clocks are good, and they have imitated our watches; they walk about with "pedometres" attached to their belts and they are not backward in copper-plate engraving and perspective. Their china is far superior to the Chinese. The country abounds with coal, though they only use that found close to the surface; but even that, a sort of bituminous shale, is good. In gold and silver I believe they could rival Mexico and Australia; iron, copper, and tin are found in profusion. A friend of mine at Yokohama gave a Japanese a piece of English cotton shirting; in a few days the man brought back two pieces, and my friend had much difficulty in saying which was his, so closely had it been imitated. In fact, they are a people who want for nothing but teachers.

Tables Relating to Locomotive Engines.

The following useful tables from the *American Railway Times*, should find a place in the engineer's note book:—

The tractive power required to move any load upon a level railway is found by dividing the square of the speed in miles per hour by 171, and to the quotient adding 8, and multiplying the sum by the load in tons.

Speed in Miles per hour.	Tractive power needed, load being 50 tons.	75 tons.	100 tons.	250 tons.
12	442	663	884	2210
15	466	691	931	2328
20	517	773	1034	2585
25	582	874	1165	2912
30	663	994	1326	3315

Table showing the tractive power required to overcome grades with different loads.

Grade in feet per mile.	Load in tons. 1.	50.	75.	100.	250.
20	8	424	636	848	2122
40	16	848	1272	1696	4244
60	26	1272	1910	2546	6340
80	33	1697	2545	3393	8489

To find the tractive power needed to overcome any grade, we multiply the load by the rise per mile, and divide the product by 5280, the number of feet in a mile.

Table of factors which multiplied by the total piston pressure give the tractive power of the engine in lbs.

Diameter of Driver.	Stroke in inches. 18.	20.	22.	24.
4	2386	2652	2918	3182
4¼	2250	2500	2750	3000
4½	2151	2390	2593	2830
4¾	2012	2236	2459	2682
5	1910	2122	2334	2546
5½	1736	1929	2122	2315
6	1591	1768	1945	2122

The above are all decimals, and are got by dividing the double stroke by the wheel circumference, both in inches.

Table of piston pressures for different cylinders, and different steam pressures.

Diameter of Cylinder.	Area of Piston.	Whole pressures on both pistons, at 100 lbs.	110 lbs.	120 lbs.	130 lbs.
16	201	40,220	44,242	48.264	52,062
18	254	50,900	55,990	61,080	66,170
20	314	62,840	69,124	75,408	81,692

Relative volumes of steam under different pressures.

Steam pressure.	Relative volume.	Steam pressure.	Relative volume.
80	359	120	240
90	323	130	231
100	293	140	216
110	269	150	203

That is, at a pressure of 100 lbs. per inch, each cubic foot of water will make 293 cubic feet of steam.

Table giving the amount of surface obtained by 100 *tubes, of different dimensions.*

Length of tube. in feet.	Square feet of surface in 100 tubes, diameter of tubes in inches being 1½.	1¾.	2.	2¼.	2½.
10.0	392	457	524	589	655
10.5	411	480	549	618	687
11.0	431	503	576	647	720
11.5	451	526	602	677	753
12.0	471	549	628	705	786

Table showing the mean pressure in the cylinder, for different percentages of admission, and different initial pressures.

Initial pressure in lbs.	Mean cylinder pressure cutting off at ¼.	⅓.	½.	⅔.	¾.
100	54	65	83	93	95
110	60	72	91	102	105
120	66	79	99	112	114
130	72	86	108	121	124

That is, if we cut off the steam at 50 per cent., which has a pressure at entering of 120 lbs. per inch, the mean pressure throughout the stroke will be 99 lbs.

On Refining Petroleum.

The methods practiced by persons engaged in refining the American Petroleums are as different as those in use for the purification of the oils distilled from coals. Some employ acids and alkalies, others use alkalies alone, and steam is applied at various degrees of heat. Some of the oils produced by those means are of good quality, others are inferior and do not ascend the wick of the lamp in sufficient quantities to afford a constant light. In others, the illuminating principle, by some change effected on the carbon, is partially destroyed, and in almost all the odor is disagreeable. The oils from some of the wells contain traces of chloride of sodium, other carbonate of soda in quantities, sufficient to effect their treatment. The denser oils, or those which contain too much carbon to admit of being consumed in lamps without smoke are excellent lubricators, either mixed or unmixed with animal oils.

It will be perceived by the foregoing statement that it would be a difficult task to prescribe a mode of purification to meet the requirments of the oil refiners. Neither the petroleums nor the oils distilled from them contain creosote, or cabolic acid, and other impurities which contaminate the oils distilled from coals and coal shales; their purification therefore, is simple and comparatively cheap.

When the proof of the oil is not below 38° Fah., distillation with water, or by the use of steam, will most frequently render the lamp oil of good color, and its illuminating properties will be of the highest order. Before the heavy oils, or those below proof 38° Fah., are submitted to any treatment, it is necessary to give them a preliminary distillation, by the aid of common or superheated steam, and the distillate should be separated into two parts, all below proof 38° Fah., being set aside to be treated for lubricating oil, a further portion to be added to the illuminating oil. Washing the lighter part of the charge with a solution of caustic potash or soda, is useful. A final distillation over a weak solution of either of those alkalies will generally render the oil pure. The heavy parts of the oil may require agitation with equal parts of sulphuric