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BINDING.—Subscribers wishing their volumes of the SCIENTIFIC AMERICAN bound can have them neatly done at this office.—Price \$1.50.

OUR NAVY.

The Secretary of the Navy has, each year since the commencement of the first term of President Grant, earnestly endeavored to impress upon Congress and upon the country the vital necessity of preserving the efficiency of our diminutive navy. Congress has, at last, taken up the matter and is considering the advisability of authorizing the construction of a number of new vessels of war.

There can be no doubt, in the mind of any thoughtful citizen, that the United States requires a navy, and that it will require one so long as we have commercial relations with foreign countries, so long as we are liable to become involved in war with other maritime nations, and so long as a large share of the great work of exploring distant parts of the globe can be best and most economically performed under the auspices of our navy department.

How large and of what character, this navy of ours should be, is not so easily decided. We must, certainly, have a number of cruising vessels to do the work which falls to our navy in time of peace, and this work may be done by ships of comparatively light armament, of full sail power, and of good speed under steam: by such vessels, it can be done efficiently.

We believe that there is not a vessel in our navy which possesses all of the requisites of such a class of ships. The "Wampanoag" class had the speed, the sail power, and the necessary armament, but were originally defective in their machinery, and are now generally worthless in consequence of the decay and weakness of their hulls. It is to make good our deficiency here, we presume, that the Secretary of the Navy proposes building ten new vessels. They are evidently urgently needed, and it is to be hoped that they will be built and built quickly. In justice to the Department, to Congress, and to the people who pay for them, it is to be hoped that they will, when completed, embody the very latest and best modern practice. They should have iron hulls; economical, simple, light and durable machinery, and an armament that shall not be rendered inefficient by deference to the hobbies of any enthusiastic inventor or of any single man. The plans should be invariably endorsed by properly constituted boards, who should be authorized and required, also, to consult experts, of generally recognized standing, in relation to all plans. Such a course would protect the navy department from malicious or ignorant misrepresentation and abuse.

We learn from the annual reports of the secretaries of our navy, commencing as far back as the administration of Gideon Welles, that our iron-clad navy, originally created under the pressing exigencies of civil war, and, as a matter of course, to some extent defective in design and hurriedly constructed, has become as worthless as the first class of ships. The Dictator is the most formidable of our iron-clads; but even the Dictator is of slow speed as compared with more recently built foreign vessels, has far less invulnerable armor, and is equally inefficient in her armament. Once the most powerful and formidable of iron-clads, she is, to-day, comparatively weak. This vessel, and others of our iron-clads, should not be allowed to become utterly worthless for want of proper care; but we question seriously the policy of building a new iron-clad fleet to compete with that of England, of Prussia, or even of Spain. We are by no means certain that the day of iron-clads has not already passed, and that the perfection of our various systems of using torpedoes for both attack and defence may not have already rendered us independent of such terribly expensive engines of war.

A new fleet of effective iron-clads, if built, should consist of not less than twenty vessels, each capable of meeting successfully the strongest foreign-built iron-clads, and would cost thirty millions of dollars.

Such a fleet might defend our shores and might successfully contend with all existing iron-clads, but it could not prevent the destruction of our limited commerce by fleets of fast, lightly-armed cruisers, and it could not enter or seriously threaten an enemy's port well defended by a system of torpedoes.

Abroad, the unarmored, lightly armed and fast vessels, which it is now proposed to build, could best destroy an enemy's commerce, and would easily avoid heavily armed cruising iron-clads, since the latter must always, of necessity, be defective, either in speed or endurance, or both.

At home, we are already safe against attack, thanks to the intelligence and energy of the torpedo corps of both army and navy.

The exigencies of our late civil war gave rise to these now well organized and effective organizations.

It would be impolitic to make public the results of their unremitting and very fruitful labors. The only suggestion that need be made is that, to still further increase their efficiency, the best talent of the naval engineer corps should be better utilized in this now vitally important work than it has yet been.

In brief, we may state that, in the event of our becoming involved in war with the most formidable of foreign powers, our harbors would be at once rendered inaccessible to the most formidable fighting machines yet put afloat, and this, too, at comparatively slight expense. Were all the fleets of the world to attack New York harbor, not one vessel would be likely to pass the Narrows. A fleet lying off the coast would be unsafe during the day and could be scattered or destroyed during a single night.

A worthy successor of Farragut would find means of destroying easily the most powerful of an enemy's fleet with the resources which are now made available by our torpedo corps.

We have fixed torpedoes that may be made to explode when struck by an enemy's ship, others that may be exploded from secure stations far away at any instant desired, others that may be rendered harmless when our vessels are passing among them and which may be then made to destroy any pursuing vessel that may attempt to pass them: and we have torpedo vessels that can be sent out without a single human being on board to attack a fleet anchored off the shore, and, directed from the shore, they will approach and explode a charge of powder under any vessel that it may be desired that they should destroy.

We may rely upon our torpedo corps, with confidence, to defend our shores and harbors against the world.

Let us have our cruisers, therefore; but let us hesitate before commencing to build iron-clads. We may find that the expenditure of many millions, in attempting to rival other nations, may be saved us by the comparatively inexpensive operations of well organized torpedo corps, and by the application of the wonderful ingenuity of our inventors to the perfection of floating and sub-aqueous torpedoes and torpedo ships.

The inventive minds of some of our readers will find here an interesting field in which to labor, and they may accomplish results of value to the nation while attacking a problem which, nearly a century ago, gave Hopkinson the text for his humorous poem, "The Battle of the Kegs," and with which Bushnell and Fulton made creditable progress at a very early period in the history of our country.

THE MOSCOW EXPOSITION.

The great Russian Exposition at Moscow was recently closed, and, according to a correspondent of the *Engineer*, the United States were extensively represented in the mechanical department; not, however, by goods sent directly from this country, but by machinery made in Austria, Prussia, Belgium, Russia and other countries, copied from American patterns, the products of American genius, protection for which by patents in the countries specified is practically denied to our citizens. At this exposition, the show of American sewing machines supplied from Germany was quite large. The correspondent says:—"If that benefactor of mankind, the ingenious Howe himself, could have appeared in the flesh and visited the Exposition, I think he would have been highly gratified, for the pet offspring of his genius, in some form or other, is continually to be met with, it being more difficult to say where it is not than where it is."

The entire motive power of the exhibition seems to have been furnished by the American Corliss steam engines, examples of which were supplied by several German manufacturers. Indeed, so many of these engines were to be seen in the exhibition that the correspondent is led to ask: "I wonder if the inventor reaps any advantage from this patent in Germany?"

This is only one of hundreds of examples of the way in which the Germans, especially the Prussians and Austrians, appropriate the best improvements of English and American inventors.

Our Commissioner, General Van Buren, in his endeavor to procure a large appropriation from Congress to be wasted in Vienna, is endeavoring to satisfy the members that unless the money is granted the United States will not be duly represented at the coming Vienna show. But Congress need not give itself any apprehension on that score. The ingenuity of America will be well represented in all the mechanical departments, by the pirating manufacturers of Austria and Germany. No nation in the world will have its mechanical ideas so largely represented at Vienna as the United

States; but our countrymen will not specially profit thereby

But to return to the Moscow affair:

Among harvesters, the Johnson American Self-raking Reaper is specially mentioned. As to steam fire engines, the first prize has been, as stated to have been, awarded to an American machine.

The display of war material was quite large, some very ancient and curious pieces, of Russian origin, being exhibited. Among these were queer shaped revolving mitrailleurs, having from twenty-four to forty-four barrels, five feet long and three quarter inch bore. These were made in the time of Peter the Great, but were discarded by him as impracticable. A brass rifled cannon was shown, which was cast in 1615—a hundred and fifty years nearly before the idea of rifling guns was known in England. A rifled arque-buse made in 1661, several breech-loaders, and a revolving gun of the seventeenth century were also on exhibition.

A SLIPPED ECCENTRIC AND WHAT CAME OF IT.

A correspondent in Connecticut, who writes to announce the sending of an excellent list of subscribers to the SCIENTIFIC AMERICAN, shows how our paper has practically benefited him and his employers as follows:

"I have taken the SCIENTIFIC AMERICAN for nine years. When I first commenced to run a steam saw mill, I worked by the day as sawyer. One day the eccentric slipped on the shaft, and the engine, of course, stopped. The proprietor being away, we were in a bad fix. The fireman did not know how to set it again, and, practically, I knew nothing about it myself; but I recollected reading in your paper the rule for such an engine (a common slide valve one). So I tried my hand and succeeded, the engine doing better work, with less fuel, making a gain of three cords of slabs in ten days."

To the practical workman the regular reading of the SCIENTIFIC AMERICAN is unquestionably of great value. It insensibly educates the mind of the reader and, if he is a workman, renders him more intelligent, more skillful and more useful to his employer. It is the custom in some establishments for employers to present their workmen on the return of each new year with a year's subscription to the SCIENTIFIC AMERICAN. Proprietors find themselves abundantly repaid in the greater industry and superior work which their men give back in return for such attentions. Those who have not already done so should remember that now is the time to register subscriptions to our paper. This is the first number for 1873.

Send in the names as fast as possible.

PROFESSOR TYNDALL AS A MONEY MAKER.

During the evening of Professor Tyndall's first lecture in this city, while he was busy in exhibiting the wonderful qualities of light at the Cooper Institute, a thief struck a light in the Professor's room at the Brevoort Hotel and carried off \$200 in gold from the Tyndall trunk. But that, after all, is a small item when we consider that the Professor is bagging about ten thousand dollars a week from his lectures, one of which he gives every other night.

If other scientific lecturers would bestow as much personal attention upon the preparation of their public appearances as does Professor Tyndall, it is probable that the demand for their services might be increased. There is never any hitch or break in the experiments, illustrations or speaking of Dr. Tyndall. The day preceding each lecture is devoted to a careful rehearsal of the experiments that are to be produced, and his assistants are drilled in the manipulation of the apparatus by their leader with the same care that the leader of an orchestra bestows in the rehearsal of his music.

Work and watchfulness are the keys to Professor Tyndall's experimental success as a lecturer.

THE VIENNA SHOW IN CONGRESS.

After a somewhat lengthy debate, a bill appropriating the sum of \$100,000 to defray the expenses of American representation in the Vienna Exhibition has passed the House of Representatives and has been forwarded to the Senate for its concurrence. In addition, two naval vessels have been designated for transport duty, to carry pianos, sewing machines, buggies and other goods of exhibitors to Trieste, Austria. Space forbids our entering into any *resumé* of the discussion in the House. The bill was introduced by Mr. Banks of Massachusetts, and the opposition was led by Mr. Shellabarger of Ohio. The latter gentleman made an able argument against the grant of the appropriation until the Austrian patent laws should be so modified as to protect American inventors; but the bill passed without this proviso, so that it now remains for the Senate to determine whether we shall allow this golden opportunity of testifying to the world our condemnation of these unjust and oppressive regulations to escape.

The amendment offered by Mr. Shellabarger, although it is a step in the right direction, hardly, in our opinion, covers the entire requirements of the situation. What we need and insist upon is not a protection merely for the limited duration of the show, but a permanent guarantee, ratified in solemn treaty obligation that the rights of our citizens in Austria, in respect to their inventions, shall be upheld the same as are the rights of Austrians in this country.

We earnestly trust that an amendment framed in this view will be introduced and favorably considered in the Senate. It is but a simple act of justice, it works no hardship to any one, and secures to us advantages that are inestimable. We have repeatedly shown that, in other continental countries, patent laws exist as oppressive as those of Austria. The latter nation is deeply anxious to procure a full representation of American genius, and, were such an amendment enacted, there is little doubt but that the objectionable features

in the Austrian statutes would be repealed. This done, we should have gained an entering wedge toward ameliorating the similar laws of other countries, and eventually we should succeed in obtaining for our countrymen as full privileges in Europe as in the United States.

Our representatives, in advocating the appropriation, seem to look no further than the so-called protective certificate to be granted to exhibitors. It should be distinctly understood that the certificate simply purports to afford protection for a year; that is, it saves the inventor from the loss of his right to a patent during the period of the Exhibition. There is nothing to prevent an Austrian from gaining all possible knowledge regarding an idea, completing every preparation, and at the end of the specified time putting all he has thus acquired into practical execution. We have shown that nothing can be accomplished by bringing infringement suits, and that to this piracy there is no check. The certificate therefore merely permits the inventor to delay his application for a patent one year, and leaves him precisely where he would be in the beginning, did it not exist. He must accordingly then manufacture within the succeeding twelve months precisely in correspondence to his drawings, etc., and comply with sundry other similar regulations, or his patent, if he gets one, is null. On the other hand, an Austrian coming to the United States with a new invention may, by our law, make, sell and exhibit it all over the country for two years, and at the end thereof obtain a patent for seventeen years giving him complete and exclusive property in his device. He is not compelled to work his invention within any specified period, but is at liberty to do precisely as he pleases with his patent, which remains good for the term granted.

It is but little appreciated in this country to what an immense extent American inventions are manufactured abroad, and what vast benefits the people of Europe reap from our ideas. The continent is full of devices of American origin, and every new improvement of value is immediately adopted there, pirated and manufactured to the exclusion of the American inventor. The scientific publications of the continent are full of extracts from American patents, which they issue, with engravings, of all our latest and best improvements, which are promptly put in use. Of the dozen or more steam engine exhibitors from Austria, Prussia, Russia, Belgium, and other countries in the late Moscow Exhibition, nearly every one displayed Corliss engines of their own manufacture, made after the patterns used in Providence, R. I.; the entire steam power of the exhibition was supplied by these engines. In Russia, Prussia, Belgium, and Austria, the McCormick reaper, Howe sewing machines, Burleigh rock drill, Blake stone breaker, Gatling guns, Hotchkiss' projectiles, Colt's revolvers, Hoe's and Bullock's steam presses, Danks' puddlers, Westinghouse's railway brakes and hundreds of other American designs are well known, and many of them used; and without doubt large numbers of our best inventions of the most recent dates will be found among the entries of foreign manufacturing houses in this Vienna show.

We should have been glad had the motion in the House to strike out the appropriation altogether prevailed. Not that we do not appreciate the value of the Exposition, or fail to believe that, in the words of a contemporary, we "ought to join in all peaceful measures which belong to international courtesy and promote mutual goodwill," but simply to publish to the world that the United States failed to take part in the Austrian Exposition, because Austria has refused to do justice to American inventors. This it is yet in our power to do, and the amendment that we advocate should be so worded as to deny the payment of the appropriation until the Secretary of State receive official notification of the alteration of Austrian laws.

Our leading position among industrial nations, our worldwide renown as a people of transcendent inventive genius and our unexampled progress in civilization during the past century are due in great part to the stimulation and encouragement which our laws give to the inventor, teaching him to study new arts and processes, to develop new ideas and in the end to turn the results of his thought and labor into substantial profit. Is it not evident that the stimulus, thus afforded, would be infinitely increased could we make a world, instead of a country, the market for our productions? Can it be controverted that the direct advantages to our people would be invaluable, did they possess an exclusive and guaranteed property in their own original ideas in foreign countries? Or is not the fact plainly manifest that, were such rights secured to the United States and other people forced to come hither for the most useful improvements in science and art, we should place all other nations under contribution? In view of such benefits, the acquirement of which is so easily begun, it seems impossible that our legislators will neglect so plain a duty as to secure for the country the advantage which is now within their grasp.

SUNDAY RAILWAY TRAINS.

A few weeks ago we published a paragraph, copied from a reliable source, to the effect that the Brotherhood of Locomotive Engineers, in their recent St. Louis convention, had passed a resolution having in view the entire stoppage of railway trains on Sunday. We commented on such action as unwise, showing that while we were as decidedly in favor of the general rest from labor, on the part of engineers, of one day in seven, as anybody could be, still we considered it to be a matter of public necessity that certain trains should be run on the Sabbath.

The New York Daily Witness, in commenting upon our remarks, says:

"Is it not strange that the SCIENTIFIC AMERICAN should

be in antagonism to this Brotherhood of Locomotive Engineers, which recently passed resolutions in St. Louis in opposition to the running of Sunday railroad trains? The SCIENTIFIC AMERICAN believes in running them for mails, passengers, and freight as a necessity. The Brotherhood believes in no such necessity; but that the running on Sunday is a breach of the divine command and an infraction of public morals. We are glad that the Brotherhood are not afraid to speak their minds in favor of all classes connected with railroads having the rest of the Sabbath. Right is might and must prevail."

The Witness, if it wishes to give reliable testimony upon this subject, should inform itself better before attempting to speak. The SCIENTIFIC AMERICAN did not urge the running of freight trains on Sunday, but spoke of the necessity of running a limited number of trains for the transit of the mails and the carriage of such passengers as from necessity had occasion to travel on that day. The SCIENTIFIC AMERICAN further alleged that it was no more sinful to travel in case of necessity on a railroad, which was a public road, on Sunday and in a railway car, than to ride on an errand of necessity in an ordinary buggy on a common road on the Sabbath.

The Witness is also mistaken as to the objects of the Brotherhood. We have received a letter from Mr. Charles Wilson, G. C. E., of the Brotherhood, from which it appears that the engineers do not seek to stop all trains on Sunday, but only the unnecessary trains. He states that on some roads more traffic is run on Sunday than on any other day of the week, and it is to prevent this and cause the Sunday trains to be restricted to such as are actually necessary that the Brotherhood have resolved.

In this laudable endeavor the Brotherhood well know that they may count upon the aid of the SCIENTIFIC AMERICAN, and to this end we will thank them to give us the names of the roads and their controlling officers who impose in the manner stated by Mr. Wilson upon their engineers.

Inasmuch as the Brotherhood do believe with us, as represented by Mr. Wilson, that the running of certain trains on Sunday is necessary, the Witness' fervid puff of the piety of the Brotherhood, as relates to the breach of the divine command and the infraction of public morals, is entirely wasted.

THE NEW YEAR.

The present number of the SCIENTIFIC AMERICAN is the first for the new year of 1873, and we would remind those of our readers who have not already done so that their subscriptions should be at once renewed. This will prevent interruption in the regular coming of their papers, and save them the risk of losing any numbers. One of our subscribers says that he regards the loss of a single number of the SCIENTIFIC AMERICAN like time lost in the prime of life. Send in your subscriptions as fast as possible. Terms, \$3 a year. One copy of the SCIENTIFIC AMERICAN for one year and one copy of SCIENCE RECORD for 1873 will be sent for \$4.50.

Some idea of the interesting and valuable character of the SCIENCE RECORD may be gleaned by reference to the general statement of contents published in our advertising columns. It will be noticed that every department of science is to be represented. Among the biographical illustrations several fine steel plate engravings are given, among which are portraits of Professor Henry, of the Smithsonian Institute; Professor Pierce, of the Coast Survey; Professor Dana, of Yale; portraits of Professor Morse, as he appeared in the prime of life, soon after the completion of the first telegraph line, of Professor Tyndall, who is now lecturing here, and other distinguished men of science.

RAPID TRANSIT IN NEW YORK.

The New York Times does not look with favor upon the proposition to use steam upon the street cars, in lieu of horses, for the reason that there would be increased liability to accident without any gain in speed. Our cotemporary thinks that the only way to realize fast traveling in the city is by means of tracks removed from the surface. The two ends of the metropolis are now twelve miles apart, and the people suffer great inconvenience for a lack of quick means of communication. The discussion of the various plans by which this may be best effected is a matter of interest, not only to New Yorkers, but to the people of all large cities. Nothing so stimulates business, gives value to property, and promotes the comfort of city life, as prompt and safe modes of local conveyance.

It is only by an elevated or an underground railway that rapid transit can be realized in New York. The relative cost of these roads is about the same, namely, from one million to one million five hundred thousand dollars per mile. The elevated road is inevitably an obstruction, in whatever street it is built, for it is simply an immense bridge, which no one wants before his doors. On the other hand the underground railway is entirely out of sight, does not interfere with the streets, and disturbs no one. In London a shopkeeper in one of the main streets was asked by an American where the underground railroad passed. He said he did not exactly know, but he believed it was on the next street back, a block distant from his premises. But the truth was, the railway in question passed directly in front of the man's door, forty feet below the surface of the ground; and the shopkeeper, who had moved in subsequent to the building of the road, was not aware of the fact, although three hundred trains a day were regularly passing. It has been affirmed by experienced engineers in this city that a single omnibus, clattering over the Broadway pavement, shakes the adjoining buildings

and makes more noise on each trip than would all the trains of an underground railway during an entire day, if built on that street. Well-made cars slide along very smoothly over a properly constructed track.

One and a half millions of dollars a mile is an immense cost for a city railway, and to insure its pecuniary success the first essential is to locate its route where its cars and accommodations will be constantly under the public eye, readily accessible to the largest portion of the population. Such was the testimony of the eminent engineer, Mr. John Fowler, before the Parliamentary Committee in respect to the London underground railways. It is evident that the route under Broadway in this city is the natural and proper line for such a road.

A variety of charters have been granted for steam roads in this city; but their routes are faulty, and none have been built, save the post railway on Greenwich street, which is far away from Broadway, and has proved a bad bargain to its original stockholders. They have not only lost their charter, but every cent of their original investments, amounting, it is said, to over one million of dollars in cash.

Another grand scheme was the Viaduct or elevated railway, the charter for which was granted to the notorious Sweeny & Co. The routes proposed were on side streets, east and west of Broadway. Although five millions of dollars were to be taken from the city treasury to help the scheme, still such was its enormously expensive character, so defective the route, and so greatly was it disapproved by the public, that it was impossible for the corporation to procure subscriptions enough to start the thing.

Three other charters were granted last year, one to Mr. Vanderbilt for an underground road on Fourth avenue, east of Broadway, another to Mr. Gilbert for an elevated railway to run on a side street either east or west of Broadway, according as certain commissioners may determine; and another to Mr. Swain for a double road, with both elevated and underground tracks, to run on the side streets west of Broadway. There seems to be no great obstacle to the procuring charters for New York railways. The grand difficulty is to secure in right route.

Of the various plans for fast railway in this city, that of the Beach Pneumatic Transit Company, for an atmospheric railway under Broadway, has been the most carefully examined and the most widely approved by the public. It has been shown that, for a cost of about one million dollars per mile, a double track railway can be built from the City Hall to Harlem which, with certain lateral branches, will give to our citizens the luxury of rapid transit all through the county. At the inception of this enterprise, the trustees of the corporation caused the most careful investigations to be made in respect to route and the method of building, and the unanimous conclusion was that the Broadway route was not only the most economical for construction, but afforded promise of accommodating a larger number of people than any other line that could be selected.

Great pains were taken to accumulate reliable evidence. Nearly all on the leading architects in New York were consulted in the matter, especially those who had had occasion to erect important buildings on the above thoroughfare. With an almost unanimous voice they joined in certifying that the railway could be built and operated on Broadway on the plan proposed by the company, without any molesting or of injurious effect upon adjoining buildings. The advice of the most eminent and experienced civil engineers was also taken, among whom were A. W. Craven, Esq., C. E., George S. Greene, Esq., C. E., Major General J. F. Barnard, U. S. Engineers, General Charles K. Graham, C. E., all of whom, after personal examination, certified in the most unqualified terms that the work proposed by the company could be executed and the railway worked without injury to adjacent property.

The advice of prominent English engineers was also taken upon the subject, among whom were Mr. F. E. Cooper, of the London Underground Railway, and Charles Douglas Fox, Esq., C. E., the well known railway constructor and engineer of London; all of whom fully coincided with our own engineers and architects. Mr. Fox did not merely write upon the subject, but had come to this country and made a personal examination of the route.

To illustrate the matter still further, and remove every lingering prejudice against the work that might exist in the minds of property owners, the company determined to construct a short working section of railway under Broadway. This they were enabled to do under the provisions of their original charter, which gives them the right to place pneumatic tubes under the streets for carrying freight and parcels. The company accordingly secured premises in the lower part of the large marble building at the corner of Broadway and Warren street, and, having constructed a novel boring machine, set it to work to excavate a railway tunnel down Broadway, below the foundations of the buildings, under the water pipes, sewers and gas pipes, without disturbing the surface of the street, and with all the omnibuses, trucks, and the enormous traffic of the street going on directly over the heads of their workmen. So carefully, expeditiously, and successfully was this work executed that the entire section of the tunnel, which is between nine and ten feet in diameter, from Warren street down Broadway to Murray street, was almost completed and the track laid before the newspaper reporters or the public were informed that anything of the kind was in progress. The work was then finished up, a large blowing engine put in, a handsome passenger car placed on the track, and the railroad set in operation. All this was done at an outlay of about a quarter of a million dollars. The admirable working of this short railway has been before described in our columns. It will