— Harper & Brothers have just ready "A History of the Kansas Crusade: its Friends and its Foes," by Eli Thayer, who planned and organized the movement by which Kansas was made a free State, with an introduction by Edward Everett Hale, a fellow-worker with Mr. Thayer in the emigration cause; and "Man and His Maladies," a popular handbook of physiology and domestic medicine, by A. E. Bridger.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The Law of Population in the United States.

PURSUING the investigation of the law of population, we come to a question of importance in an economical and ethnographic view. What is to be the relative progress in numbers of the Caucasian and the African races here?

The late revolution in Hayti has led to the publication in the daily press of America of so many concise abstracts from the history of that African republic as to make it familiar to all who interest themselves in these matters. It is to be regretted that the progress of regulated liberty in that island has not, in a century, been greater. It is a prevailing belief that with us the African increases faster than the Caucasian. The figures of the census during a hundred years do not confirm this opinion. We find that while the whites since 1790 have increased on the average in each decade by 33.46 per cent, the blacks have gained in the same time only 26.81 per cent.

Applying these rates to the present numbers we may forecast the *possible*, if not the probable, population, during the next century as follows: —

Year.	Total population.	African descent.	Proportions.
1890	67,240,000	8,000,000	8 to 1
1900	89,738,000	10,144,000	
1910	119,650,000	12,862,000	
1920	159,890,000	16,309,000	10 " 1
1930	213,320,000	20,681,000	
1940	284,697,000	26,223,000	11 " 1
1950	379,960,000	33,252,000	
1960	507,090,000	42,163,000	12 " 1
1970	676,760,000	53,463,000	
1980	903,200,000	67,790,000	
1990	1206,400,000	85,957,000	14 " 1

The reader can draw his own inferences from these significant figures. We only say that in 1940 and thereafter this country will not be able to offer free space and citizenship and suffrage for the surplus overflowing of China, to a race which does not assimilate with us, and which is pagan; and that it is time to discontinue the complaint that the Chinese exclusion act was mere demagogism. In the light of these figures, it was the highest statesmanship. The importation of native Africans ceased by the Constitution in 1808, though it is alleged that a few fanatics imported cargoes later. But practically the forced importation ceased then. There never has been any voluntary immigration from Africa.

Both Malthus, in 1794, and Alison, in 1840, held that the population of the United States after 1640 doubled every twenty-three and a half years. This rate has continued to 1890, for two hundred and fifty years.

M. C. MEIGS.

Washington, D.C., Sept. 2.

INDUSTRIAL NOTES.

Comparison of different Street Car Systems.

BEING continually requested by street railroad men to furnish them with a statement of the cost of equipment and operation of a road by means of storage battery traction, and also how the cost of this method of traction will compare with other systems, the Julien Electric Traction Company of this city have made a comparison of the four methods available to-day for street-car propulsion in large cities,— horses, storage batteries, electric conduit, and cable. The estimates and comparisons, it is claimed, have been carefully prepared, and special attention has been given to obtain good authority for statements, mostly from roads having the different systems in actual operation. The estimates are based on a medium-sized road running on the headway generally employed in cities, trying, as far as possible, to cover roads operating under such different circumstances as are found in different localities.

The company mainly aim to treat the subject as applied to cities. They have not included figures on the overhead system as they consider them barred from operating in that field, owing to the necessity of the presence of overhead electric conductors, and the growing sentiment in all communities against the erection of poles. As regards the Julien system, the figures show the results of two years' experience on the Fourth and Madison Avenue line in this city.

The estimates are based on a road six miles long, double track, operating sixty cars, running eight miles an hour by mechanical, and six miles an hour by animal traction, running on one and one-half minutes headway, and eighty-four miles a day in the former, and on two minutes headway, sixty miles a day, in the latter case, allowing nine horses to a car. The item of building and land is not included, as they differ so widely in different cities and localities.

According to the figures given, the cost of constructing and equipping such a road, on the Julien storage battery system, would be $491,500, or, if the current were taken from a central lighting station, $419,000; the same road constructed and equipped for a horse railroad, $229,620; as a cable road, $1,076,000; as a conduit electric road, $762,000. The annual running expenses under the different systems would be as follows. Julien system, eighty-four miles a day per car, with electric plant, $99,206, being $4.52 per car-day, or .053 of a cent per car-mile; same system, using current from a lighting station, $113,330, being $5.17 per car-day, or .061 of a cent per car-mile; horse traction, sixty miles a day per car, $129,562.20, being $5.91 per car-day, or .098 of a cent per car-mile; cable road, eighty-four miles a day per car, $163,712.50, being $7.47 per car-day, or .089 of a cent per car-mile; electric conduit system, eighty-four miles a day per car, $111,157.50, being $5.07 per car-day, or .06 of a cent per car-mile.

Carhart-Clark Standard Cells.

In last week's *Science* appeared an abstract of a paper on an improved form of Clark standard cell read before the American Association for the Advancement of Science by Professor H. S. Carhart of the University of Michigan, vice-president of the Physical Section of the association. We add a few points relating to the special features of this cell and its mounting for commercial and scientific purposes, as sold by James W. Queen & Co., Philadelphia, who have the exclusive handling and sale of it.

This cell embodies several new and important features, chief among which are its low temperature coefficient and safety in transportation. These features are secured by the methods of Professor Carhart, devised after a series of investigations extending over nearly three years. The change of electromotive force produced by a temperature change of a few degrees is practically negligible except in scientific work of the greatest accuracy. The coefficient is only 0.038 per cent per degree C. This is somewhat less than one-half the coefficient of Lord Rayleigh's form, for which he found a value ranging from 0.077 per cent to 0.082 per cent per degree. Almost absolute safety in transportation is secured by confining the mercury to the bottom of the cell, thus precluding the possibility of its reaching the zinc and short-circuiting the cell, no matter how violently it may be shaken. This process presents the additional advantage of increasing the electromotive force about 0.35 per cent above the old form, and of preventing local action, by which very serious changes took place in the old form of the cell on open circuit. Greater uniformity and constancy, it is believed, result from this method of making a cell.

Another well-marked characteristic of these new cells is their remarkable uniformity. This is due to great care in the preparation of the salts and standard solutions, and to the absolute cleanliness observed in every part of the cell. In the Clark cell, as made by Lord Rayleigh, the mercury salt always turned from its normal white to a canary yellow on mixing with the zinc sulphate, a change probably due to the presence of mercuric salt. In this

new form the salts remain white if they are kept out of the light, no change whatever in color appearing on mixing the mercurous sulphate with the zinc sulphate. This result is secured by the greatest care in making the mercury salt. It is found that a mercurous sulphate can be made so free from the mercuric form that it does not turn yellow when all the acid is washed out.

Professor Carhart says, in a letter to Queen & Co. of July 8, 1889, "Sent you six new standard Clark cells, numbers 106, 107, 108, 109, 110, 111. The extreme difference between these cells when only four days old was only 0.0006 of the electromotive force of the cell, and they were still approaching one another. There was a difference of only 0.0003 between five of these, and only 0.0001 between four of them." Again, referring to six cells, not made in the latest secure form for transportation, which were sent by express from Ann Arbor, Mich., to Queen & Co.'s laboratory in Philadelphia, and returned to Ann Arbor, a journey of over fourteen hundred miles, he writes, "After letting the cells rest thirty-six hours I am much gratified to find that their extreme difference from one another is only 0.08 per cent, and the average of the six cells is only 0.08 per cent lower than my standards kept here." These are remarkable results from such a severe test as this, but the latest form will make a still better record.

A new process of sealing the cell is also employed. Marine glue, which was recommended by Lord Rayleigh as a sealing material, always gave trouble to secure a firm hold on glass and to prevent air bubbles from being inclosed to such an extent as to greatly weaken the seal. Its viscosity was also such that any small internal pressure, due to heat or the generation of a little gas, was liable to force the cell open. With the new compound employed the closure remains perfectly firm, and forms an entirely satisfactory hermetic sealing.

These cells are all set up by Professor Carhart in the physical laboratory of the University of Michigan, and are furnished with his personal certificate, giving the electromotive force of the cell, its temperature coefficient, and guaranteeing each cell "provided no current greater than 0.00002 ampère be passed through it, and provided it be subjected to no violent mechanical strain or jar." With even a larger current than the above, these cells show no polarization whatever in five minutes, and with ten thousand ohms external resistance a polarization of only 0.01 per cent is observed in this time. The cell recovers from this small polarization, which is less than the usual accidental differences between different cells, in five minutes or less. The errors arising from ignorance of the exact temperature of the cell are greater than any liable to occur from polarization. To guard against accidental short-circuiting, Queen & Co. are mounting a graphite resistance of about twenty thousand ohms in circuit with the cell and inside the case which incloses it. These cells are mounted in handsomely finished brass cases, $3\frac{3}{4}$ inches high and $2\frac{3}{8}$ inches in diameter, with an engraved hard rubber top, giving the number of the cell corresponding with the certificate, indicating the positive and negative poles, and having a hole for the insertion of a thermometer to ascertain the temperature in the inside of the cell. Batteries of these cells, in any number desired can be mounted if required.

Boissier Dynamos for Plating and Lighting.

THE dynamos shown in the accompanying illustrations possess some features of novelty, invented and patented by Mr. Herman Boissier, electrician of the Arnoux & Hochhausen Electric Company of this city. The aim of the inventor was to produce a dynamo of low first cost, not liable to get out of order, and so simple in construction that it would require no more attention than could be given it by any workman of average intelligence in plating or electrotyping establishments. The favor with which the machines have been received and the flattering testimonials of those who use them would seem to indicate that the dynamos approximate very closely to the inventor's ideal.

The machine shown in Fig. 1 occupies a floor space of only sixteen by twenty-six inches, and weighs about a hundred and thirty-five pounds, of which only about thirty-five pounds are copper. It furnishes current for twenty-five sixteen-candle-power lamps, or a proportionate current of lower voltage when wound for plating purposes. Owing to the peculiar method of winding the armature, there are only four sections to the commutator. Fig. 2 shows a form of dynamo made specially for use in electrotyping establishments, and furnishing a current of very low voltage. The field

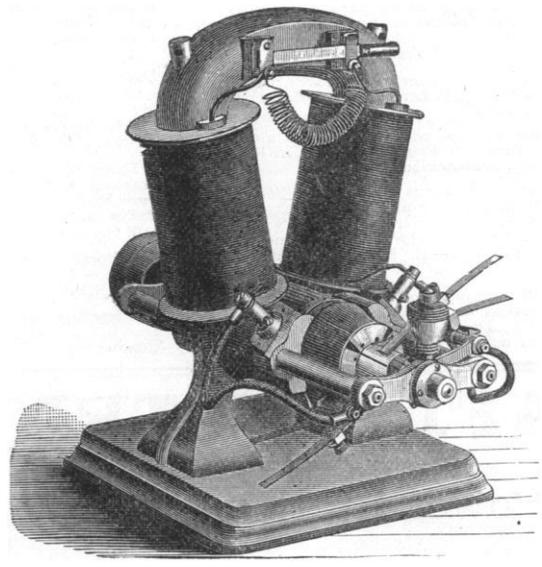

FIG. 1. — BOISSIER DYNAMO.

coils are composed of copper ribbons alternating with ribbons of insulating material. The armature, shown in Fig. 3, is composed of heavy copper bars passing round a cylinder of insulated soft

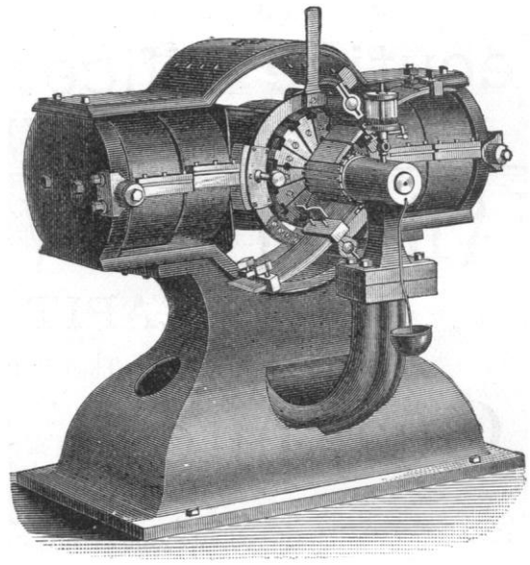

FIG. 2. — BOISSIER DYNAMO.

iron wire. All insulating material on the armature is fire-proof, so that it is impossible that the armature should ever burn out. Two of these dynamos are in use in the government printing office at

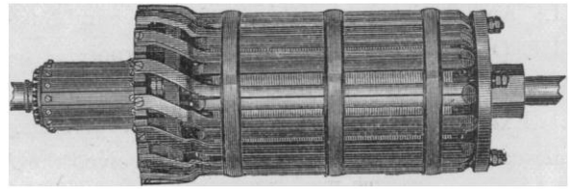

FIG. 3. — ARMATURE OF PLATING DYNAMO.

Washington, in the electrotyping department, where they have a record of three hundred ounces of copper deposited in two hours, using one machine only. They are manufactured by the Arnoux & Hochhausen Electric Company.