Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union *eight dollars and fifty cents a year.*

Building Edition of Scientific American.

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico. $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign Postal Union countries, $6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign Postal Union countries, $11.00 a year.

Export Edition of the Scientific American,

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," a Spanish edition of the SCIENTIFIC AMERICAN, published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 50 pages, profusely illustrated. It is the finest scientific, industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. $3.00 a year, post paid to any part of the world. Single copies, 25 cents.

☞ Manufacturers and others who desire to secure foreign trade, may have large and handsomely displayed announcements published in this edition at a very moderate cost. MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, JANUARY 18, 1896.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 1046.

For the Week Ending January 18, 1896.

Price 10 cents. For sale by all newsdealers.

THE ADVANTAGES OF THE INDUCED OVER THE FORCED DRAUGHT SYSTEM.

It has been abundantly proved that the excellent steam-raising qualities of the forced draught system are obtained at the cost of a very serious strain upon the material and fittings of the boiler itself.

A certain well known naval authority has characterized it as "an invention of the evil one," and it is a fact that many of the later ships that have been built in European navies have been put through their natural draught trials only, the naval boards not caring to subject the boilers to the severe ordeal of a forced draught trial.

Until very recently it has been a common experience for ships in the British navy to have their trial trips brought to a sudden close on account of leaking tube ends in the tube plate.

There are many fine ships afloat in the navies of the world to day which are provided with all the appliances for forced draught, and yet dare not make use of it except under the pressure of extreme emergency.

There is a further objection to this system, arising from the fact that it necessitates the use of the closed stokehold, in which the firemen work under the air pressure that is set up by the fans; all communication with the outside world being shut off by means of airtight doors. It has been sought to escape these difficulties by substituting induced for forced draught. Induced draught is similar in its action to natural draught, which is the kind that takes place in any domestic or factory flue or chimney.

Broadly speaking, induced and natural draught are the result of a vacuum which is produced at the bottom of the uptake of a boiler, in the rear of the furnace; forced draught results from an excess of pressure of the air in front of the furnace over the atmospheric pressure.

The two expedients which have been adopted in place of forced draught are to be seen on the United States cruiser Brooklyn, in which the natural draught is increased by the employment of smokestacks of exceptional height, and in the British ship Magnificent, where the same result is gained by placing a fan 8 ft. 6 in. in diameter at the bottom of each uptake. In both cases the rush of air through the furnaces is promoted by creating a vacuum at the rear of the furnaces.

The system adopted on the Brooklyn has this advantage, that it saves the weight, first cost, and running cost of the auxiliary engines for driving the fans as used on the Magnificent. Moreover, there is a considerable saving of steam—a weighty consideration in modern war ships, where there are so many auxiliary engines for pumping, lighting, and refrigerating purposes, that already use up a large amount of the total steam supply.

The use of abnormally lofty smokestacks has been tested in the merchant marine in the steamship Scot, which runs from Southampton to the Cape. Her smokestacks measured 120 feet in height from the firebars. Those of the Brooklyn are to exceed this, and the application of the system to this first class cruiser will be watched with great interest by the naval world.

THE ACCELERATION OF RAILWAY SPEEDS.

The question is frequently asked as to how fast a passenger train can be run. The various conditions which affect the making of railroad records are intimately correlated, some being found in the engine, some in the train, and some in the roadbed and track upon which they run.

Taking the standard fast train of to-day as represented by the Empire State Express on the N. Y. C. and H. R. R. R., it can safely be said that when in 1893 it ran for a short distance at over 100 miles an hour, it was for that short spurt traveling up to the very limit of the possibilities of our present system of railway locomotion. The whole tendency of the age toward time saving makes it certain that, before the twentieth century is far advanced, the traveling public will be clamoring for a vastly increased rate of speed over present rates. The experience of the past teaches that when the patrons of a wealthy transportation company, whether on sea or land, demand a faster service—and are willing to pay for it—they usually get it.

We state a few suggestions as to the proper lines of investigation to be pursued in order to effect such improvements.

The Track.—This must be straightened as much as possible. On a tangent the whole tractive effort of the engine is available on the drawbar of the train. On a curve the effort is split into two components, one of which is expended against the outer rail of the curve, while the other is available to haul the train. The component which is lost in the outer rail increases with the increase of the sharpness of the curve; and vice versa, the more we can straighten out or "ease" the curve, the less will be the loss from this cause.

Grades must be Lightened.—The resistance due to grade is too obvious to call for elaboration here.

Heavier Rails must be Provided.—No amount of care can keep a roadbed in perfect level. The storms and frost of winter and the drought of summer will develop soft places. If the steel rail be deep and heavy, it will bridge these weak spots, and preserve the general level. The load of the train is concentrated at certain points of contact, where the steel tire meets the steel rail. The ideal track will distribute this concentrated load as evenly as possible to the widest possible surface of roadbed. For a speed of 75 miles an hour, 100 to 125 pound rail should be laid upon ties 6 inches by 10 inches by 10 feet long.

Better Rail Joints will be Required.—The joints are to-day by far the weakest point, even in our best tracks. The perfect joint should be as rigid, and yet as elastic, as the rail itself. To get the required depth for stiffness it should be of the sub-rail type, associated with some form of angle bar to secure alignment. With the introduction of 60 foot rails, the number of joints will be reduced to one-half, and some of the expense thus saved could be well spent in improving their quality. Whenever it is possible to hear the "click" or "hammer" of a joint, we may be sure that a certain amount of the momentum of the train is being absorbed at that point. A perfect track involves a silent joint.

Engines.—The fast express engine of the future will be a single driver. It has been abundantly proved that 20 tons on one pair of drivers will give all the adhesion necessary to haul an express train of to-day. Engines with single drivers are not troubled with slipping of the wheels, except occasionally in damp weather. At such a time steam sanding apparatus gives the drivers the necessary adhesion. Where loads are heavy, as in the slower and heavier passenger trains, or in freight trains, it becomes necessary to couple on an extra pair of wheels.

The Philadelphia and Reading engine is doing better work with a single driver than its sister engines of the four-coupled type. The single driver engine is easy to counterbalance and the internal friction is largely reduced.

The drivers will be of not less than 7 or 8 feet diameter, and running as they will on 100 to 125 pound rail they can be safely loaded up to 25 tons. This will give sufficient adhesion for 20 or 21 inch cylinders; which, with a steam pressure of 200 to 225 pounds and large steam ports, would give us a locomotive of very large high speed hauling capacity.

Cars.—It is in the reconstruction of cars that the greatest gain will be made. We have for many years been of the opinion that the weight of a Pullman car was out of all proportion to the number of people it carried. In a train made up of Pullman cars, the engine has to haul not less that 1½ tons of dead load for each passenger carried. On the race track the bicycle carries its load at average railroad speed on a deadweight basis of 20 pounds to the passenger. One hundred and fifty times as much deadweight to be carried per passenger on a railroad as on a bicycle. Making all allowance for the shelter and convenience of car travel, there is evidently something wrong. The weight of the car is excessive, and it is the outcome of the rough and dangerous condition of the earlier railroads, and of the competition among the builders to excel in providing a luxurious "palace" car. The car was made heavy in order that it might ride easily on rough track and hold together when it jumped the track; it was loaded down with heavy plate mirrors, solid hard wood carving and moulding, and massive brass and plated work in the attempt to beautify it. The two causes have both disappeared. Our trains stay on the track and automatic signaling has done away with collisions. They can safely be built lighter. A better taste has been cultivated among us in the matter of decorations and fittings, and Pullman cars could be relieved of much silver plating and glass plate, and yet be made artistic and pleasing in their interior fittings.

The weight per linear foot of an express train could be greatly reduced by reducing the length of the individual cars. A car rests upon its two trucks in the same way as a bridge upon its abutments. Like the bridge, its weight per foot will increase rapidly with its length. Two forty foot cars would not weigh as much as one eighty foot car; and though there would be four trucks for two, they would be of very much lighter construction. Moreover, the distribution of the load upon double the number of trucks would cause it to haul with greater ease. The trucks of a 50 ton Pullman car depress the track by their excessive concentration of load, and are always running in a hollow or, as it has been well expressed, "climbing up hill."

The cars could be further lightened in their construction by the substitution of high grade steel for timber. The use of nickel steel for the floors and side trusses, with thin plating for sides and roof, would result in a light, but very stiff and strong car. By furnishing the interior with rattan or basket work chairs and lounges, such as are to be found on some lines to-day, a further saving of weight could be effected.

It is a mistake to claim that light cars ride roughly. On rough track they do; but on first-class track weight ceases to be at a premium.

Queer Things That Are Sent to the Patent Office.

Every event of importance brings down upon the examiners at the Patent Office a myriad of impossible inventions which their wild-eyed originators believe to be the greatest things in the world. It is, therefore, expected at the Patent Office that the possibility of a war with England will cause all the idle dreamers in the inventing line to send new devices for killing men and sinking ships. There will be, if the war talk is continued, guns, ammunition, war balloons, unsinkable ships, new kinds of armor, armed flying machines, and other similar devices, ninety-five per cent of which will be absolutely worthless in the eyes of the examiners and will be rejected on this ground. The policy of England is quite different in respect to worthless inventions, for any invention with which a fee is sent may secure a patent and the visionary inventor may continue to haul up the empty buckets he has been letting down into the empty well. In the United States such discrimination is shown that the business of inventing has reached the dignity of a profession, in which many men are earning more than mere livelihood.

Upon the model makers devolve the worry and bother of the visits of these inventors, and upon the examiners of the Patent Office the responsibility of selection. In certain classes of inventions, for a patent to be granted a working model must be furnished, and this rule, in the case of the perpetual motion fiend and his ilk, saves the examiner a great deal of work and needless bother. In the case of ordinary freak inventions the matter is not so simple, for some inventions that were once thought to be senseless have, after the expiration of the patents, come into use and are of extreme value. There are other cases where the insanity of the idea of the inventor is too apparent. A man not long ago invented a plow with a cannon attach ment. If the farmer was attacked in the field at a distance from his home, he could turn on the battery and disorganize the attacking party. Another man came to the Patent Office with what he considered to be the discovery of the century. This was nothing less than a new method of tempering iron. He was quite sure that as soon as the patent was granted he would have no difficulty in disposing of it to the great iron and steel makers of the world, and that guns and armor of a superior quality could be furnished in a short space of time through his idea. The tempering solution he proposed was Jamestown weed, one ounce; apples, one ounce; turnips, two ounces; water, one gallon. The ingredients were to be cooked, and the iron dipped into the mixture.

Perhaps one of the most amusing patents ever granted was issued on the claim of an Ohio man in 1883. He evidently had not lived a great length of time on a farm, for his invention of a new corn planter, while original to an extreme degree, could hardly be put into use. The picture accompanying the patent is a work of art. It represents an old horse driven by a stout man, who holds the lines nonchalantly in one hand, an expression of much pleasure on his face, while at his side trudges a small hairy dog of the yellow variety. To the horse's forelegs, just above the fetlocks, are attached two small boxes to contain the feed. Ropes are fastened to catches in the sides of these boxes and lead through pulleys attached to a small saddle over the horse's shoulder and back to the horse's hind legs. As the horse moved forward each step of the hind leg opened the seed boxes, and corn was sifted down into the holes made by the front hoofs. The verbiage of the claim on this patent is as original as is the drawing:

First. I claim the combination substantially set forth with the cheap old horse, A, to the forelegs of which are attached the boxes, B B, that are to be filled with corn.

2. I claim the pulleys, C C, in combination with the strings. D D, substantially as shown in the drawing.

3. I claim the guide, E [a small iron affair shaped like a rowlock, fastened above the horse's tail, through which the lines pass], for the purpose set forth, and the sticker, H, to prevent the lowering of the tail.

4. I claim the fat driver, F, to prevent the said cheap horse from going too fast.

5. I claim the fat dog, G, merely as company for the driver.

6. I claim the worms (not shown) in combination with the crows, K K, substantially as shown in the drawing for the purpose set forth [a purpose not set forth].

A man who was afraid of being buried alive claimed a patent for a coffin of peculiar shape. The coffin was connected with the air above by an opening containing a small spiral staircase. If the supposed dead person concluded to resurrect himself he could seize the handles above his head and haul himself up, ascending the circular staircase at his convenience. If he was not strong enough to lift himself, a bell cord was situated near his hand by means of which help could be summoned from the neighboring office of the cemetery.

At first glance the idea of attracting noxious insects to imitation flowers where they could be killed by poisoned honey might seem absurd. Yet it is said that this scheme, a patent for which has been issued, works very well. A man out in California patented a scheme for killing destructive insects on fruit trees a number of years ago. He surrounded the tree with a balloon-like affair, and then injected a gas noxious to the insects but harmless to the tree. People laughed at him, and he was considered a crank. Two years ago, when the patent expired, people began to see what a good idea it was, and now the method is in extensive use in California. It will be seen, therefore, that patent examiners are obliged to be both careful and discriminating in judging the merits and demerits of an application.

A man not long ago invented a balloon attached to a trolley wire. This balloon was presumably for purposes of long distance investigations by telescope in time of war. Underneath the trolley wire was a motor which operated two large wooden propellers sending the car along and pulling the balloon. Another man invented a "steam nigger," operated by an electric motor in the regions of the pit of the stomach. The invention's use is not set forth. S. S. Applegate invented an arrangement for waking himself up early in the morning. A series of corks dangled above the place his head ought to be in a bed, and actuated by clockwork, made life a burden for the weary sleeper, until in self-defense he was obliged to get up. Another invention of the same kind was a contrivance for dumping the hired girl out of bed at 5 A. M. This, too, was actuated by clockwork. It was not considered to be so polite or gentle a method as that of Mr Applegate's. There was another invention intended to save the weary Benedict a few hours of slumber in the morning, for a mechanism placed under the kitchen fire was supposed to light it at any hour desired. There is a very funny model at the Patent Office of a cat made of sheet iron operated by clockwork It is intended to be placed on the roof of a house, woodshed or back wall in neighborhoods where the night is made hideous by nervous Thomases and Marias. At any touch or warlike demonstration on the part of its curious neighbors the clockwork sets the claws going all at once at a tremendous rate and there is a temporary rest for the weary. At the Patent Office there are models of Mark Twain's scrapbook, the pages of which are already mucilaged, and Lincoln's device for getting vessels off shoal places. This consists of bags of inflatable rubber, which, as occasion requires, are blown up and the vessel raised.

There are innumerable inventions to prevent accidents by collision on railroads. One of these patented recently consists of a very elaborate device by means of which one train runs over the top of the other, both presumably continuing on their way uninterrupted by the chance encounter. There is another English invention having much the same idea. The application is different, however, for the front of the engines are built wedge-shaped, with the wedge inclining more to one side than the other, by which means at the impact one train goes to one side of the track and the other train to the other side. Both trains are derailed, but the force of the collision is reduced and the loss of life brought to a minimum. Besides these inventions, there are modes of changing the shape of the features, modes of operating every conceivable thing on earth by windmills, modes of soaring through space, and traveling through fire and water without the least discomfort, modes of making steel and iron by simpler processes than have ever been dreamed of which uniformly do not work, and hundreds and even thousands of plans which have resulted in nothing but bother to anybody who has had anything to do with them. Certain methods have been patented for locating gold and silver by means of divining rods. Even methods of making gold are found. Here is an English recipe for manufacturing gold:

"Cut whole wheat straws into little square snips the width of the straw and mix this with a quart measure of the grains. Measure out half a two-quart saucepanful and set it aside. Fill the saucepan three-quarters full of water and set it to boil over the fire. Pour in the mixture and let it boil two and a quarter hours, adding water at intervals. Then strain off the liquor in thin layers in soup plates, and allow the same to rest thirty-eight hours at a temperature of 46° Fahrenheit. Then slowly bake them dry and find the gold adhering to the plates."

But of all the vast army of cranks who besiege the model makers and the examiners of the Patent Office, the perpetual motion fiend is the most troublesome of all. It is he who goes into the model maker's shop with a wild look in his eye, and, after peering cautiously about and swearing the model man to secrecy, brings out his senseless contrivance and sets it triumphantly on the work bench. He is the man of all men whom the model maker dreads most. Fortunately a recent order in regard to perpetual motion inventions requires a working model to be shown to the examiner before a patent can be issued in this class of inventions, and it greatly simplifies the task of the examiner. He listens to the enthusiasm of his visitor, and then quietly asks for the model. Of course this does not work, and when the inventor excuses the lack of continuous action on some ground, he is told to bring it in again when it is fixed. He leaves the room protesting that it is all right. Sometimes he returns and sometimes he doesn't. When he doesn't the examiner is pleased; when he does the same proceeding is gone through again.

Many inventors have come near—very near—the solution of the problem, but have not quite reached it. There was one crank who walked here all the way from Georgia. His perpetual motion machine consisted of a tall framework of uprights. In this framework was swung back and forth the trunk of a large tree. When the butt end of the tree was swung from one side to the other it struck a spring which was set loose and pushed the tree back to the other side. There another spring was set loose, and the action was supposed to be kept up forever, but it wasn't. Another man had a scheme which was more expensive and elaborate. He had a steam engine, a dynamo, a heat generator, and water. The office of the steam engine was to run the dynamo, that of the dynamo to operate the heater; the steam was to be generated from the water, and the steam would run the steam engine. Another man had a propeller in the bow of a vessel. The propellershaft extended aft to a point opposite the paddlewheels, where the power developed by the propeller was communicated to them. He said that the forward motion of the vessel turning the propeller would develop enough speed to turn ten paddlewheels of similar size. Another man had a tipping board on a pivot, upon which a little car ran up and down. When the little car reached one end it released a spring, and the tipping board was pushed up so that the car went back again. This was accomplished, or was proposed to be accomplished, by one spring winding another up while it ran down itself. One of the most ingenious, perhaps, of these perpetual affairs is the invention of G. H. Furman. It consisted of an inner and an outer wheel. The edges of the cogs in the inner wheel were filled with shot, and as they descended they were supposed to fall on the outer wheel with such force as to send it around until the shot caught in its curve and fell again into the inner wheel.—N. Y. Sun.

Improved Arms for the National Guard.

The conditions which are prescribed by the New York State Board of Examiners as desirable, and in some cases essential, in the construction of a suitable arm for use by the National Guard of the State of New York have been published. This statement is published in compliance with the following action of the board of date of December 19, 1895:

"Resolved, That the instructions relating to the design and construction of rifles and their test be printed and issued as a circular to proposing exhibitors of guns, and that said exhibitors be allowed until March 2, 1896, to comply with the same."

At said date, every proposing exhibitor will be expected to appear personally or by an acceptable representative, or, should this be for any reason impracticable, he shall deposit his keys with the secretary of the board at his office, 17 Adams Street, Brooklyn, N. Y., on or before said date.

The board may waive any condition not deemed absolutely necessary to the successful operation of the guns; but will in all cases assign a value to any proposed form of rifle which will be the higher as said rifle approaches more closely the ideal set forth in the circular.

The plan of test of guns submitted is subject to modification by the board, should such change be found in its judgment necessary or desirable in view of any difficulties that may arise in the execution of the scheme as published; but it is not anticipated that any important or extensive alteration of the plan outlined will be made.

Schedule A relates to the fundamental principle of construction of the army rifle; schedule B exhibits the method of testing proposed.

Full particulars may be obtained from a circular which includes schedules A and B. This circular may be obtained of the secretary, H. E. Abell, 17 Adams Street, Brooklyn, N. Y.

THE two new United States battleships will be named Kentucky and Kearsarge. In awarding the contract for these two vessels to the Newport News Ship Building and Dry Dock Company, at $2,250,000 each, Secretary Herbert encountered some opposition, especially from influences that were directed in favor of the Union Dry Dock Company, of San Francisco. While it was the intention of Congress to have one of the ships built on the Pacific coast if the terms were reasonable, in order to carry out this intent Secretary Herbert would be obliged to declare that the difference between the Newport News Company's bid of $2,250,000 for one ship and the bid of the Union Iron Works, of San Francisco, of $2,740,000 for one ship was only a reasonable difference, which he could scarcely do in the face of the decision made by his predecessor, Secretary Tracy, that this difference should not in any case exceed 3 per cent.—Marine Record.