IMPROVEMENT IN STOVES.

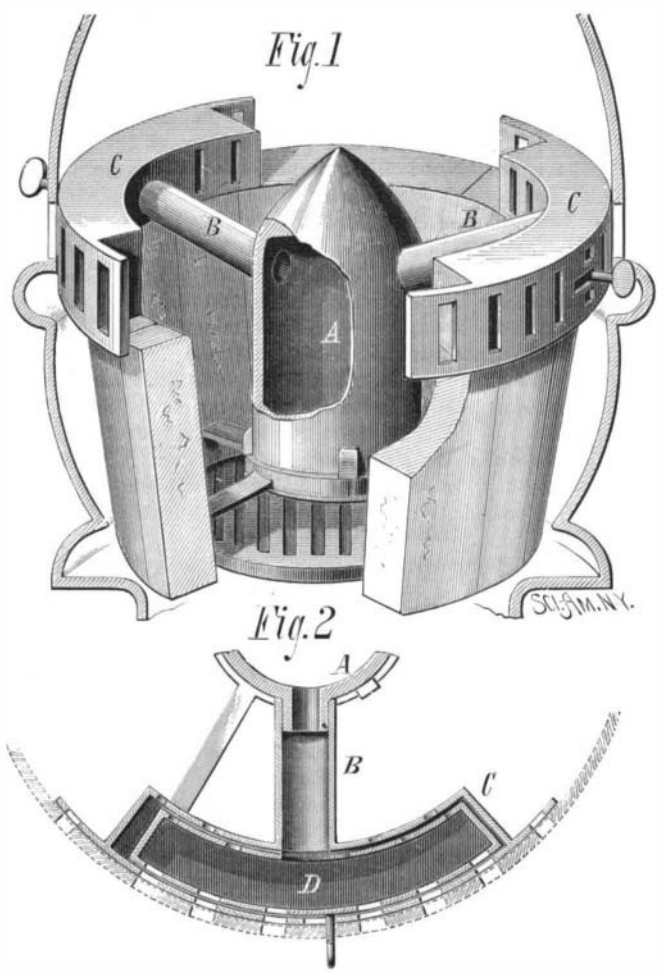
The cone attachment shown in the annexed engraving is designed to economize fuel, improve combustion, and to utilize to the fullest extent the heat of the fire. A hollow cylinder, A, having a conoidal top and two radial pipes, B, is supported in the center of the fire pot of a stove or furnace a short distance above the grate by lugs which rest on a spider supported by the lining or side of the stove or furnace. There is sufficient space between the cylinder and the grate to allow the grate to move freely.

The pipes, B, are connected with segmental covered hot air boxes, C, resting on the stove lining and against the inner side of the stove. The inner and outer faces of these boxes are apertured and provided with sliding registers, D, which are connected together and have their apertures arranged in relation to those of the boxes, so that when communication is established between the interior of the boxes and the external air, communication between the interior of the stove or furnace and the boxes is shut off, while a movement of the register in the reverse direction will establish communication between the boxes and interior of the stove. Air is admitted beneath the grate into the cylinder, A, and through the connecting pipes, B, into the hot air boxes, C, becoming highly heated in its passage. Then, by adjusting the registers, the heated air may be admitted into the room in which the furnace or stove is located, or by simple arrangement of pipes may be conducted to any other room in the house. A contrary movement of the register will direct the current of hot air from the boxes into the stove or furnace itself.

When raking down or replenishing the fire in the stove or furnace the inner perforations of the hot air boxes are closed by the register to prevent the entrance of dust and ashes.

In a stove or furnace the cylinder occupies the space that would otherwise be occupied with coal, so that with an equal amount of coal placed in a stove or furnace about the cylinder more extensive heat-radiating surface is secured than there would be in the absence of the cone. As the economic value of coal in a house furnace or stove is in a great measure controlled by its exposed radiating surface, this device must serve to increase the heating capacity of the coal.

This invention has been patented by Mr. J. H. Egan, of St. Johnsville, N. Y., who may be addressed for further information.



EGAN'S CONE ATTACHMENT FOR STOVES.

Native Californian Tobacco.

Professor J. T. Rothrock is of the opinion that the early natives of California smoked the leaves of *Nicotiana clevelandii*—a species only quite recently described by Professor Asa Gray. It is a small plant with small flowers, and it was found by Professor Rothrock only in association with the shell heaps which occur so abundantly on the coasts of Southern and Central California. He states that perhaps of all the remains of extinct races so richly furnished by that region, none were so common as the pipes, usually made of stone resembling serpentine. The tobacco of *N. clevelandii* Professor Rothrock found by experience to be excessively strong.

IMPROVED CAR STARTER.

In the traffic of a great city like New York or Philadel phia it is no uncommon thing to see a pair of horses toiling up a grade with a car loaded to its utmost, the horses pulling almost to the limit of their strength, and when the car is stopped, as it necessarily is at very short intervals, it becomes evident that extraordinary exertions are required on the part of the horses to overcome the inertia of the heavy load and to get the car again in motion. The position of the horses, the slipping of their shoes on the pavement, and the tension of the traces all indicate that a great deal of power is required to start a car by a direct pull, and any observing person must have noticed that it requires a great deal of maneuvering on the part of the driver to release the car brake at the precise moment when the horses begin to pull. The fact is this is seldom or never accomplished, the brake being usually relieved before the horses have fairly started; the consequence is that there occurs a retrograde movement of the car, which adds to the momentum acquired by the backward movement the inertia of the load, making the matter of starting much more difficult than it would be if it were possible to start from a state of rest.

The case is the same on level roads, although not in the same degree; and, added to the effects already mentioned, there is the jerking of the passengers whenever the car is started, the racking of the cars, which results in their rapid destruction, the strain on the harness, the frequent loss of the horses' shoes, the latter being a matter of considerable importance, since the horse suffering this loss must wear a boot and go at a slow pace, often seriously delaying the entire line of cars following.

Most of what has been said in relation to street passenger cars is equally applicable to coal cars, mining cars, and railroads of every description employing horse flesh as a motive power.

It is certain that more damage is done to horses in starting the cars than in all the actual work done in drawing them along the track, and any invention calculated to avoid these evil effects is worthy of attention.

We give herewith an engraving of a nove car starter recently patented by Mr. Jacob Hansell, of Philadelphia, Pa. It has been practically tested for several months past upon some of the most trying street car lines in Philadelphia, and is found to work admirably, saving the horses from the sudden and severe strains which inevitably come upon them when starting the car in the usual way, and also effecting a great saving in the wear and tear of cars.

The invention shown in the cut is very simple, and may be readily applied to the ordinary cars. If the device is applied to a car while building, a saving of at least $5 will be effected in the construction of the car, as many of the heavier parts which are made especially for supporting the brake while under a heavy strain may be omitted.

Fig. 2 gives a general idea of the manner of applying the starter to a car, and Fig. 1 is a detail view of the starting mechanism. A ratchet wheel is secured to one of the axles of the car, and a lever, A, which embraces the axle on each side of the ratchet and carries a pawl capable of engaging the ratchet when the free end of the lever is raised. The lever, A, is connected by a short link with a bell crank lever, B, pivoted in bearings suspended from the bottom of the car. The lever, B, is connected by a rod, C, with the drawbar, D, having a spring surrounding it between the two guides, and not differing materially from the drawbars in common use.

The tongue, if one be used, is supported by a vertical rod hinged to the outer end of the draw bar and supported at its lower end by a brace, G, connected with the inner end of the draw bar and provided with adjusting nuts by which the inclination of the tongue may be changed.

The pawl on the lever, A, is connected by a small rod or chain, F, with a lever on the driver's platform, the rod or chain being connected by suitable angled levers. By this arrangement the driver may disengage the pawl from the ratchet by simply pulling on the rod or chain, F, when the motion of the car is to be reversed. When the cars always run in the same direction this pawl will never be raised. When the horses pull, the forward motion of the draw-bar moves the lever, A, upward, and as the pawl is in engagement with the ratchet, the axle is turned and the car started. The direct pull of the horses is thus applied to a car already in motion and never to the dead weight of the inert car. In fact sufficient headway is given to a car by this starter to make it impossible for a balky horse to impede the car after having given one pull. This is very important, as it insures a ready and positive start. The power is then applied directly, in the most advantageous manner, propelling the car forward for from twenty to twenty-seven inches. The draw bar being then pulled out as far as possible, the car is drawn in the usual way, until it is again stopped. In passing around curves this device is especially effective, as it transfers the pull to the middle of the car, thus diminishing the lateral or twisting strain which tends to make the car bind on the track.

The actual saving of power in starting a car with Hansell's car starter is 33 1-3 per cent. If a car is stopped on an up grade, it will be prevented from retrograde movement by the pawl and ratchet, giving the driver the use of both hands and consequently full control of the horses, the brake being entirely unnecessary, and the car will be started from a state of rest.

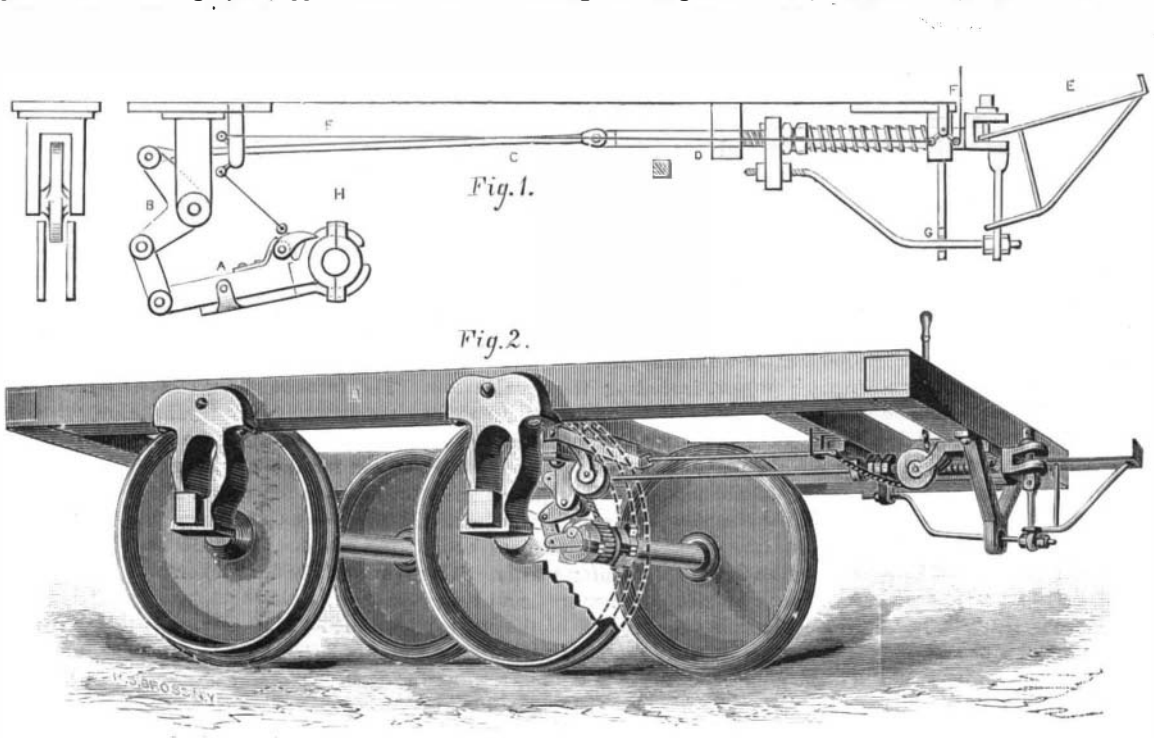
When this starter is applied to a car in the process of construction, the ratchet wheel is simply keyed to the axle; but when it is applied to cars already built, the ratchet wheel is split and is held in place by bolts.

This device relieves the horses of dead weight in starting the car, and renders the operation of car-starting as easy as car-drawing. We are informed that horses with galled shoulders have been rapidly healed while working regularly drawing cars with this improvement attached. This invention may be applied with great advantage to cars propelled by steam, the lever, A, being connected with the draw bar in substantially the same way as in the case of street cars. With steam cars as with horse cars the greatest power is exerted in starting, and the application of this device by reducing the amount of power required to start will permit of using lighter engines in propelling the trains.

This starter not only saves horses from strains which wear them out more rapidly than all the steady work they accomplish, but it saves enough every year in horseshoes alone to pay for its application to a car, and it relieves the car from the racking strains which loosen the joints of the wood work and cause every window and timber to rattle. It is stated that a car with this improvement attached will last twice as long as a car of ordinary construction which is started by a direct pull in the ordinary way. A first class car costs $1,000, and, as commonly used, becomes rickety in five years. With Hansell's car starter applied the same car will last at least ten years.

The device requires no attention whatever, needs no oil, and will outlast the car to which it is applied. It is as simple as a piece of mechanism can be to accomplish the work and is always ready for use.

Many attempts have been made to apply to a car apparatus for storing the power lost in stopping, and to expend the power thus stored in starting the car. Other devices have been tried which employ a combination of springs and



HANSELL'S CAR STARTER.

levers to start the car, but all of these have failed either through inefficiency or from their complicated nature. It is an admitted fact that anything to be applied to a car for this or any other purpose must be perfectly simple and absolutely free from liability to get out of repair. This device has these qualities, besides being very efficient for the purpose.

There are many points in favor of improvements of this class which will suggest themselves to those practically acquainted with the management of street-car lines, and it is deserving of attention not only as a matter of money saving but from a humane point of view. Any one witnessing the efforts of horses in starting a heavily laden car can but wish that a device calculated to relieve the animals from these extraordinary strains might be put into practical use.

The inventor informs us that the car starter has been critically examined by competent engineers during its several months of trial, and they have spoken in the highest terms of its value and practicability. However, the device needs no special indorsement, as any one familiar enough with mechanics to understand its construction and operation will readily admit that it must be efficient.

For further information address Mr. Thomas H. Kemble, 617 North Sixteenth street, Philadelphia, Pa., or the Inventors' Institute, 733 Broadway, New York, where a model of the invention may be seen.

AMERICAN INDUSTRIES.—No. 54.

THE MANUFACTURE OF STEEL.

The Pittsburg Steel Works of Messrs. Anderson & Co. are among the oldest in the United States, having been established in 1845, more than a third of a century since, long before railroads became universal, and at a time when it was generally thought that fine steel must necessarily come from England. But the steel industry has outgrown almost every other manufacture, and the quality of the various products is fully equal, if not superior, to anything imported.

The Pittsburg Steel Works had a small beginning, but as time passed they gradually developed, adapting themselves to the numerous and constantly increasing wants of the country, until they now cover a larger area and produce steel for a greater variety of purposes than any other mill in Pittsburg. Its managers are men of energy, perseverance, courage, and practical ability, who have fostered the growth of inventions in the manufacture and application of steel, and whose efforts have been very fruitful in the development of industrial resources.

Wherever a particular kind of steel has been required for a particular purpose it has been characteristic of this firm to embody the new form of steel in their manufactures. As a consequence of this they have many specialties in their business, among which may be mentioned the five-plate safe cast steel, which is used exclusively by Hall's Safe and Lock Company, of Cincinnati, whose safes are largely used throughout the United States; agricultural steel, which is used in the large plow factories of the West; steel for hoes, for shovels, also for forks, harrow teeth and rake teeth; grain drill, reaper, and machinery steel, and, in fact, steel for every variety of agricultural implement. They have acquired a reputation in the Eastern States for a fine quality of steel used in the manufacture of table cutlery, which is equal to any of the Sheffield productions. They have also a large railroad trade in frog points, side bars, and heel plates for switches, and they manufacture steel for hammers, chisels, and drills, which is generally used in the quarries of New England. Most of the steel rods from which the wire was drawn for the Brooklyn Bridge was furnished by this firm.

To turn out all these products, Messrs. Anderson & Co. employ 575 men, whose wages amount to $400,000 yearly.

The general appearance of these extensive works is shown in the small perspective forming one of the views in our title page engraving, and the interior views convey an idea of some of the operations conducted here.

The plant consists, briefly stated, of five 24 pot Siemens furnaces, 3 sets of coke hole furnaces, 6 converting furnaces having a weekly capacity of 90 net tons, 3 single puddling furnaces, 16 hammers, a rake tooth shop, 10 trains of rolls, two of them being 20 inch plate rolls, one 16 inch bar, one universal train, one 16 inch spring, two 16 inch sheet, and one 8, one 9, and one 10 inch guide.

The wire rod mill was erected in 1877 on the Belgian system, with a capacity to turn out 20 tons of No. 5 crucible steel every ten hours. One hundred and fifty pots can be used at each heat in the steel works. These are run double turn, making three heats each turn, making them equal to 900 single pots daily. The annual output is 15,000 net tons, the product is cast and German plow steel, plate steel, and the best edge-tool steel. The cast steel consists of selected pieces broken and melted in the crucibles and poured into ingot moulds. It is afterward reduced to bars or sheets by hammering and rolling. One of the upper views in our engraving shows the crucible furnaces in the foreground, and the iron ingot moulds being filled with melted steel in the middle ground.

The open hearth steel works, added in 1879, contain one 15 gross ton and one 7 gross ton Siemens open hearth furnace, one blooming mill, and one plate mill. The 15 ton furnace, which is shown in our engraving, is the largest in this country.

The rod rolling mill, shown at the top of the engraving, turns out rods for wire manufacturing, and one of the smaller views shows one of the trains for rolling sheets of steel. Under the huge steam hammer shown immediately below an ingot of heated steel seems as plastic as clay.

The lower right hand view shows several of the immense shears employed in cutting agricultural steel into the hundreds of shapes in which it is required.

THE MILL IN OPERATION.

To a person unaccustomed to the scene, a sudden introduction to the whirr, clatter, and roar of a vast establishment like that under notice is confusing. Trip hammers pound, trains of rolls whirl out the flaming iron or steel, engines puff and rattle, furnaces glow with white heat, and the heated iron or steel flashes as it is drawn out. Immense shears clip great sheets of iron as easily as ordinary shears would paper. Vast grindstones smooth and polish the plow colters, and up and down, intense activity, wondrous power, and seeming confusion are apparent amid the most deafening noise. But there is no confusion. The mill is departmentized. Each set of hammers, or train of rolls, or set of shears, or engines, is under a superiutendent or manager, who is responsible for the quality of the work. Rigid accountability follows every department of the work—the standard in this mill being as near absolute perfection as it is possible to reach. It seems amazing that administrative capacity should be so developed as to follow the broken scraps of steel or pigs of iron, from the weighing room, through all the stages of manipulation, till they come out in the form of the most perfect steel now manufactured in any part of the globe, and yet avoid confusion, loss of time, waste of material, or loss in any form. Yet it is done here in the quietest manner and without display of any kind. It is confusing to think of the accuracy in technical knowledge essential to the management of such works. The tensile strength, resistive force, enduring power of the product is to be considered; the combination of material, the chemical properties involved and to be produced. The changes of the rude lumps of pig iron from one quality to another, till it is beautiful finished steel, are perplexing to the uninstructed mind. And then the business aspects of the affair! They involve the closest study of economy, the successful dealing with many men, the survey of the world, its wants, demands, present and prospective, in the line of steel. The proprietor of the works under mention looks upon the broad world as a market. Every section of this country, South America, and Europe, afford the market. It broadens one's conception of the importance of our great manufacturing establishments when we realize how vast is the scope of their trade, and how closely they must study the competitive forces arrayed against them.

THE SIEMENS FURNACES.

In appearance, these furnaces resemble coke ovens, flattened at the top. The pots, containing the metal to be melted and manipulated, are let down through long, narrow slits, at the top, and are thence taken out when ready. The fuel used is gas, manufactured for the purpose, and mixed with air, and introduced under the furnaces by means of huge pipes. The heat generated rises to 3,000° Fahrenheit—the most terrible intensity of heat known to be artificially produced. The men who take out the pots of melted metal stand over these slits, at the top of the furnace, exposed for the moment to the intense heat, and with long iron pincers grasp the pots of melted metal, lift them out and pour the metal into receptacles to cool. These men have cloths wrapped around their limbs, and thoroughly saturate them with water before going to the furnaces, thus preventing the burning of clothes or body. In a moment they turn away, smoking from the intense heat.

THE SIEMENS PROCESS.

It may be of interest to our readers to know of the process by which steel is manufactured under this patent. This process was introduced in this country by Mr. Anderson. Cast steel is made from blister steel, broken into fragments, and carefully selected as to temper, placed in crucibles of plumbago, lowered into the smelting furnaces, and exposed to the heat of 3,000°. The most exact skill is required in this part of the process. When the contents of the crucible are ready for pouring they are poured into an iron flask, or mould, forming ingots of various sizes. Four hours are required to transform blister steel into cast steel. The Siemens furnace consists of two distinct parts, the producer, in which the fuel is converted into gas, and the furnace proper, including the regenerators. The furnace proper is composed of one heating and four regenerating chambers. The latter are placed beneath the heating chamber in such a manner as to leave space between for the passage of air and gas. The gas enters at the bottom of one of the chambers, the air enters the neighboring chamber, and the two, mingling at one end of the furnace, produce an intense and uniform flame. This heat is utilized entirely, passing the regenerators, and being used in various ways. Thus, by the reversal of the current of heated gas, it is thoroughly used, producing a continuous heat of 3,000°. The action of the furnace is so perfect that the gases which enter the stack through the waste flue to be cast into the air do not exceed 300° Fahrenheit. This is the process which has been in use here since 1868, when this firm first introduced it into this country.

This vast business in all its extensive ramifications requires executive ability of a high order. The established success which the works have achieved is largely owing to the untiring industry, indomitable perseverance, and persistent energy of Robert J. Anderson, who twelve years ago, in connection with other partners, purchased the business from Jones, Boyd & Co., the senior member of which firm opened the business in 1845. The business has thus changed hands only once in thirty years. The best evidence of successful management is found in the fact that all through the last several years of financial depression these works have never stopped except for repairs, having run double turn, and sometimes the whole twenty-four hours of the day. They are now turning out agricultural steels, and bid fair to have a future as successful as the past. Progressive in their ideas, fully up to the wants of the age, having all the elements of success, they cannot fail to obtain it.

Representatives of this firm are located as follows: A. B. Parker, No. 21 Astor House, New York; Wm. F. Potts, Son & Co., Philadelphia, Pa.; Carolan, Cory & Co., San Francisco, Cal.; Augustus Wessel, Cincinnati, Ohio; Tronell, Handy & Greer, Baltimore, Md., and Miles & Cotton, 170 Lake St., Chicago, Ill.

ASTRONOMICAL OBSERVATIONS AT HIGH ELEVATIONS.

The progress of modern optics is now furnishing observers with telescopes of a power which exceeds the capacities of our lower atmospheres for their constant employment. The obstacles to definition due to this atmosphere have grown to be so nearly a barrier to any rapid progress that attention has lately been given to the conditions of vision which it is very commonly supposed will be found to be best on mountain summits. There is no exact information on this subject, however, and Prof. S. P. Langley was therefore led to make some observations on Mount Etna during a visit there in 1878, and the result of which he records in the July number of the *American Journal of Science and Arts*. His object was to gather some sort of quantitative estimate of the degree of transparency and definition, to take the place of vague statement, and to give a kind of standard for comparison with sites in our own territory. The station chosen was "Casa del Bosco," at an elevation of about 4,200 feet. The observations were directed to the sole end of determining the character of vision, as tested at night on stars and nebulæ, and by day upon the sun. After a limited number of comparisons, he infers that at this station about nine-tenths of the light of a zenith star reaches us, and that only one-tenth is absorbed by our atmosphere. The gain on Etna over a lower station, as tried by the tests of a double star observer, was more in clearness of the atmosphere than in that freedom from tremor which accompanies good definition. The latter was indeed upon the whole better than below, but not conspicuously so.

Prof. Langley concludes, as the result of his researches, that the balance of advantages for astronomical observations is most likely to be found in a dry atmosphere, and certainly at a great elevation. Such elevations have undoubtedly the advantage of diminishing the atmospheric absorption of the more refrangible rays, an absorption so important that it probably cuts off from us the larger portion of the ultra violet spectrum. The gain for observations of precision will be, though positive, not in itself probably such as to justify the difficulty and expense of such a site; but for the study of the nebulæ and stellar photometry the gain is very essential indeed, while for almost every problem in solar physics it may be said without reserve that, for rapid progress, such observations have now become not merely desirable, but indispensable. The summit of a lofty mountain, however, is not a desirable station. At an altitude of 10,000 or 11,000 feet the observer may still enjoy all the conditions of health that fit him for labor, but beyond this unfavorable conditions increase very fast.

Quoting from his own experience of a stay of ten days upon Pike's Peak, at an altitude of between 14,000 and 15,000 feet, Prof. Langley says that at this height the attenuated atmosphere makes a long stay impossible for some, while even for the healthiest the conditions of life begin to be such as to render continuous hard work scarcely possible. At the same time the mountain condenses about itself continuous clouds, so that, except during a brief period in the autumn, the opportunities for observation are far rarer than on the plains. A dry climate and a table land at an elevation of something like 10,000 feet, sheltered on the side of the prevalent winds by a mountain range, which precipitates their moisture in clouds that rarely advance beyond the observer's horizon, appear to be the most promising conditions in our present knowledge. Upon the whole, though the ideal station, where atmospheric tremor does not exist, and the observer pursues his studies in an ever-transparent sky, is not to be found on any part of the earth's surface yet examined, we find, says Prof. Langley, within our own territory, in the dry and elevated table-lands of Colorado or New Mexico, every condition which experience points out as favorable.

Our Leading Cities.

Cities.	1880.	1870.	1860.
New York	1,208,471	942,252	813,669
Philadelphia	843,000	674,022	565,529
Brooklyn	554,693	395,099	266,661
Chicago	502,940	298,977	109,260
St. Louis	395,000	310,864	212,418
Boston	352,345	250,526	177,841
Baltimore	350,000	267,354	212,418
San Francisco	280,000	1 9,473	56,802
Cincinnati	246,153	216,239	161,044
New Orleans	215,239	191,418	168,675
Washington	160,000	109,204	61,112
Cleveland	156,946	92,829	43,417
Newark	136,983	105,059	71,941
Milwaukee	130,000	71,440	45,246
Detroit	119,000	79,577	45,619
Louisville	112,000	100,753	68,033
Jersey City	105,000	81,744	29,226
Providence	104,500	68,904	50,666