As much as 11 and $\frac{1}{10}$ is less than 10 and $\frac{7}{10}$ of 100, that much he has gained in power over what the popular theories in science says he could have gained, by the mechanical power up an inclined plane, added to this, he has gained the full amount of power that necessarily must be lost by friction Can you or any of your scientific correspondents explain this matter?

The gentleman alluded to, says that theories of science are wrong about not being able to create power by the application of the lever, and that the idea of creating power by moving through a greater space is only a coincident that attends the lever power by which it can be mathematically calculated. That it does not by any means follow that a gain of power is a necessary result of moving through a greater space. That an erroneous idea of the wedge being a mechanical power that could be mathematically calculated the same as the lever, has grown out of this mistaken theory.

To those who are disposed to treat his theory with contempt he can produce the ocular demonstration of the fact above stated, which to the practical man is much more important than fine spun theories. H. H.

Berlin, Wis.

[We see nothing strange in moving 100 lbs. four feet up an incline of four and a quarter inches by the weight of 8 lbs. 14 oz. provided the lesser weight is allowed space enough, an element which seems to have entirely escaped the attention of our correspondent. Is he not unnecessarily exercising himself about a problem which is solved every day in many ways?—[EDS.

Cleaning Marble.

MESSRS. EDITORS:—It may be of some value to telegraph operators, who have marble-based instruments and housekeepers who have marble-top furniture, to know that a common solution of gum arabic is an excellent absorbent and will remove dirt, etc., from marble.

First, brush the dust off the piece to be cleaned, then apply with a brush a good coat of gum arabic,about the consistency of thick office mucilage, expose it to the sun or dry wind, or both. In a short time it will crack and peel off. If all the gum should not peel off, wash it with clean water and a clean cloth. Of course, if the first application does not have the desired effect it should be applied again. C. G. F.

La Grange, Ky.

The Time Extended for Obtaining Patents in New Brunswick.

GENTLEMEN:—We forward you herewith notices of the granting of Letters Patent, to two of your clients, in the Province of New Brunswick. The new Patent Law for the entire Dominion will not come in force until after the meeting of the general Parliament some time during the coming Fall. In the meantime, by proclamation of the Governor General, under date of 1st of July, the present Lieut. governors of the Provinces are to hold office until further orders, and all existing laws to remain in force until repealed by new laws. The privilege of granting patents in New Brunswick, to foreign citizens, therefore still holds good, and will continue so until the passage of the new law. Any of your clients who may be desirous of securing their inventions, have therefore a few months left in which to do so. Of the provisions of the new law when passed, with reference to granting Letters Patent to foreigners, we have no certainty. Your clients had better take advantages of the present liberal law of New Brunswick, while the same is in force.

Your ob't serv't, L.

MESSRS. MUNN & Co., NEW YORK.

[Inventors desiring to avail themselves of the limited opportunity of obtaining patents in New Brunswick can have the business transacted through this office. Full information given on application to Munn & Co., office SCIENTIFIC AMERICAN 37 Park Row, N. Y.—EDS.

Delay at the Patent Office.

MESSRS. EDITORS:—Your appeals to the Commissioner of Patents to devise means so as to work up the accumulated business of the office, are well timed and just. As inventors pay the expenses of the concern, it is but just to them that promptness and dispatch should characterize the business transactions of the Patent Office. I have had a claim pending five months. How much longer I must wait remains to be seen. In a former patent I was twelve months in getting through to a finality. In reflecting over the delay I concluded that the efficiency of the attorney employed has much to do with the case. Having several more inventions for which I design making application for patents I have concluded, when I am ready, to try the editors of the SCIENTIFIC AMERICAN.

Some time ago I saw a notice of an invention to make glass from native ore, which the statement said had the tenacity of cast iron. Can you tell where it is made and the address of the manufacturers?

In a late number of your journal I see an article on the uses to which paper can be applied. Among them is that of making water tanks and pipes. If that branch is a success could it be used to advantage in the construction of pumps, that is, pump tubing? If so I would like to correspond with papier maché manufacturers. JOHN W. SHEAFFER.

Sterling, Ill.

[The inventors will be moved to hold an indignation meeting if a reform is not brought about pretty soon. The Patent Office was not established to yield a revenue to the government, and now when there is a surplus of money, it is a shame that it should be crippled in its efficiency.

The publication of our correspondent's inquiries will probably bring him in communication with the parties he desires to know.—EDS

Science Familiarly Illustrated.

Ventilation.

Look at an asthmatic sitting before an open window, regardless of the cold, though it be winter, with his chest heaving laboriously and his countenance expressive of exquisite anguish. What is the matter? Is he in pain? No. What, then, is the distress? It is simply from want of a due supply of fresh air. The spasm in his lungs not only prevents the free admission of air from without, but the free egress of that which is within, so that the air which is in the lungs is a mixture of foul and good air.

When so many died in the famous Black Hole at Calcutta, it was because the pure air was so shut out that they could not even get as much as the asthmatic does.

Here we have palpable results, and they startle us; and yet we may be suffering from day to day, in so small a way as to be imperceptible, the evil results of a deficiency of air, which may so accumulate as to impair the health, and even perhaps ultimately destroy life. It is only a few that occasionally lose their lives suddenly from want of air, but a comparatively slight but continuous deficiency in its supply is constantly destroying vast multitudes by a slow poisoning.

A good supply of fresh air is an imperative necessity. Such a supply it is easy to get when we are out of doors; but we do not get it when we are indoors unless we make special provision for it—or, in other words, unless we take measures to secure ventilation.

A proper supply of pure air in our habitations and places of public meeting *costs something*, at least in cold weather. That is the chief difficulty. Economy is in the way. Less fuel is required with defective than with proper ventilation.

A small room closely shut up is warmed at less expense than a large room with suitable inlets for fresh air, and outlets for foul.

The necessity for freeness in ventilation may be seen if we look at the amount of fresh air required for consumption. Each person requires a gallon every minute, that is fourteen hundred and forty gallons in twenty-four hours. It is easy to see that small and closely shut-up apartments, and large gatherings of people in public buildings, as they are ordinarily constructed, are incompatible with any such supply as this.

That you may see clearly what the necessity for ventilation is, observe what the lungs actually do with the air which they receive.

Pure air is composed of three gases, in certain proportions: oxygen, nitrogen, and carbonic acid; this latter being in very small quantity. These proportions are altered in the lungs, so that the air which is breathed out is different from that which is breathed in. It has less of oxygen and more of carbonic acid.

It is less vivifying by the loss of oxygen—that is, is thus negatively injured—and it has also acquired a positively bad character by the increase of the carbonic acid. Much increase of this renders the air palpably poisonous.

If, therefore, there be great lack of ventilation, as there often is in small rooms in dwellings, or in crowded public assemblies, much injury is done to the health by the diminution of vigor from the loss of oxygen, and by the direct poisonous influence of the added carbonic acid.

And if the exposure of these deleterious influences be frequent, there will inevitably be an accumulation of evil results, seen in a broken-down system, in positive disease, and at length in death.

Observe what provision is made in nature for the constant purification of the air, and how this is often more or less defeated by the arrangements of man. As oxygen is taken up in the lungs of all animals, and carbonic acid gas is sent forth from them, breathing is continually deteriorating the air. But this is remedied by a counter operation.

Every leaf that you see is doing just the opposite of what lungs do—it takes in carbonic acid and emits oxygen—so that there is an exchange going on between leaves and lungs. In this way the due proportion of the ingredients of the air is everywhere maintained, so that if the chemist examines air taken from various quarters of the earth, he always finds precisely the same proportions.

But this is true only of air that is free, and not of that which is shut up where there are sources of contamination. Wherever there is breathing going on, if ventilation be not properly attended to, there is a want of these natural proportions, and the deterioration is increased by fires and lights, for they, like lungs, use up oxygen, and return carbonic acid to the air.

There is still another important provision for the purification of air.

The three ingredients of the air are not of the same specific gravity. The carbonic acid gas is decidedly heavier than the oxygen and nitrogen, and therefore has a tendency to lie below them, as water lies below oil.

Now if this tendency were not obviated in some way, the carbonic acid, generated from lungs and fires and various decompositions, would accumulate all over the surface of the earth, pushing up the oxygen and nitrogen above it as water does oil, and would destroy life, and put out fires everywhere.

But this tendency is obviated by another—the tendency of gases to mingle together. It is just as the heavier water does not remain below the lighter alcohol poured upon it, but mixes with it. Agitation promotes this mingling, and therefore, in ventilation, the communication of motion to the air is an important measure, and should be accomplished so far as it can be done, without inconvenience.

There are other deleterious gases besides carbonic acid, produced in various ways, indoors and without, that are carried off by this same mingling and diluting process; but of these we will not speak, the carbonic acid being the most important.—*London Herald.*

London.

The growth of the town since the happy year when Londoners learned how, with proper accuracy, to count their own noses, presents us a record full of interest, and at the same time to us full of wholesome admonition to cultivate a grace rarely found in America—urban modesty.

In 1801 the population of London was			864,845
In 1811	"	"	1,009,546
In 1821	"	"	1,225,694
In 1831	"	"	1,474,069
In 1841	"	"	1,873,676
In 1851	"	"	2,363,141
In 1861	"	"	2,803,034

Taking the last census in each country as the standard of comparison, it appears that during the ten years preceding 1861 London added to itself a new city one half the size of New York, more than twice the size of Baltimore, nearly three times the size of Boston, more than three times the size of Cincinnati or St. Louis, and more than four times the size of Chicago. If the eight cities of Buffalo, Rochester, Albany, Pittsburg, Newark, Providence, Portland, and Milwaukee had been taken up bodily in 1861, put on shipboard, conveyed across the Atlantic, and deposited on the fringe of the skirts of London, they, with their united populations, would not have added to London so much as London quietly added to itself during the previous decennial period. Every twelve months a new city springs into being along the globous verge of London equal to the city of Cleveland.

Several years ago the metropolis, like some fabulous Cyclops, sprawled out upon its couch of 78,000 acres; but the original *city*, the venerable parent of this gigantean monster, is still content with that pigmy bed of 723 acres on which it has reposed for a thousand years. The *city*, though so small, is still the center of the trading, financial, and journalistic life of London, and has, it seems, a day population of 283,520 souls, and a night population of only 113,387 souls. Thus, every morning there come rushing into the city from suburb and rural cottage and country villa, to toil and get rich with in the narrow walls of the old city, 170,133 persons, while there are 509,611 customers and clients who enter the city every day to deal with them. What tremendous energy, then, must be in the systole and diastole of this Cyclopean heart, whose throb can suck in and expel every day along its veins and arteries a living stream of 728,986 human beings!

Every morning nearly a million of men make a rush to get into a space of seven hundred acres, and every night they make a rush to get out of it. No wonder that in addition to streets on the level of the houses they are compelled to build streets under the houses and streets over the houses, and that in a few years there must inevitably be three continuous cities of London—terrene London, subterrene London and superterrene London. But the swollen and congested state of the veins and arteries of the mighty town is not the only source of anxiety. What shall London do for lungs? A meeting assembled some time ago, under the call of the Lord Mayor, to consider the peril arising from the disappearance of commons and open spaces in the neighborhood of the metropolis. The meeting was addressed by Thomas Hughes and other gentlemen of note. Mr. Benjamin Scott, the excellent and versatile chamberlain of the city, said that in dealing with the question before the meeting they should not confine their calculations to 3,000,000 inhabitants. He found that in 1861 there were 3,322,717 persons living within an area of sixteen miles, taking Charing Cross as the center. An increase of population had been going on within that area during the past half-century at the rate of 19$\frac{6}{10}$ per cent every ten years. In fifty years, at this rate, the population of the same area would be 8,532,000 souls. What would be their position fifty years hence if they were allowed only the radius at present supposed to be sufficient? He found that in 1801 the people were twenty yards from each other, in 1851 about fourteen yards, and in 1866 something over nine yards. If this diminution of space went on for fifty years more, they would be more closely packed than his audience were at that moment—in fact there would be no standing room for them.

We may get some impression of the present magnitude of London by looking at a few details of its colossal state. Its houses number more than 350,000, and its streets, if placed in line, would extend from Liverpool to New York, and are lighted at night by 360,000 gas lamps, consuming every twenty-four hours about 13,000,000 cubic feet of gas. Of the water supply 44,383,328 gallons are used per day. The traveling public sustain 5,000 cabs and 1,500 omnibuses, besides all the other sorts of vehicles which human need can require or human wit invent. Its hungry population devour in the course of every year 1,600,000 quarters of wheat, 240,000 bullocks, 1,700,000 sheep, 28,000 calves, 35,000 pigs, 10,000,000 head of game, 3,000,000 salmon and innumerable fish of other sorts, and consume 43,200,000 gallons of beer, 2,000,000 gallons of spirits, and 65,000 pipes of wine. As a consequence 2,400 doctors find constant employment. London, finally, supports 852 churches which are presided over by 930 divines of greater or less note.—*The Nation.*

THE NEW ISLAND.—One of the vessels of the expedition which sailed in search of our new insular possession in the Pacific returned to San Francisco with only part of her crew, and taking on board a large force of men set sail again on the next day, under a fishing license. Public curiosity is much excited as to what the new land contains that the explorers are so anxious to secure. The position of the island is 40° 31 north latitude and 151° west longitude, and the discoverer reports the land dotted with birds, and the water alive with seals and sea elephants.

Automatic Device for Holding Horses.

As a servant and companion of man the horse is a useful and valuable animal, but when he takes the bits between his teeth, when, as Job says, "he paweth in the valley, and rejoiceth in his strength," when he "swalloweth the ground with fierceness and rage," that is, takes a race-course gait, he becomes a troublesome customer.

Multitudes of accidents to life and limb are daily chronicled in the papers caused by runaway horses. Valuable lives are lost, persons crippled for life, and property to a large amount destroyed for the want of properly hitching teams, or neglecting to tie them at all. Hitching posts are not always convenient, and so the driver, hoping his team will stand during a momentary absence, leaves them; they are startled by a fluttering paper, a puff of steam, or the screech of a whistle, and he returns to find his vehicle a wreck and his team ruined.

There have been several devices to prevent horses from running away when the driver was absent such as the strap and weight used by physicians, as an anchor to the horse, and an attachment of a halter to the wheel by means of some mechanical device, but this one claims to possess advantages over any other which has yet been tried.

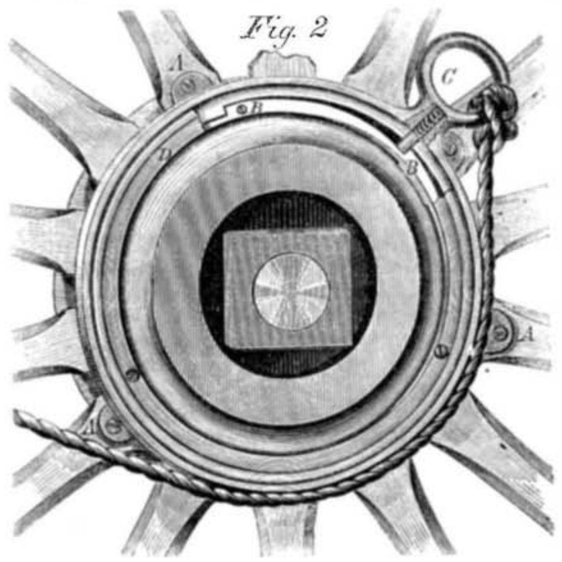
Fig. 1 gives an idea of the device as attached to a wagon, and Fig. 2 shows its construction and operation. It is a ring surrounding the hub of a wagon or carriage, and secured to the spokes by the lugs and screws, A. This ring has, on an inner projection, a series of ratchet teeth, as seen at B, with which a catch sliding into a receptacle in the shank of the loop, C, engages, being moved forward by a light spiral spring. The loop, C, forms a part of an exterior ring which turns freely on the ratchet ring and is secured in position by the back projection of that, and also by the outer casing or ring, D, which is represented as broken away, to show the inner ratchet, for about one fourth the circumference.

It will be seen now if the reins of the horse, or a halter, be secured in the loop, C, (in the engraving a common rope is shown,) any effort of the horse to start or run away will only result in winding up the line, and the further he draws the carriage the more the line will be wound around the hub. Of course the pull upon the horse's mouth will be very severe as the leverage is so great. In one direction, the pawl would, of course, merely slide over the teeth of the ratchet, while, in the other, the wheel could not be moved far until the pawl became obstructed by the teeth of the ratchet. The first is the condition of being "backed," the other the moving ahead. Beside being a preventive of danger, this device seems to be admirably adapted to break young horses to stand.

This improvement can be attached to any carriage, wagon, or other vehicle without making any alteration in the wheel hub, and is so simple as not to be liable to get out of order. It was patented through the Scientific American Patent Agency, Nov. 13, 1866. Further information regarding it may be obtained by addressing W. B. Chapman & Co., La Salle, Ill. [See advertisement on another page.]

Fig. I.

Fig. 2



CHAPMAN'S HORSE HOLDER.

THE SIEMENS FURNACE.

There is a small collection of gas-furnace models exhibited at Paris by Messrs. Siemens, and now distinguished with the highest prize of the international jury, viz., the "grand prix." It may be said with justice that the Siemens furnace in this present Exhibition holds much the same position which the Bessemer process held in 1862, viz., that of the most important and most successful metallurgic invention of the day. It is hardly less important than the Bessemer process, and although its invention dates about as far back as Mr. Bessemer's patents, it has only lately attained commercial success. In the space of the last five years the Siemens furnace has not been very materially altered or improved, but it has been largely introduced and its success established in many different branches of industry. The first manufacturers in England who availed themselves of the new furnace, were the glass-makers. For purposes of metallurgy greater difficulties and prejudices required to be surmounted. Some of the steel makers on the continent led the way. Mr. Mayr, of Leoben, in Styria, we understand to have been the first to introduce the new furnace for crucible steel making on a large scale. In this instance the unfavorable position of the Styrian iron works with regard to the supply of mineral fuel, was the principal inducement to apply gas in the steel-melting furnace. The gas is made at Mr. Mayr's works, from lignite, which cannot be directly applied for melting steel, as the heat from it when burnt on the grate, is not sufficient to produce the high temperature required for this operation. Mr. Mayr erected ten gas furnaces, and they have proved a complete and perfect success, enabling him to make crucible cast steel by means of the cheap and very inferior lignite which exists in his locality. Within the last two years the Siemens furnace has been adopted in all the larger Bessemer steel works in England. In France, the Siemens furnace is gaining ground with equal rapidity, and there are now twenty furnaces in course of erection under Mr. Siemens' own superintendence at the Creusot Works.

There are two distinct principles embodied in the Siemens furnace, viz., the application of gaseous fuel, and the regeneration of heat by means of piles of bricks alternately passed over by the waste gases and by the gases entering the furnace before their combustion. The gas producer is a brick chamber about 6 feet wide by 12 feet long, with its front wall inclined at an angle of 45° to 60°, according to the nature of the fuel used. The inclined plane is solid about half way down, and below this it is constructed as a grate with horizontal bars. The openings for introducing the coal into the gas producer are on the top or roof of this chamber, and the air which enters through the grate effects the combustion of the coal at the lowest points of the chamber. The products of this combustion rise, and are decomposed by the superposed strata; they are, moreover, mixed with a quantity of steam which is drawn in through the grate from a constant supply of water maintained underneath the latter. The steam in contact with the incandescent coal also decomposes and produces hydrogen and carbonic oxide gas, which are mixed with the gases produced by the coal direct. The whole volume of these gases is then conducted to the furnace itself by means of wrought-iron pipes. The gases enter one of the regenerators. The regenerators are chambers packed with fire-bricks, which are built up in walls with interstices and air spaces between them, allowing of a free passage of gas around each single brick. Each regenerator consists of two adjoining chambers of this kind, with air passages parallel to each other, one passage destined for the gaseous fuel, and the other for the supply of atmospheric air required for combustion. Each furnace has two such regenerators, and a set of valves is provided in the main passages, or flues, which permit of directing the gases from the producer to the bottom of either of the two regenerators. The gases, after passing one regenerator, arrive at the furnace, where they are mixed with the air drawn in at the same time, and produce a flame of great heat and intensity within the body of the furnace itself. They then pass, after combustion, into the second regenerator, which forms a set of down flues for the waste gases, and ultimately leads them off into a common chimney On their way from the furnace to the chimney, the heated products of combustion raise the temperature of the fire bricks over which they pass, to a very high degree, and the gases are cooled more and more the further they proceed through the regenerator. After a certain time the fire bricks close to the furnace obtain a temperature almost equal to that of the furnace itself, and a gradually diminishing temperature is arrived at in the bricks of the regenerator proportionate to their distance from the furnace. At this moment the attendant, by reversing the different valves of the furnace, opens the heated regenerator for the entrance of the gaseous fuel and atmospheric air, at the same time connecting the other regenerator with the chimney for taking off the products of combustion. The entire current of gases through the furnace is thus reversed. The cold air from the atmosphere, and the comparatively cold gases from the producer, in passing over bricks of gradually increasing temperature as they approach the furnace, become intensely heated, and when they are mixed in the furnace itself, enter into combustion under the most favorable circumstances for the production of an intense heat. The principle of this so-called regeneration of heat, therefore, consists in storing up the waste heat in one set of fire bricks, and afterward making use of that heat for elevating the temperature of the fresh gases introduced for combustion. The action of these regenerators is so perfect that, with a temperature of somewhat about 4,000° in the furnace, there is no more than about 300° to be felt at the base of the chimney, the escaping gases having a temperature no greater than is absolutely required for maintaining the draft.

This is the present state of this beautiful and important invention. It has supplied us with the power of maintaining an exactly regulated temperature in a furnace of any required size and shape; it has made us practically independent of the quality and nature of the fuel used for producing the required heat from the most moderate, up to the very highest temperature. It has reduced the expenditure for fuel to a very great extent, and it has given us one of the greatest desiderata in so many metallurgical operations, viz., a *clean* furnace, free from ashes, dust, and dirt, and perfectly suitable for the working of the more refined and purified materials which modern industry has produced and is still constantly improving upon. We have further to name as an important feature of the Siemens furnace, the possibility afforded by it of changing the nature of the flame at will, by altering the relative proportion of air and gas admitted through the flues. A surplus of oxygen in the mixture will produce an oxydizing flame, and will give all the corresponding effects upon the materials exposed to its action. By the admission of a surplus of gas, on the contrary, the flame can be made of a reductive character, and used accordingly for de-oxidation. In metallurgy, and particularly in the treatment of iron and steel, this is of the utmost importance. There are already several new modes of manufacturing steel direct from the pig iron, patented and practically carried out in France and in Germany, wherein the Siemens furnace is made use of as an indispensable condition for their success. The Exhibition contains a collection of samples of very fine steel made by M. Berard's process. This is called "Acier à gaz." and is made in a Siemens furnace direct from pig iron. M. Berard constructs a Siemens furnace with the bottom formed into two separate parts, each hollowed out like a dish, and with a bridge between them upon which the pigs introduced into the furnace receive a preliminary heating. The flame is maintained with a surplus of oxygen, and a quantity of pig iron is melted in one of the chambers or dishes. The oxydizing action of the flame decarburizes and refines the pig iron, and after a certain time a second quantity of pigs is thrown into the second dish and melted there. The flame is now reversed in its direction; the oxydizing flame is made to enter at the side where the fresh pig iron is placed. In passing over this, and oxydizing the carbon, silicon, and other impurities in the iron, the flame loses its surplus oxygen, and becomes of a neutral, or at least only slightly oxydizing character. In this state it passes over the other bath of molten iron, now partly refined, and it continues to act upon the impurities without attacking the iron itself. At a certain moment this portion of iron is completely converted into steel, and that part of the furnace is then tapped so as to make room for a fresh charge of pigs in that place. After that the current of gases is again reversed, the second bath now entering into the position previously taken by the first, and so the process is carried on continuously with two portions of iron, one freshly introduced and acted upon by the oxidizing flame, the other partly converted into steel and exposed to the neutral flame passing away from the first. M. Berard states that by protracting his process, and by adding speigeleisen, he can remove sulphur and phosphorus from the iron, and make steel from inferior pigs. Such statements, however, have been so frequently made by inventors, without having been borne out by facts in actual practice, that we must be cautious in accepting them.

Messrs. Emile and Pierre Martin, of Sireuil, have also commenced steel making in a Siemens furnace. They melt a quantity of pig iron, and introduce wrought-iron scrap, puddled steel, or other malleable iron into the mass while exposed to the oxydizing influence of the flame. They have produced steel of excellent quality by this method, and are now about to introduce their process into several steel works in France. The great advantage obtained by them, and one which has not yet been arrived at by the Bessemer process, is the conversion of old iron rails and similar articles into steel. This is a great desideratum—particularly at this present moment of transition of the permanent way from iron into steel—is well known, and attempts have been made by Mr. Bessemer, Mr. Adamson, and several others, to effect the same thing in