open a *wide* passage, and to have this *done* by the time the piston recommences its motion. The valve alluded to (the old one used until 1838,) cannot accomplish this. Its motion is gradual, not instantaneous. The passage only begins to open when the piston is on the turn, and is not wide open until the piston has traveled through one-tenth of its entire stroke. The steam in the cylinder, is, consequently, restrained from escaping, being wiredrawn in the passage out, and, consequently, takes *considerable time* to assume the pressure of the atmosphere.

“In the meanwhile the new stroke has begun, and been partially completed, and so far the piston has had to contend with a resistance altogether illegitimate, a resistance which, in many cases, and especially at high speeds, has been equal to the sum of all the other resistances put together.”

The merit of first getting rid of this illegitimate resistance is ascribed to Mr. Dewrance, of the Liverpool and Manchester line:—

“The next important improvement in the valves is due to Mr. Dewrance, and was suggested by him early in the year 1840. His principle was, that the exhausting passage, instead of being only partially open at the moment of completing the stroke, as was, more or less, the case with the engines before named, should be nearly wide open, which was to be accomplished by making the ‘lap’ of the valve equal to the width of the steam port;—moreover, that the travel of the valve should be made proportionate to the increased lap, so as to allow the same area, or the same amount of opening of the steam port for the admission of steam. A favorable opportunity occurred for carrying out these ideas, both as regarded increased lap and increased travel, from the circumstance of two engines requiring extensive repairs, which would allow time for the needful alterations. One inch lap was given to the *Rapid’s* valve, which was now made to travel $4\frac{1}{4}$ inches. The result of this arrangement was, that the exhausting passage was one inch open at the end of the stroke, and that, supposing the stroke of the piston divided into 100 equal parts, the steam was cut off at 79; it expanded from 79 to 95; at 95 it began to be released, and was escaping into the atmosphere from 95 to 100. The *Rapid’s* gross average consumption of coke, when running sixty-four trips of 30 miles each with coach trains, *before* the alteration, was 36.3 lbs. per mile, and 28.6 lbs. per mile immediately *after* the alteration. Thus we have a measure of the effect produced—a saving of one-fourth of the fuel.”

Mr. Wood gives the following valuable summary of the work

done, coke consumed, and loads carried, by the several classes of engines on this line for the last four years. It deserves, and, we doubt not, will receive the earnest attention of all other railway companies.

GROSS CONSUMPTION OF COKE.

Passenger Engines.

Coke.

				Tons.	cwt.	qrs.	Per mile
½ year end'g	June, 1840	3463	Trips, 30 miles	1523	16	3	= 32.9 lbs.
	December, "	3596	"	1276	9	1	= 26.5
	June, 1841	3493	"	1036	15	3	= 22.1
	December, "	3496	"	958	19	0	= 20.5
	June, 1842	3655	"	853	3	3	= 17.4
	December, "	3526	"	684	9	2	= 14.5
	June, 1843	3243	"	646	1	1	= 14.9
	December, "	3555	"	717	2	2	= 15.1

Average loads,
7 coaches.

Luggage Engines.

½ year end'g	June, 1840	1925	"	1160	12	3	= 45.0 lbs.
	December, "	1653	"	867	9	3	= 39.2
	June, 1841	1640	"	749	0	1	= 34.1
	December, "	1370	"	531	17	1	= 29.0
	June, 1842	1604	"	559	2	2	= 26.0
	December, "	1521	"	421	17	2	= 20.7
	June, 1843	1588	"	441	7	2	= 20.7
	December, "	1605	"	451	12	2	= 21.0

Average loads,
22 wagons.

Bank Engines.

½ year end'g	June, 1840	349	Days.	486	11	3
	December, "	356½	"	369	10	0
	June, 1841	349½	"	343	3	2
	December, "	341½	"	251	11	0
	June, 1842	361	"	174	6	3
	December, "	363½	"	143	13	3
	June, 1843	452½	"	162	8	3
	December, "	517½	"	183	12	2

Coal and Ballast Engines.

½ year end'g	June, 1840	436½	"	489	4	0
	December, "	370	"	344	17	3
	June, 1841,	334	"	325	4	2
	December, "	351½	"	312	4	2
	June, 1842,	407	"	313	3	2
	December, "	443½	"	243	3	3
	June, 1843,	306½	"	226	5	0
	December, "	398½	"	274	13	3

Average load,
15 wagons.

General Result.

In the year 1838,	12604	tons of coke consumed.
1839,	11754	"
1840,	6518	"
1841,	4508	"
1842,	3393	"
1843,	3103	"