

Scientific American.

MUNN & CO., Editors and Proprietors.  
PUBLISHED WEEKLY AT  
NO. 37 PARK ROW, NEW YORK

TERMS.

One copy, one year \$3 00  
One copy, six months 1 50  
Club Rates (Ten copies, one year, each \$2 50 25 00  
(Over ten copies, same rate, each 2 50  
TO BE HAD AT ALL THE NEWS DEPOTS.

VOL. XXVII., No. 1. [NEW SERIES.] Twenty-seventh Year.

NEW YORK, SATURDAY, JULY 6, 1872.

Contents:

(Illustrated articles are marked with an asterisk.)

A Lecture on Thomson's Galvanometer.....	4	*On the Measurement of Musical Intervals.....	8
A Machine that Talks.....	8	Postal Reform.....	8
Answers to Correspondents.....	10	Preparing Telegraph Poles.....	5
Business and Personal.....	9	Progress of the Eight Hour Strike.....	7
Cement from Sewage.....	2	Rapid Transit in New York.....	8
Educated Railroad Men.....	5	Recent American and Foreign Patents.....	10
*Feed Water Heater.....	6	Scientific and Practical Information.....	9
Horse Hair.....	6	Screw Life Boat.....	3
*Ice Preserver.....	1	Sewing Machine Patent Extended.....	3
Improved Blowpipe.....	1	Small Fast Steam Propellers.....	2
*Improved Steam Heater.....	1	*The Ducking Stool.....	2
Inventions Patented in England by Americans.....	12	The Open Polar Sea.....	4
Iron Ship Building in Wilmington.....	4	The Price of Iron.....	2
*Locomotive Boiler Explosion.....	2	The Tariff and Tax Reductions.....	8
Manufacture of Sewing Thread.....	3	Volta Induction.....	6
Molasses or Hydrochloric Acid for Flowers.....	5	*Watchman's Clock.....	1
Nitrous Oxide or Laughing Gas.....	5	Weight, Pressure, Force, Power, Energy, Work.....	7
Notes and Queries.....	10		

WEIGHT, PRESSURE, FORCE, POWER, ENERGY, WORK.

We have, in our last number, page 415, considered the difference between the conceptions formed from the first three of these names; we will now devote a few remarks to the latter three.

Weight and pressure, when expressed in numbers of units, can, as we have seen, represent strictly nothing but an amount of matter; in order to pass to a higher conception—force—another element must be introduced, that of space, in which matter may move; if this space is measurably large, and the molecules move in mass, we have what we commonly call motion; if the space is immeasurably small, and the molecules move separately, either in vibratory, oscillating, rotating, or any other hidden motion, we have one of the so-called imponderable forces, heat, electricity, etc., which are only different active conditions of ponderable matter.

In order, now, to pass to a still higher conception—power—we must introduce again another element, that of time. To express, for instance, a so called horse power, it is not enough to state that it is equal to 33,000 foot pounds, or 33,000 lbs. lifted one foot high against gravitation. A man may do this by means of proper contrivances, or simply by subdividing the 33,000 into 300 separate pieces of 110 lbs.; and if employing two seconds for the lifting of each, it will then take him 600 seconds or 10 minutes to raise the whole 33,000 lbs. one foot; but he could not possibly perform this job in one single minute, even with the most ingeniously contrived mechanical arrangements. Experiments have shown that an average horse can do this, and therefore the formula has been adopted that a horse power is equal to lifting 33,000 lbs. one foot high in the time of one minute, or 33,000 foot pounds per minute. We see thus that, for the conception of power, in the most commonly accepted sense of the word, we want the three elements, weight, space, and time, combined.

It is evident that the heavier the moving mass and the greater the space through which it moves, the greater is the power; but also that, inversely, the shorter the time is, the greater is the power, and this exactly in the inverse ratio. So 60 horse power can raise 33,000 lbs. one foot in one second, and 7×60, or 420 horse power in one seventh of a second. If the height is increased, the time must be increased in the same proportion in order to perform the work with the same amount of power. Suppose, for instance, that we wish to lift 33,000 lbs. of water 170 feet high; we must multiply the time with 170, which, in the latter supposed case of 420 horse power, would give 170× $\frac{1}{7}$  of a second, or 24 seconds, nearly; 420 horse power will thus lift 33,000 lbs. 170 feet high in 24 seconds, or 150×33,000 lbs. in 150×24 seconds, which is 4,950,000 lbs. per hour, and 237,600,000 lbs. in 48 hours. If this weight is water, it is very near 30,000,000 gallons, and is exactly the duty performed by the lately built steam engine at the Ridgewood waterworks, in Brooklyn, which is of 420 actual horse power, and lifts, every 48 hours, 30,000,000 gallons of water into the reservoir 170 feet above the lake from which the water is raised.

The water thus raised is a power stored up, a potential energy, if we wish to use a learned expression introduced in the mathematical considerations of mechanics; in common language, it is work performed, and we may again get work out of it, as is done in a few churches in Brooklyn, where the pressure of this very same water works the bellows of the organ, and thus dispenses with the blower—a very proper improvement, as the blowing of an organ is a very unsuitable work for a man, especially on a hot Sunday.

To recapitulate: Weight and pressure are nothing but the results of a certain amount of matter acted on by gravitation; the latter giving the means of measuring it; another

measure of matter could be founded on the space which the bulk of the matter occupies; but, as this is exceedingly variable for the same amount of matter, we are compelled to resort to gravitation, and the resultant weight is the most absolute of material measurements. Besides, no stereometric instrument (that is, one by which we determine the bulk of any substance) can compare at all in delicacy and accuracy with the balance by which we determine weight.

Force, if we wish to give only a single meaning to this word, and the one most in accordance to its etymology, is the product of mass or weight with space. It is very unfortunate that this word has been introduced in the treatises on mechanics in a not properly defined manner, mostly as identical with weight, as evidenced from the method of measuring force by weights or pressure, and speaking, for instance, of a force of 50 lbs.; at another time force is called "the agent which drives machinery." Neither of these should be called force. In the first case, we should say "of a weight or pressure of 50 lbs.;" in the second, we should speak of the "power driving the machinery."

In defense of the method of measuring force by weight, it may be said that weight or pressure is not matter, and this is true; but it is simply a result of a certain amount of matter acted on by terrestrial gravitation, and as such is dependent on matter, namely: first, on the mass itself; next, on the mass of the Earth; and, finally, on the distance from the Earth's center. If, now, gravitation produces motion in a body, we have force; if not, we have not an actual force, but we have force stored up, or potential energy. Such is the case with the planets, revolving around the sun and kept at their respective distances by the tendency of matter to move in a straight line, very improperly called centrifugal force. If the latter agency ceased, the gravitation would act freely and produce an accelerating motion toward the sun; and finally, when this motion of the masses ceased by reaching the sun, it would be converted into molecular motion, heat, raising the sun's temperature still higher. No doubt that the sun's present heat once originated in the same manner, and is thus a result of gravitation.

The cause that our mechanical text books, the best in existence not excepted, do not give properly defined meaning to the words in question is that mechanical science is much older than the true conception of what really constitutes force. The attainment of this conception was reserved to quite recent times; and it is amusing to see how many, even at the present day, envelope themselves mentally in a fog by their inability to ascend to the modern conception of force as matter in motion, still clinging to the old idea that it is something ethereal, independent of and separate from matter. It is not surprising that, in that period of time when all the functions of life were not yet biologically proved to depend on the transformation of matter and the motions inherent in matter, investigators were led to the acceptance of a separate so-called "vital force;" it was indeed the easiest way to dispose of the phenomena of life. However, strictly speaking, it was no explanation whatsoever, but merely the invention of a word, referring all unexplainable phenomena and results to the mysterious entity supposed to be represented by that word.

The same irrational method is still adhered to by many physicians who have not yet risen to the full comprehension of the doctrine of the conservation of forces and the mechanical equivalent of heat; they speak still of a caloric fluid, an electric fluid, a luminiferous ether, an electric ether, a magnetic fluid and even a psychic fluid for the phenomena produced by the supposed psychic force. All such hypotheses will remain acceptable as long as minds are educated in our schools in such a way as to be satisfied with taking mere words for things and empty phrases for rational explanations.

PROGRESS OF THE EIGHT HOUR STRIKE.

It seems to be an impossibility for the workmen enlisted in the eight hour movement to comprehend that, although they have a perfect right to demand as much wages as they please, to talk as loud and as long as they like, or to strike as often as suits them, they have no authority to interfere with the rights of others, or to destroy the property of employers who refuse to accede to their demands. The record of events of the past week in this city shows a series of attempts on the part of the strikers to compel, by sheer brute force, all other workmen to yield to their views. As a natural consequence, they have come into collisions with the officers of the law, which have invariably resulted in their discomfiture and defeat. Apart from the loss of public moral support caused by such reckless violation of the law, the eight hour movement has been still further weakened by being abandoned by large numbers of its adherents, while among those who still hold out, in spite of their continual reinforcement by bodies of men who have become dissatisfied with terms to which they at first agreed, there seems to be a large decrease in confidence in the ultimate success of the strike.

The first overt act of riot was committed by a gang of strikers at Steinway's pianoforte factory, on the morning of the 15th ultimo. There being some five hundred and forty men still at work in the building, the strikers gathered in a mob and started, according to their own representation, merely to present to the operatives a copy of resolutions which had been recently passed by the eight hour league. This, however, is hardly credible, because they undertook to charge upon and force an entrance into the building, and when ordered by the police to disperse and clear the street, they re-

fused to obey the command. A charge by the police followed, which resulted in the scattering of the crowd and the severe clubbing of about a dozen of the strikers—a proceeding which occasioned the greatest excitement among the supporters of the movement generally, and brought down on the police condemnation, from several of the daily journals, for resorting to unnecessary violence. We cannot for our own part see what excuse our contemporaries can find for such acts as attempts to break open factories or raise riots, nor can we perceive with what shadow of justice the police have been made the objects of animadversion because they did their duty in protecting private property and dispersing a lawless mob.

The heaviest blow which the movement has received has been the resumption of work under the old system by all the coach makers, including the painters, body makers, and trimmers, in the carriage trade. The collapse of this branch of the strike is due to the action of the employees of Messrs. Brewster & Co., numbering some three hundred men. We commented in our last issue on the folly of the course taken by these workmen in breaking up the industrial association by which they were governed. It seems, however, that at present, after becoming convinced that they had caused a loss to the firm of over twenty thousand dollars, besides forfeiting all the dividends due them, they have concluded that they were in the wrong, and, after considerable discussion have abandoned the strike and returned to work at the old hours and old prices.

Among the iron and metal workers, there are still 1,150 men on strike; 2,500 are at work on the eight hour system, and are taxed two dollars per week for the support of those who are still unemployed. It is reported that this branch of trade is supported by English associations. At the Metropolitan Gas works, where a little more than a week ago a reduction to eight hours labor was granted to the employees, the strike has again broken out. On account of the reduction of the number of hours, three gangs of workers were organized instead of two as heretofore. This necessitated the employment of new men, who were immediately made the objects of persecution by the old hands. Some of the latter, having been discovered in attempts to get the new comers discharged for bad work, were themselves dismissed, whereupon the entire gang struck, refusing to work until the offenders were reinstated. The company has declined the demand, and has returned to the twelve hour system with twenty five per cent advanced wages, carrying on their works with a new set of men.

At Charles Durant's sugar refinery in Brooklyn, another collision occurred between the police and some four hundred strikers, who were trying to force an entrance into the buildings. The latter were very roughly handled and forced to disperse. There seems more justice in the demands of this body of men than in those of any other trade. They receive only from \$1.60 to \$2.50 per day for working fourteen hours in rooms heated to 80° or 90° Fahrenheit. What they now ask is a uniform rate of \$3.50 for ten hours' work, and twenty-five cents an hour for extra labor. The refiners on their side state that many of these men were getting much greater wages than they now demand, and that, if the pay of all be equalized, the absurdity will be presented of workmen striking for a lower instead of a higher rate of remuneration. Thirteen refineries are on strike, but as the employees appear to be slowly returning to work under the old system, a speedy resumption of business is anticipated. On the New York Central and Hudson River Railroad, it is reported that the workmen are joining the movement along the entire route. In the piano factories, two thirds of the men have resumed work under the old system; no advance in wages has been accorded except at Steinways', where ten per cent has been allowed.

At a meeting of employers recently held, in which were represented many of the largest establishments in the city, concerted action was agreed upon and the views of several leading manufacturers fully expressed. Speeches were made by Mr. Britton, of Brewster & Co., Mr. A. S. Cameron, Mr. John Roach and others, detailing their past experience of the strike. The following resolutions were adopted as the ultimatum of the employers of the city:

Whereas, We, the undersigned employers, representing the general manufacturing interests of the city of New York, have been called upon by our employees to reduce the hours of labor from ten hours to eight; and

Whereas, We have given the subject our most careful and serious consideration, and we find that labor has cost more in New York than at any other point—a fact which has driven a large number of manufacturing concerns from our city—and as a reduction of the hours of labor would increase the cost of living, it would be necessary, in order that mechanics might live as comfortably as heretofore, to pay them more for eight hours' labor than we have been accustomed to pay them for ten—increased cost of production being a direct tax on the producer—and having been sorely pressed heretofore by close competition outside of our city, we find that we are entirely unable to meet this demand; and we have, therefore,

Resolved, That we will hereafter pay our workmen by the hour, and we will only employ such as are willing to work ten hours per day, and we will close our establishments, if necessary, and keep them closed, until we can employ workmen on this basis. And as the "trades' unions," "societies," and "leagues," so called, have, by their unreasonable and arbitrary demands, done much to destroy the relations between employer and employed by forming combinations to secure the same rate of compensation for inferior as for superior workmen, by dictating to employers the condition under which they will be permitted to conduct their business, in some cases imposing heavy fines on such employers as infringe the regulations laid down by their workmen; and, considering such tyranny incompatible with the best interests of both, we have therefore further

Resolved, That we will not hereafter retain in our employ any workman guilty of any act looking to the arbitrary

establishment of relations between the employer and employed.

And, in conclusion, we earnestly call upon our mechanics individually to exercise their own good sense in the present emergency, and to avoid evil counsels.

When trades' unions, as in the case of the iron molders, go so far as to attempt to regulate the number of apprentices a shop shall contain, to prevent whom they please from earning his daily bread, to fine men for trying to get work save through their agents, and to deliberately resolve that owners of works shall not "presume" to control their own business, we think it high time for employers to join in combination and refuse all society men admittance to their shops. Such associations are productive of no benefit to the working man, and if he individually cannot resist their power, it is the duty of the employer to afford him every protection against them.

#### POSTAL REFORM.

As a means of disseminating useful information through the medium of cheap literature to the masses, as an aid in promoting social intercourse, as a facilitation of business enterprise, as a help to self education through increased letter writing, and as affording fuller and freer interchange of ideas, our postal system is of the utmost national importance; and the acquisition of such reforms as will insure its greatest efficiency at the lowest possible cost is a subject interesting to every individual able to read and write. The success attending the use of postal cards in England affords evidence of the favor with which any step in the direction of cheap postage is popularly regarded; and the large increase of matter passing through the mails of that country since the introduction of the system proves that the people gladly welcome any project tending to decrease the expense of intercommunication.

There is no question but that at the present time a necessity exists for still further modification of our postal laws, in accordance with the growth of the nation in territory, population and commercial prosperity. The day when every letter was accompanied on its journey by a regular bill of lading which had to be checked at each post office through which it travelled is past: but the labor of transportation, assortment, and delivery, although materially simplified, is not reduced to the lowest possible expenditure, nor has the service in general that completeness and uniformity of organization adequate to the proper fulfilment of the work it is called upon to perform.

Transportation, cost of stamps, salaries of employees and rent of buildings are the elements which make up the sum total of our postal expenses. So far as the transportation of letters themselves is concerned, their actual weight is of but little moment. It is rarely that an ordinary communication weighs half an ounce, the legal rate, so that double or even quadruple the number of letters might be carried without producing any material difference in the expense arising from the mere heaviness of the mails. But there is other and far bulkier material than prepaid letters to be forwarded. The free exchange of periodicals and the abuse of the franking privilege necessitates the transmission of a vast quantity of matter which, from its nature, constitutes the bulk of the mails, and on which no tax is levied. As a result, letter postage is placed at a figure sufficiently great to meet the deficit thus incurred, so that, virtually, the people at large have to pay for the tons of Congressional documents and transient publications which are yearly sent on private business between private parties. Taking all this dead-head matter into consideration, in connection with the cost of its transportation over the great distances separating points on our territory, it is plainly evident that, so long as the present state of affairs exists, postage as cheap as that of Great Britain will be an impossibility; nor can any reduction of the sum at present paid for letter postage be effected until a uniform rate be established, taxable on every particle of matter forwarded and based upon weight, or on weight and distance sent, combined.

In the city of New York, it costs as much to send a letter across the river to Brooklyn as to San Francisco, and yet it can hardly be urged that the expense is as great to transmit that letter to one city as to the other.

For other matter than letters, an equalization of charges is even a greater necessity. We see no reason why the publisher of a weekly journal should, in case he desires to forward fifty-two copies of his journal at one time to a non-subscriber, be compelled to pay one dollar and four cents postage; while if, to a subscriber, one number of the paper be sent weekly for fifty-two weeks, the charge for the entire year is but twenty cents. In both instances the number of copies sent is precisely the same; why then should wholesale rates be paid in one case and not in the other? What is needed is a fixed uniform rate of newspaper postage, sufficiently low to make it no great burden if imposed on exchanges or on publishers who forward large quantities of matter, and which, if collected on every periodical or package passing through the mails, would yield an income sufficient to counterbalance the reduction of letter postage to one cent per half ounce. The franking privilege is simply a crying evil, and we trust that the day of its total abolition is not far distant.

The new postal rates, which have lately come into effect, are more valuable on account of their opening the way toward future and greater reductions than for the saving of postage in which they may at present result. Postal cards, for correspondence or for printed circulars, similar to those already in use in England and other European countries, have been authorized. The card will bear a one cent stamp and will be imprinted with lines for the address. The back will be ruled for the letter. The price for both card and stamp will be one cent. As the plates for printing are not yet prepared, it will probably be three or four weeks before

the cards will be ready for issue. The charges on circulars are reduced from two cents to one cent for every two ounces or fraction thereof. Transient newspapers, pamphlets, magazines, etc., are also to pay one cent for every two ounces or fraction, instead of two cents for every four ounces or less as under the old law. On books, the postage is two cents for every two ounces or fraction, the weight being limited to four pounds; and on samples of merchandise, etc., the rates are the same as for books, with the limitation of weight to twelve ounces.

The cost of labor in our post office system can only be lessened by a thorough remodeling of the various departments, and by doing away with much unnecessary and useless work which tends but to make their interior machinery complicated and unwieldy. There is very little value in the stamp of date and locality usually imprinted on the exterior of the envelope. It is almost invariably illegible and might easily be dispensed with on ordinary letters; though if its use were required by the sender, means should be provided and a charge made for affixing it carefully and properly. A contemporary suggests that stamped envelopes should be more generally employed for drop letters; and by this mode, the time and labor of obliterating the postage stamp would be saved, as the mere writing of the address on the exterior would be a sufficient cancellation.

A thousand million letters yearly pass through our mails, and yet the statistics of the Post Office Department show that the country suffers a deficiency, and that, instead of being a means of revenue, our postal arrangements are a source of expense. This, by proper organization, judicious retrenchment, and a uniform low rate of postage honestly enforced, can be eventually remedied; and although the various innovations and improvements will doubtless in the beginning prove expensive, still in the end we believe they will become self supporting by the postal increase they will produce.

#### THE TARIFF AND TAX REDUCTIONS.

The bill providing for a reduction of fifty-three million dollars yearly of government revenue from taxes and tariffs has at length passed both houses of Congress. The substance of the act is as follows: The present duties on cotton goods, wools, metals, glassware, paper (except sized printing paper, which is made twenty five per cent *ad valorem*), leather and books are reduced ten per cent. The addition of ten per cent *ad valorem* on indirect shipments of East India products is revived. Hides are placed on the free list, and important reductions are made in the duties on salt and coal. Inventors will be interested in Section 6, which provides that, for a term of two years from and after the passage of the act and no longer, machinery and apparatus designed for or adapted to steam towage on canals and not now manufactured in the United States may be imported by any State or by any person authorized by the Legislature of any State, free of duty, subject to such regulations as may be prescribed by the Secretary of the Treasury. The free importation of steam plows is also permitted for the same period of time and under the same restrictions. Shipbuilding material for use in vessels engaged in foreign trade is exempt from duty, but vessels receiving the benefit of this provision cannot engage in the coastwise trade for more than two months in a year without the payment of the usual tariff. Salt to be used for curing fish is also made free. Extensive alterations are made in the mode of collecting revenue from distilleries, and voluminous instructions are given for the conduct of their business. The tax on distilled liquors is consolidated, but no actual reduction is made. On tobacco, the tax is equalized at twenty cents per pound, instead of sixteen and thirty two cents a formerly. The standard of vinegar, according to which import duties are to be collected, is fixed at a strength which requires thirty-five grains of bicarbonate of potash to neutralize one ounce troy of vinegar. The tax on gas made from coal, wholly or in part, or from any other material, is repealed.

The stamps on legal papers, stock sales, foreign bills of exchange, merchant notes, etc., are abolished after October 1st. The stamp duty on friction matches is retained, and also the two cent stamp on checks, drafts and orders for money. Informers' moieties are rescinded, and an appropriation of one hundred thousand dollars made to cover the expenses of bringing to punishment persons violating the revenue laws. The internal taxes against shipbuilders for sales of vessels are remitted.

Before the 1st of January, 1873, the President is directed to reduce the revenue districts to eighty in number. One collector and one assessor in each district are all the officials hereafter to be appointed by the President, and their appointees are to be reduced to the lowest possible number. This provision necessitates the removal of about two hundred and eighty office holders, and is the most important, in an economical point of view, in the entire act.

With the exception of tea and coffee, which were made free from July 1st, under a previous act, and the revised whiskey and tobacco taxes, which take effect from the same date, the alterations and reductions provided for by the bill go into operation on the 1st of August next.

#### RAPID TRANSIT IN NEW YORK.

At the recent session of the New York State Legislature several projects for securing rapid transit in this city were passed, but only two of them have been approved by the Governor. Of these, the most prominent is the charter granted to the millionaire Vanderbilt, giving him authority to construct an underground steam railway, in connection with the existing Harlem railway, commencing on Fourth avenue at 59th street, and extending southwardly, through Fourth avenue, the Bowery, Bayard, Park, and Center streets

into the City Hall Park, at a point near Broadway between the City Hall and the Post Office. The expenses of construction will be very heavy, but it is stated that it will be soon commenced and rapidly built. We hope that this statement will prove to be correct, for the citizens of New York are subjected to great inconvenience for lack of the means of rapid transit, while the owners of property are compelled to lose the benefits of the increased valuations which would be theirs were the city limits rendered more accessible and more fully inhabited. The privileges granted to Vanderbilt are in some respects remarkable. It would naturally be supposed that both the Legislature and the Governor would take care, as far as possible, in the wording of the grant, to protect the inhabitants of the city from all unnecessary nuisances, either in the construction or the operation of the road. As the latter is to be laid underground, beneath some of our best streets, and is to be operated by steam locomotives, it might have been expected that the company would be compelled to provide for the necessary ventilation, by side shafts and chimneys built on their own property so as not to incumber or impair the public streets. But no such provision was exacted. On the contrary, the bill gives the company permission to make openings for ventilation in the middle of the streets, the holes to be six feet in diameter, twenty feet apart, each surrounded by an iron railing. The two splendid and important thoroughfares under which the road runs are therefore to be occupied and disfigured by the railway corporation, while the air of both avenues is to be contaminated by the foul gases from the locomotives.

The project for the Broadway Underground Railway, known as the Beach Pneumatic Transit plan, which is admitted to have the best route and to be the most carefully prepared and most popular of any of the railway schemes ever presented to our citizens, passed both branches of the Legislature by large majorities, but failed to receive the Governor's approval. One of his principal adverse reasons was that a city engineer had officially reported to him as his opinion that the sewerage of Broadway would be interfered with, and that the work was impracticable; but many of our eminent engineers and architects had testified to him that the work was entirely practicable. The action of the Governor shows how deficient in practical information some of our prominent public men are, and how little they appreciate the public wants. Broadway is the backbone of Manhattan island. From it, the land slopes gently off to the rivers on each side. It is the grand thoroughfare of the city, the special objective or central line of business and travel, and the construction of a first class fast railway under its surface is urgently demanded for the public convenience. It is generally conceded that the existence of such a railway under Broadway would greatly increase the traffic of the street and augment property values. The Beach Transit bill provided for the construction of ventilated tunnels, built on the most approved plans. The bill lacked one vote of a passage over the Governor's veto in the Senate, and will probably become a law at the next session. The company has spent a large amount of money in the perfecting of their plans and in the demonstration of their practicability. They have put a short section of their underground railway in operation under Broadway, between Warren and Murray streets, heretofore fully described by us. The route is from the extreme southern end of the city at the Battery, up Broadway to and under the Harlem river, with sundry branches.

In this connection, it may be stated that the expenses of constructing an underground railway through the heart of a city are necessarily very heavy, and in order to secure the success of such an enterprise the route adopted should be the one best calculated to accommodate the public and yield the largest local traffic. In New York, the Broadway route stands pre-eminent in these respects. Mr. John Fowler, Engineer-in-Chief of the London underground railways, testifying recently on the general subject of underground city roads before a Parliamentary committee, said that "the stations must be on the thoroughfare, and visible to the public." In other words, a city road must be located with special reference to the convenience of the people, or it will not be properly patronized.

The other rapid transit bill approved by the Governor is known as the Swain three-tier road. It provides for the construction of an underground railway, a surface railway, and an elevated railway, all on the same line. The route authorized is upon the west side of the city, commencing at or near the Bowling Green and running northwardly to and over Harlem river. The company is compelled for the most part of its route to buy its way through private property, and this cost, added to the expense of building the works, will, it is believed by many, be so great as to hinder the construction. But we hope not. In so large and prosperous a city as New York, there is room and need for several lines of rapid transit railways, and all of them would doubtless be well supported.

#### A MACHINE THAT TALKS.

There has lately been on exhibition, in one of the theatres in this city, an ingenious machine which counterfeits, with remarkable fidelity, the sounds of the human voice. It was invented some thirty years ago by Professor Faber, of Vienna, and was, as we learn, exhibited shortly afterwards in this country. Recently, however, the apparatus has been so much altered and improved by a son of the inventor that at present it bears but little resemblance to the original, and may, for all practical purposes, be considered an entirely different machine.

Although the mechanism is constructed to imitate as closely as possible the simple working of the human vocal apparatus, yet it is so intricate in detail that an attempt to describe accurately the functions of its many tubes, levers,