The tube, it is now generally known, is filled with some highly rarefied gas, and platinum wires are hermetically sealed into the ends. When the discharges from a Rhumkorff's coil apparatus are passed through this tube it becomes filled with a mild, diffusive light, which lasts as long as the discharges pass through the rarefied medium. This light is unaccompanied by heat; it cannot, therefore, under any circumstances, explode the fire-damp of our coal mines.

This new "safety lamp" consists essentially of a cylindrical zinc vessel about 6 inches high and 4 inches in diameter, which incloses a porous vessel holding a cylinder of carbon. A solution of the bichromate of potash is placed *in* the porus cell, and dilute sulphuric acid *without* it. This battery is secured by a wooden cover, which is, by means of india rubber packing, made to fit closely. Then there are a Rhumkorff's coil and condenser, and a Geissler's tube. This tube is arranged into a conical coil, so that a large surface of light is secured within a small space. Of course the objection to this will be the cumbrous character of the machine and its adjuncts. Dumas and Benoit think they have answered this objection by the very ingenious arrangement which they have secured. We are assured that the weight of the glass case does not exceed two pounds, and that of the other parts of the apparatus is not more than twelve pounds. That there are many advantages in this electrical lamp cannot be denied. But we doubt if so delicate a machine can be intrusted to the hands of colliers. Under circumstances of danger, such a lamp as this would prove of the highest value. As Dumas and Benoit are making practical trials of their "cold light" as they call it, we shall, if they are successful, hear more of this interesting application.

The Institute of France has given the inventors a prize of 1000 francs for the ingenuity of their plan. We understand that some trials have been made in the Newcastle collieries. The objection raised by the miners is, that the light is a "glimmer"—not a steady illumination.

For the Journal of the Franklin Institute.

The Economy and Safety of different Modes of Traveling. By Wm. Bouton, University of Michigan.

The purposes of the traveler are so various that the mode which is most economical for one purpose may be very expensive for another. If the purpose is to storm a battery, there is no way quite equal to going on foot.

Some noted travelers have commenced their career by journeying on foot over the most populous countries of Europe, and have even had the audacity to recommend it as the fittest mode for one, who wishes to see the sights and learn the customs of those nations.

If a man should set out to seek the head-waters of the Nile with the thought that civilized man had never trod the path before him, a *locomotive engine* would be as much out of place in his outfit as a panorama of Paradise Lost printed on six thousand feet of canvass.

But these purposes generally involve the common desire to reach the journey's end with the greatest possible *rapidity*, *ease*, and *safety*, and with the least *cost*.

The mode of travel which at the same time secures all these requirements in the highest degree will be preferred. Or since perfection cannot be attained, a great gain in one, speed for example, will be chosen at some loss in another, as safety.

What are the exact equivalents of each, in terms of the other, or how far any one of them may be sacrificed for a given gain in another, it is difficult to say. It rather is evident that no two men would judge of them and agree. One man thinks more of his ease: another will make great exertion to avoid most distant danger: a third values his time and is willing to take greater risk, so he can accomplish more. Yet all will agree practically, that speed, safety, ease, and cost of travel, are each convertible in terms of the other between *some* limits. The prudent man never lived who would always drive a spirited horse at a walk, though it might be much safer to do so.

Formerly, perhaps yet, public opinion regarded railway traveling as much more dangerous than the time-honored system by stage coaches. Men traveled by railroads nevertheless, and stage coaches had to migrate. This does not prove, that when men made the charge against railroads, of greater danger, they were insincere. They valued the increased speed and cheapness as well as ease, more than they regarded the difference in safety. A journey of 300 miles, but an ordinary day's ride by rail which gave the night for rest, would consume four or five days in comparatively hard work by stage, and without half the certainty of making connexions between different lines. The stages charged *six* cents a mile more or less for fare, the railroads charged *three* cents. These advantages, too palpable to be overlooked, revolutionized the world's travel. Greater *safety* was not generally believed in.

If now it shall appear by an examination of statistics that the danger of accident on railroads is really much less than by the old methods or by existing modes of canal and river packets, it will result that in speed and safety, as to cost and comfort, railroads stand pre-eminent.

A railroad accident occurs; everybody hears of it. The newspapers are filled with glaring capitals and detailed accounts of how it all happened. Who ever heard of a stage coach accident being published outside the county journal. The impression gains that railroads are very destructive to life.

To judge justly let us reduce the statistics to some standard of comparison. When we can get the necessary data, let us compare the number of casualties with the whole number of miles traveled on any road. This ratio is more satisfactory than any other, for we wish to know the danger in accomplishing a given journey, whether it be crowded into a day or spread out over a week.

On the railroads of New York State in 1853, a little more than twelve millions of passengers were carried an aggregate distance of 531,512,298 miles, 15 persons were killed, or 1 in 35,434,153 miles

traveled. But a large majority of these accidents resulted from getting on or off the train when in motion, standing or lying on the track and the like. If we exclude these, but three fatal accidents remain or 1 in 177,170,766 miles traveled. In the Cyclopædia of Commerce, 1860, I find that in New York, for a series of years, the average loss of life was 1 person killed for 47,164,426 miles traveled. If, as before, we exclude accidents arising from the sufferer's own carelessness the ratio is 1 in 235,822,132. These results are tabulated from the State Reports. In the same publication for the year 1863, I find that Dr. Lardner has estimated the chances of a fatal accident per mile of railroad travel, 1 to 65,363,735. The chances of injury, 1 to 8,512,486. Such an estimate from so eminent an authority is entitled to much weight. We see that the range is very wide; we should also find the danger on some roads and in some sections of country uniformly greater than in others.

Taking Dr. Lardner's estimate and allowing 300 miles as a day's work, traveling by rail, a person must travel 597 years before there would be an expectation of a fatal accident, (I refer here to the mathematical and not the moral idea of expectation.) Reductions on the same basis, from some of the figures given above, would give over 2000 years before the expectation of a fatal accident to the traveler on those roads. Are not fatal accidents quite as common in the ordinary business of life, as on railway trains?

In Hunt's Merchants Magazine, vol. xxxix, page 249, a table is given of the casualties from railway traveling in England, Scotland, and Ireland for the years named, formed by dividing the total number of passengers by the number killed, as follows:—

Year.	Ratio as above.	Year.	Ratio as above.
1850	6,071,202	1855	11,859,513
1851	4,494,268	1856	16,168,449
1852	8,913,572	1867	5,200,000
1853	2,841,296		
1854	9,529,907	Mean,	8,137,276

In order to compare this table with the results given above on other roads, I find in the Cyclopædia of Commerce for 1859, data from which it results that the average distance traveled by each passenger in the United Kingdom during this time was 16 miles very nearly. Hence we find that there was one fatal accident in 130,196,416 miles traveled.

The following table shows the comparative safety of railway traveling in different countries, compiled, the writer says, from the statistics of a series of years. It would seem that there must have been a very large proportion of wounded to make these figures agree in the case of England with those just given for Great Britain. Hunt's Merchants Magazine, vol. xxxix, page 504.

Prussia,	1	killed or wounded for	3,294,075	carried safely.
Belgium,	1	" "	1,611,237	"
France,	1	" "	375,092	"
England,	1	" "	311,345	"
United States,	1	" "	188,459	"

In seeking an explanation for these figures I have found that the average travel of each passenger in the United States is about forty miles while in Great Britain it was but 16 miles, or if we multiply the ratio in the United States by the average distance traveled by each passenger, we shall have for the ratio of casualties to the whole distance traveled, $188{,}459 \times 40 = 7{,}538{,}360$. A little more than 12 per cent. more disastrous than the mean given by Dr. Lardner.

How was it in the good old times of stage-coach traveling? Statistics were rare. I have been able to find the following:—

On French railroads 212 miles in length, of 1,889,718 passengers who traveled over 316,945 miles, in the first half of 1843, not one was either killed or wounded, and only three servants of the railroad suffered. Comparing with this, the traveling by horse coaches in the *same region* we find that in seven years, from 1834 to 1840, 74 persons were killed, and 2073 wounded.—*Gillespie's Roads and Railroads.*

In Hunt's Merchants Magazine, vol. xxxix, I find that under the postal system of France, 1846 to 1856, of 7,109,276 passengers, 20 were killed and 238 were wounded. This was after railroads were introduced which accounts for the small number of passengers, but I do not quite see how it accounts for the large proportion of accidents,—1 killed or wounded for 27,555 carried safely. More than six times as disastrous as the worst show that has been made among all the systems of railroads examined. On an American railroad, traveling 30 miles an hour a traveler is safer than in a French diligence, traveling 5 miles an hour!

If we consider fatal accidents only, the ratio is 1 to 355,463, more than 22½ times the ratio of fatal accidents to the number of passengers on railways of Great Britain for the same period!

Some of the reasons for this great difference are the system to which railroad management has been reduced so as always to fix the blame where it belongs; the great strength with which the cars are made so as even to collide at high speeds and only smash the engine and baggage car; the smoothness of the road, freeing the wheels and axles from such severe jolts and strains as they are liable to on common roads; the centre of gravity of the cars is lower, hence they are less liable to be overturned, the engine does not take fright and is at least more manageable than a vicious horse.

The following statistics of the loss of life by *steamboat* accidents may be interesting. The figures include the lake, river, and harbor casualties of the United States in the years mentioned.

1853	576 killed.	1857	303 killed.
1854	587 "	1858	364 "
1855	176 "		

We see that the loss of life was on the whole decreasing while the travel was increasing. I think it is evident that the proportionate

loss of life is greater than on railroads, though I have been unable to determine the total amount of travel.

The statistics of canals which I have found, refer to the economy with which they carry freight and not their value as lines of travel.

The following table gives the number of casualties from railroad accidents in the United States for eight years.

Year.	Number killed.	Number wounded.	Number of Accidents.	Average No. killed and wounded at each accident.
1853	234	496	138	5·28
1854	196	589	193	4·07
1855	116	539	142	4·61
1856	195	629	143	5·77
1857	130	530	126	5·24
1858	119	417	82	6·54
1859	129	411	79	6·83
1860	57	315	74	5·03

These figures show that while the number of miles of railroad was increasing 2000 to 3000 miles a year, and the old roads were increasing their business, still the number of casualties very steadily decreased. The last column shows that the accidents which did occur were as serious in 1860 as 1853 and 1854. Has this ratio decreased since that time?

In Great Britain from 1854 to 1860, after their railroad system was nearly completed, the yearly travel increased eight per cent. per annum. I cannot find as definite statistics for this country, but if we consider how each new road adds to the business of the whole and the rapid increase of the population, we shall be safe in assuming that on the old roads in this country the travel increased ten per cent. per annum for the same period. Combining with this the fact that from 1853 to 1860 the total length of railroads in the country increased from 17,000 to 31,000 miles and it will result that in 1860 the railway travel in the country was $3\frac{1}{2}$ times what it was in 1853. If the number of accidents had maintained the same proportion, we should have had in 1860, 483 accidents and 819 lives lost by them, instead of 74 accidents and 57 lives lost. Even 1865 does not threaten to compete with 1853 in the danger of railway traveling. And in that year railroads were several times safer than any other mode of travel known.

If other testimony were wanting to prove the safety of railroad traveling, we might mention that in England, companies insure against loss of life and proportionately against injury from railroad accidents.

On a trip from London to Liverpool, 1 penny insures against loss of life for £ 500, and their reports show that for dividends, the stocks of the insurance companies are better than those of the railroads.

New Boiler Regulations in France.

From the London Artizan, Mar., 1864.

A ministerial decree has been issued in France relative to steam boilers. The following is a *résumé* of the chief instructions issued:—