Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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 any address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union, *nine dollars a year*.

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, 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, $5.00 a year; combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign countries, $11.50 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

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, OCTOBER 17, 1891.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 824.

For the Week Ending October 17, 1891.

Price 10 cents. For sale by all newsdealers

THE SHIPS WE WANT NOT THE KIND WE ARE GETTING.

The statements made by Secretary Tracy respecting the future necessities of the navy and the announcement that his forthcoming report will recommend that no more unarmored cruisers like those of the white squadron be constructed have aroused much interest among naval officers. The Secretary is reported as saying:

"We need three distinct classes of ships. First, battle ships such as the Massachusetts, Indiana, and Oregon will be when completed; second, fleet commerce destroyers like the New York; and third, a large number of small thousand-ton vessels for police purposes. Our battle ships can fight anything afloat. There is nothing in the English, French, or Italian navies that they cannot fight. As a matter of fact, the number of vessels in any of the foregoing navies that could successfully oppose them are comparatively few. With a dozen such vessels added to our monitors for harbor defenses, we could in our own waters successfully withstand an attack from Great Britain herself. The New York is an armored cruiser. She is now building at Cramps' yard at Philadelphia at a cost to the government of $3,000,000. Her purpose is to destroy an enemy's commerce. Four such ships distributed in various quarters would put an effectual stop to the depredation of as many fleets of ordinary cruisers. She will have, in many respects, a wider field of usefulness than any other ship yet designed for the navy."

Small cruisers for police purposes, the Secretary says, can be quickly constructed. Their crews are small, they burn little fuel, and their cost, exclusive of armament, is only a trifle in excess of $300,000 each. "For ordinary police purposes," said Secretary Tracy, "they will be quite as effective as any of the heavier cruisers. They carry eight 4-inch rifles and a small subsidiary battery of rapid-fire guns. Where difficulties arise with small countries like Hayti, San Salvador, and Nicaragua, which have no navy, such vessels fill every requirement, while the expense of maintaining them afloat is trifling as compared with that of the larger ships. At this time, too, we could use them in China."

If the recommendations in Secretary of the Navy Tracy's forthcoming report are carried out, we are likely to expend a large sum of money on what we don't want and unnecessarily to postpone the building of the type of ship we shall be in most pressing need of when we need any. The great battleship of the Massachusetts type, in which he seems to repose so much confidence, would not, in all probability, have anything to battle with in case of war, unless the enemy should commit the folly of taking to the high seas to meet her. The best thing the enemy could do would be to leave her alone, for she could do no harm, unless coming up with something as slow and cumbersome as herself, in which case she would be only doing the enemy a service to sink it. And what would such enterprises avail if the enemy was plying his ocean trade unmolested? The purpose of deep-sea fighting heretofore was to prevent interference with commerce. But the most important commerce to-day is carried on in fast steamers, and in case of war would, in all probability, be confined to this character of craft, which, it may be said, is being more powerfully engined yearby year. What hope would there be of intercepting it by such weighted-down and unwieldy warships as the coming Massachusetts, Indiana, and Oregon? As for depredations on an enemy's coast, the present superiority of the land gun over the marine target has rendered such impracticable. Thus the Secretary's declaration that these ships "can fight anything afloat," even if true, is without important significance.

Let us now consider the commerce destroyer New York, now building at Cramps' yard, and of which the Secretary says: "Four such ships distributed in various quarters would put an effectual stop to the depredations of as many fleets of ordinary cruisers." Perhaps they could. But how about the enemy's fast merchant fleet; could they overhaul it? There are at least four merchant steamers at present in the Atlantic trade that, even with heavy cargoes, are good for 21½ knots, and which with lighter cargoes can undoubtedly do better than this. The guaranteed speed at sea of the new Cunard steamers, contracts for which are reported as having been given, recently, to the Fairfield Co., is to be 22 knots per hour. Each boat 12,000 tons. Will the New York be up to this? We hope so, but the experience with our other new ships leaves room for serious doubt.

As to the "large number of small thousand ton craft with small batteries to do police duty and cost $300,000 each," which the Secretary would build, it is clear that they would be too weak to fight and too slow to run away. It is evident that our most pressing need is a fleet of commerce destroyers, fast enough to overhaul the fleetest craft afloat. During the civil war three swift steamers, the Alabama, Georgia and Florida, were the means of driving our great merchant fleet from the seas. These ships could come up to anything we had afloat, and in order successfully to play a similar role in a coming war, ships to do such work must have a like recommendation. The navy engineers, accounting for the lack of speed of those of our new ships that promised to be so swift, declare it impossible to get maximum speed out of engines unless they are constantly kept up to it, that is to say, constantly driven at full speed; the stokering maintained at maximum efficiency, the engineers experienced in meeting obstacles and correcting defects.

If this is the case, and no one can deny the reasonableness of it, the answer is that the thing should be done. Ships of the commerce destroyer class should, like the swift passenger vessels, be kept driving away at full speed in time of peace, to be prepared to perform their proper service with precision if war should come. Those who read the orders as they come from the navy office are aware that ships are constantly being sent to call at foreign stations, and it is a fact that in all the regular squadrons, North Atlantic, South Atlantic, Pacific, European, and Asiatic, the regular order is cruising over an extended track. Thus a long cruising ground could readily be selected for such craft as commerce destroyers, when they were not employed for emergency calls to far-away stations, and instead of burning 75 or 100 tons of coal per working day with two-thirds speed, they might be allowed 200 tons, or enough to drive them always at maximum speed.

Fast craft we want if we want any, and if the only means of keeping them fast is by constant pushing, let them be pushed for all that is in them.

ELECTRICAL TRANSMISSION OF 300 HORSE POWER.

If it is true, as cabled, that 300 h. p. gathered from the river Neckar is being delivered at the Frankfort exposition, 108 miles distant, in the form of electrical energy and with a loss of only 25 per cent, it is an event of uncommon importance and is likely to awaken as much interest in other parts of the world as at the chief city on the Main. It is more likely that there is some exaggeration in this statement, and yet the presence of many expert electricians and the remarkable care and cunning with which the transmitting apparatus has been set up and operated leaves room for the hope that an important advance in the science of transmitting large parcels of power has been attained. We are told that the power is obtained from a turbine placed in the channel of the Neckar at Lauffen, driving a rotation current dynamo which converts the energy into the form of a combination of alternating currents. These currents are next transformed into a current of high pressure and small strength. It is transmitted through three thin bare copper wires of no more than four mm. diameter. These are strung along ordinary telegraph poles. The line passes through Heilbronn, Jagstfeld, Eberbach, Erbach, Babenhausen, Hanau. At the exposition this current feeds 1,200 incandescent lights, runs a powerful rotation current motor, a number of smaller motors, a centrifugal pump supplying a waterfall 10 meters high and much other power-consuming apparatus.

We are not told how the operators have overcome the influence of that potent disturbance, the Foucault currents, which, from the time of Marcel Deprez's experiments at the railway shops of the Chemin de Fer du Nord in Paris down to the present time, have rendered futile all attempts at the economical transmission of large parcels of electricity over a long line. One hundred miles is a long distance to transmit 300 h. p. less 25 per cent, and if actually accomplished, it leaves a strong hope that both the load and distance may be gradually increased till finally the prophesy Sir William Thomson uttered at Niagara will have been fulfilled and vast quantities of power gathered at the great falls will be transmitted in the shape of electrical energy to operate mills and workshops and railways hundreds of miles away.

A NEW EDISON ELECTRO-MOTOR.

Mr. Edison, if correctly reported, has constructed a novel electro-motor or made important improvements in the present type—he is not yet prepared to say which—and because of this discovery declares that electrical traction will drive out all other forms, at least for city passenger traffic. Moreover, he says that the Broadway and the Third Avenue car companies will soon have cause to regret their enormous expenditures for cable roads, for that his new system could be installed by simple and readily accomplished changes in the roadbed. This will prove as melancholy news to Broadway merchants as to the companies, for if true, the long-continued and, indeed, not yet expired term of inconvenience and confusion might have been avoided.

Many who have watched the introduction and progress of the overhead trolley system were long since convinced that it would not prove a permanent form of traction. Too many parts of the apparatus are left exposed to the weather and other conditions unfavorable to reliable working, and though important improvements in economic apparatus are constantly being made, and running expenses have been declared by competent authority to be less per car mile than in any other now in practical usage, it was easily seen that the peculiar adaptability of electricity for operating motors was being utilized to only a small extent.

A self-contained motor without attendant wires and poles or charged rails or mains is the want of the day. Perhaps this is what the new Edison motor will prove to be. As it is declared to be easily applicable to Broadway and the Third Avenue it cannot need such accompaniments, for no one knows better than Edison how impractical such a system would be. As it would require but a slight and inexpensive change of the tracking, it evidently needs no pendent arms in a slot. Nor is it likely that so practical an inventor would resort to an exposed current transmitter with a metallic brush traversing it. Yet the fact that it will require a change in the tracking would seem to indicate that it is not to be operated by either a primary or secondary battery.

Whatever it may be, if it will run with speed and certainty in all weather, demanding neither poles nor overhanging wires, nor requiring an exposed conductor in the permanent way, it is urgently wanted and cannot come too soon.

Seed Farms of the United States.

According to Census Bulletin No. 111, the production of seeds as an industry has been for the first time made a subject of census investigation. This report is prepared by Mr. J. H. Hale, special agent, under the direction of Mr. Mortimer Whitehead, special agent in charge of horticulture. The material from which these statistics are compiled was obtained directly from the seed growers upon schedules prepared for that purpose and by personal visits of special agents to seed farms and dealers in all parts of the country.

This investigation included only such farms as were devoted to seed growing as a business, and did not consider the large amount of field and garden seeds grown as side crops on thousands of farms, which would greatly swell the aggregate yield of seeds, but would not fairly estimate seed growing as a special industry. It will be noted that seed growing has been carried on as a business in this country for more than a century, but that only within the past thirty years has it assumed large proportions. More than one-half the total number of establishments reported were started between 1870 and 1890. This report shows that there were in the United States in the census year 596 farms, with a total of 169,851 acres, devoted exclusively to seed growing, of which 96,567¼ acres were reported as producing seeds. Of these, 12,905 acres were devoted to beans, 1,268 to cabbage, 919 to beets, 10,219 to cucumbers, 71 to celery, 15,004 to sweet corn, 16,322 to field corn, 4,663 to squashes, 7,971 to peas, 5,149 to muskmelons, 662 to radishes, and 4,356 to tomatoes. The 596 seed farms reported represent a total value of farms, implements, and buildings of $18,325,935.86, and employed in the census year 13,500 men and 1,541 women. Two hundred and fifty-eight of these farms are in the North Atlantic divison, with an average of 185 acres per farm. In the North Central division there are 157 seed farms with an average of 555 acres per farm. The seed farms in Iowa and Nebraska average 695 acres, several being nearly 3,000 acres in extent.

Prior to 1850 all the seed farms of the country were in the few northeastern States of the Union, Connecticut and New York for more than half a century producing more seeds than all other States combined; and while each has at present more seed farms than any other State, the general westward tendency of all that pertains to agriculture has stimulated seed growing on a very extensive scale in the central West and on the Pacific coast. There has of late been a feeling of depression among the growers generally, who, previous to 1883, made exceptionally fine profits out of the business, and were thus stimulated to establish more seed farms than could profitably find market for their products during the past few years. The general feeling now is that prices must be advanced, or some method of production be discovered whereby a greater yield may be secured at less cost of labor.

A Dog Lives Twenty-seven Days without Food or Water.

On the night of September 27, 1891, the janitor of Parker Hall, Manasquan, N. J., went into the ticket office to put away some old tickets, and was much startled at feeling something crawling about his feet. Upon investigation, it proved to be a dog, which was in an extremely emaciated condition, and barely able to crawl.

The janitor alone has the keys of the place, and he is positive that the office nad not been unlocked since September 1. As he could get in by no other way, the dog must have been shut up for twenty-seven days without food or water.

There were only some old tickets and a cigar box or two in the office, and these were chewed into bits by the famishing animal.

The janitor had been in the hall several times between the above dates, but heard no outcry, and was greatly astonished when he found the office occupied. The dog was given a good drink of water and a loaf of bread, which latter was eagerly devoured, and at a subsequent date the dog was doing well, being apparently little the worse for his fast. O. D.

Can We Make It Rain?

I am not going to maintain that we can never make it rain. But I do maintain two propositions. If we are going to make it rain, or produce any other result hitherto unattainable, we must employ adequate means. And if any proposed means or agency is already familiar to science, we may be able to decide beforehand whether it is adequate. Let us grant that out of a thousand seemingly visionary projects one is really sound. Must we try the entire thousand to find the one? By no means. The chances are that nine hundred of them will involve no agency that is not already fully understood, and may, therefore, be set aside without even being tried. To this class belongs the project of producing rain by sound. As I write, the daily journals are announcing the brilliant success of experiments in this direction; yet I unhesitatingly maintain that sound cannot make rain, and propose to adduce all necessary proof of my thesis. The nature of sound is fully understood, and so are the conditions under which the aqueous vapor in the atmosphere may be condensed. Let us see how the case stands. A room of average size, at ordinary temperature and under usual conditions, contains about a quart of water in the form of invisible vapor. The whole atmosphere is impregnated with vapor in about the same proportion We must, however, distinguish between this invisible vapor and the clouds or other visible masses to which the same term is often applied. Clouds are not formed of true vapor, but consist of impalpable particles of liquid water floating or suspended in the air. But we all know that clouds do not always fall as rain. In order that rain may fall, the impalpable particles of water which form the cloud must collect into sensible drops large enough to fall to the earth.

Two steps are therefore necessary to the formation of rain; the transparent aqueous vapor in the air must be condensed into clouds, and the material of the clouds must agglomerate into raindrops. No physical fact is better established than that, under the conditions which prevail in the atmosphere, the aqueous vapor of the air cannot be condensed into clouds except by cooling. It is true that in our laboratories it can be condensed by compression. But, for reasons which I need not explain, condensation by compression cannot take place in the air. The cooling which results in the formation of clouds and rain may come in two ways. Rains which last for several hours or days are generally produced by the intermixture of currents of air of different temperatures. A current of cold air meeting a current of warm, moist air in its course may condense a considerable portion of the moisture into clouds and rain, and this condensation will go on as long as the currents continue to meet. In a hot spring day a mass of air which has been warmed by the sun, and moistened by evaporation near the surface of the earth, may rise up and cool by expansion near the freezing point. The resulting condensation of the moisture may then produce a shower or thunder squall. But the formation of clouds in a clear sky without motion of the air or change in the temperature of the vapor is simply impossible. We know by abundant experiments that a mass of true aqueous vapor will never condense into clouds or drops so long as its temperature and the pressure of the air upon it remain unchanged. Now let us consider sound as an agent for changing the state of things in the air. It is one of the commonest and simplest agencies in the world, which we can experiment upon without difficulty. It is purely mechanical in its action. When a bomb explodes, a certain quantity of gas, say five or six cubic yards, is suddenly produced. It pushes aside and compresses the surrounding air in all directions, and this motion and compression are transmitted from one portion of the air to another. The amount of motion diminishes as the square of the distance; a simple calculation shows that at a quarter of a mile from the point of explosion it would not be one ten-thousandth of an inch. The condensation is only momentary; it may last the hundredth or the thousandth of a second, according to the suddenness and violence of the explosion; then elasticity restores the air to its original condition, and everything is just as it was before the explosion. A thousand detonations can produce no more effect upon the air, or upon the watery vapor in it, than a thousand rebounds of a small boy's rubber ball would produce upon a stone wall.

So far as the compression of the air could produce even a momentary effect, it would be to prevent rather than to cause condensation of its vapor, because it is productive of heat, which produces evaporation, not condensation. The popular notion that sound may produce rain is founded principally upon the supposed fact that great battles have been followed by heavy rains. This notion, I believe, is not confirmed by statistics; but, whether it is or not, we can say with confidence that it was not the sound of the cannon that produced the rain. That sound as a physical factor is quite insignificant would be evident were it not for our fallacious way of measuring it. The human ear is an instrument of wonderful delicacy, and when its tympanum is agitated by a sound we call it a "concussion," when, in fact, all that takes place is a sudden motion back and forth of a tenth, a hundredth, or a thousandth of an inch, accompanied by a slight momentary condensation. After these motions are completed the air is exactly in the same condition as it was before. It is neither hotter nor colder; no current has been produced, no moisture added. It must, however, be added that the laws under which the impalpable particles of water in clouds agglomerate into drops of rain are not yet understood, and that opinions differ on this subject. Experiments to decide the question are needed, and it is to be hoped that the Weather Bureau will undertake them. For anything we know to the contrary, the agglomeration may be facilitated by smoke in the air. If it be really true that rains have been produced by great battles, we may say with confidence that they were produced by the smoke from the burning powder rising into the clouds and forming nuclei for the agglomeration into drops, and not by the mere explosion.—*Prof. Simon Newcomb, in the North American Review for October.*

Horses, Mules, and Asses on Farms.

Census Bulletin 103, prepared by Mr. Mortimer Whitehead, special agent of the Census Office, gives statistics of horses, mules, and asses on farms of three or more acres, but not including this kind of stock on ranges, kept on holdings of less than three acres, or in cities and villages.

The figures of the tables show that in the States and Territories there were on hand June 1, 1890, 14,976,017 horses, 2,246,936 mules, and 49,109 asses; that in 1889 there were foaled 1,814,404 horses, 157,105 mules, and 7,957 asses; that there were sold in the same year 1,309,557 horses, 329,995 mules, and 7,271 asses, and that there died from all causes 765,211 horses, mules, and asses during the same period.

Taking the whole country into consideration, the mule is not keeping pace with the horse as a farm animal; but the mule grows in favor and use in several of the Southern States faster than the horse. One reason for the change in the Eastern, Northern, Central, and Western States is probably the falling off in the profits of agriculture during the past decade, causing the farmer to economize in many ways. The price of horses has held up better than of most classes of farm stock during the past ten years. A team of mares can do the farm work and raise a pair of colts each year, so mares have taken the place of mules on tens of thousands of farms.

Still the breeding of mules is a great industry, found largely in Missouri, Kentucky, Tennessee, and Texas, with a considerable development in Kansas, California, Illinois, Arkansas, Mississippi, Alabama, and North Carolina. Under the diversified system of agriculture rapidly spreading in the South the breeding of horses and mules is growing in favor, and cannot fail to add largely to the material wealth of that section.

The hardy little burro has advantages over both horse and mule, and in some sections count up into the thousands, notably in New Mexico, California, and Colorado. Census figures show that on the ranges of New Mexico, in 1890, there were 13,074 of these useful creatures employed as pack animals for transportation.

The breeders of "jack stock" are mainly located in Tennessee, Kentucky, Illinois, Colorado, Missouri, Texas, Louisiana, and Alabama.

The jack stock imported into this country comes mainly from Spain, France, Italy, and the islands of Malta and Majorca. The best animals sell as high as $2,000 and $3,000 each. In the Poiteau district of France, not larger than most of our counties, statistics show that in a single year 50,000 mares were bred to jacks, and the yearly export of young mules amounted in value to between two and three millions of dollars.

Cheap Reservoirs.

Mr. C. D. Durban says that the cheapest reservoir that a man can build on his land for retaining water for irrigation purposes is a tunnel run into a hill. An open reservoir in a cañon or other suitable place will lose one-third of its water during the summer from evaporation, while in a tunnel there is no loss. A small spring will supply a tunnel with sufficient water for many purposes. He has illustrated this in a practical manner. On his own land at Mesilla Valley he ran a tunnel thirty-five feet long into a hill, in so doing tapping a spring; this tunnel he dammed up, leaving a space thirty-five feet long and the size of the tunnel, which is about five by six feet, to be filled with water. The water he carried to his house in pipes and we observed that it supplied his dwelling, another near by, his barn and drying house for raisins, as well as irrigated quite a space devoted to flowers for a garden. He says that the tunnel is the cheapest and best form, and that for each dollar expended one can obtain a space equal to twenty-five cubic feet.