Scientific American.

ESTABLISHED 1845.

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878) ..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, MAY 27, 1899.

IS SMOKELESS POWDER RELIABLE?

It will be a great misfortune if the recent bursting of a 10-inch gun at Sandy Hook disturb the confidence of our artillerists in the reliability of smokeless powder just at the time when we are introducing it extensively into our naval and military service. For the idea of abolishing the new powder is not to be entertained for a moment—all Europe is committed to its use, and we are already so far behind in this matter that a retrograde step at this juncture would be disastrous. We have been informed on the very best authority that immediately upon receipt of the tidings of the Sandy Hook disaster, the department canceled all orders for smokeless powder. If this be the case, the responsible authorities must have been in a state bordering upon panic, and the War Department, surely, is the last quarter in which a panic should be possible.

The accident is being made the subject of an exhaustive inquiry whose resulting verdict would carry more weight if the question of smokeless powder had been taken up in earnest half a dozen years earlier than it was, and our ordnance officers had acquired that familiarity with the subject which can only be gained by long and careful study in the laboratory and at the proving ground. It is an open secret that the War Department has been prejudiced, or, shall we say, ultra-conservative, in its attitude toward this supreme military question; and in its investigation of this, the first actual catastrophe due to the new propellant, it should guard against jumping to hasty conclusions, or being influenced by preconceived ideas. Conservatism is an excellent quality in the abstract, and there are certain spheres of activity in which we cannot well have too much of it. But the field of artillery and explosives is certainly not one of these; and it is a question whether it was not the determination of our experts to take no risks and make no mistakes that placed the country in the serious plight as to powder in which it was found at the opening of the Spanish war.

Official conservatism—the determination not to imperil expert reputation by risky but none the less imperative experimental work—is responsible for many of the fatalities at Santiago and in the Philippines. Surely, in our experimental work we could have afforded to burst an occasional gun or wreck a powder factory, if by such work the 20 or 30 per cent increase in our dead and wounded due to telltale brown powder would have been avoided. And that it could have been avoided the official dispatches only too clearly show.

We feel that it is impossible to attach too much importance to the smokeless powder discussion—seeing that it touches so nearly the very foundation of our system of naval and military defenses—and hence, we have thrown open our columns more freely than is our custom to the ventilation of a special technical question. In the current issue of the SUPPLEMENT will be found an article from Mr. McGahie, who has been intimately associated with the production of the form of smokeless powder adopted by the army and navy, on the question of Wave Action in Guns. Some of the data presented will be in the nature of a surprise to anyone who believes that the era of dangerous pressures was ushered in with the advent of smokeless powders and that the era of safety died with the passing of the "brown prismatic." The firing records obtained under the late Capt. Sidney E. Stuart prove that it was possible for practically the same charges of brown powder to show a variation of over 80 per cent in the pressures developed. Thus while 400 pounds in a 12-inch gun gave a normal chamber pressure of 36,000, 406 pounds showed a pressure of 60,000 pounds; while of two charges of 200 pounds in a 10-inch gun, one showed 37,600 pounds in the chamber and the other 59,000 pounds. Mr. Brown, the inventor of the wire gun of that name, is jubilant over the fact that in the 157th round at the test of his first 5-inch gun, a pressure of 82,600 pounds was recorded in the gages—a result which was as damning to the brown powder as it was creditable to the gun.

Evidently occasional irregularity in pressures is not confined to powders of the smokeless kind, and in view of the general excellence and uniformity of the results obtained with our smokeless powder, we cannot but feel that any determination to stop the introduction of an up-to-date propellant into our service is greatly to be deplored. As is shown in the article referred to, the possible causes of abnormal pressure have been investigated and are in a fair way to become definitely known. Here, by the way, is one of the most promising and alluring fields for further investigation of which we know.

THE FORTY-FOOT ENTRANCE TO NEW YORK HARBOR.

It is a cause of genuine gratification that the contract has now been let for dredging the great forty-foot entrance channel to New York Harbor. The position of New York as the leading port in the New World, and the point of arrival and departure of the great trans-Atlantic steamship companies, renders it imperative that its facilities shall not only be equal to the growing demands of shipping, but that they shall anticipate them. It goes without saying that, for a harbor to be entitled to rank as first-class, it must be capable of receiving the largest vessels at any state of the tide, and New York has always seen to it that the entrance channels to its harbor were deepened from time to time to meet the increasing draught of the largest ocean steamers. In 1881, when the maximum draught was 22 feet, the main channel was maintained at 24 feet; in 1891, when the draught had increased to between 25 and 27 feet, the channel was deepened to 30 feet; and last year, when the maximum draft of vessels actually entering the harbor had risen to 32 feet, and other even larger ships were either building or planned, it was decided by Congress to dredge out an entirely new channel, and increase the depth to 40 feet. At first sight this looks like an extravagant depth, especially as it is to be maintained for a clear width of 2,000 feet; but he is a bold man who, in view of the rapidity with which the dimensions of ocean steamships are increasing, will venture to predict that it will prove to be in excess of the requirements of the near future.

The present main ship channel is crooked and somewhat difficult to navigate, containing one sharp turn of about 95.° The new channel, which is to be about 7 miles in length, will commence on a southerly course and at once curve with a broad, easy sweep to a southeasterly course, on which it will run in a direct line to the 40 foot contour, 5 miles outside of Sandy Hook. The present soundings on the line of the channel vary from 32 feet at the inner end to 16½ feet on the outer shoal, and the estimated quantity of sand to be removed is 40,000,000 cubic yards. The contract has been let to Mr. Andrew Onderdonk of this city at a rate of 9 cents per cubic yard. By the terms of the contract he is given a year in which to prepare his plant, and after that he must remove 400,000 cubic yards in each working month of the first year and 1,200,000 cubic yards in each working month of the succeeding years until the task is completed. The work should be finished in about six years.

The scheme also provides for an inside channel, which will extend from the Narrows to beyond the Erie Basin and follow the shoreline on the Brooklyn side. It will be 1,200 feet wide and 40 feet in depth. The dredging of this channel will involve the removal of between 20,000,000 and 30,000,000 cubic yards of material, and the contract price is $2,485,000, thus making the total cost of the improvements $6,085,000.

The outer channel will probably be excavated by powerful sea-going suction dredges, similar to those in use on the Mersey bar off Liverpool, an illustrated description of which appeared in the SCIENTIFIC AMERICAN of August 27, 1898. These vessels can pump up 2,000 cubic yards of sand from a depth of 50 feet in three-quarters of an hour. Their hopper capacity is 3,000 tons. It is likely that the inner channel will be excavated by dredges of this kind assisted by scoop dredges of the standard type.

A QUESTION OF GOVERNMENTAL ECONOMICS.

In these days of increasing paternalism, with a multitude of State and National Experiment Stations around us, we hear much of Economic Entomology, Economic Botany, etc., and rightly so. But there is a phase of the "economic" portion of this work which appears to be in grave danger of escaping from the public view under the weight of printed material now showered from these centers of research. The case of the introduced "Cabbage butterfly," *Pieris rapæ*, an insect now pretty generally distributed throughout the country, although known to science west of the Mississippi but a few years, is in point. An examination of the bibliography of this species of insect pest divulges the fact that there has been much over a hundred papers or tracts published having reference, solely or in great part, to this species; and a cursory examination of these is all that is necessary to prove that, in most of them, there are no new or pertinent facts recorded, and that they contain but a reprint or rehash of former work, usually that so well done under the auspices of the late United States Entomologist, Prof. C. V. Riley, or his able successor, Dr. L. O. Howard. The case of this butterfly is but one of many like cases; that of the Texas "horn-fly" is almost as marked. It would seem that, if this work is to continue to deserve the title "economic," the directors in charge of the Experiment Stations should devise some means whereby the original work of one station would be electrotyped, or even printed at some common headquarters, and from there distributed to all needing it. That each station best knows its individual needs, and is best able to distribute literature to its immediate constituency, there can be no doubt; but that the recompilation and typographic and illustrative reproduction that is now the rule is not based on true economy is equally beyond doubt. The appropriations at hand, and the time of the able corps of students conducting this work, are far too limited to warrant this form of wastefulness, while so many economic problems of the first magnitude remain practically untouched.

HOW OUR ART MANUFACTURES MAY AFFECT OUR EXPORTS.

Art and art industries receive much more encouragement abroad than in the United States. We do not fully realize in this country the commercial value of art as applied to industries. We have, of course, many firms who produce artistic iron and bronze work, silver, glass, and ceramics which compare favorably with almost anything produced in Europe; but there are many things of every-day use which are made in the United States for home consumption and for export which are far from beautiful, and their ugliness is wholly unnecessary, and in time this will have an influence upon the export of these articles. There are many articles which we make which are far better than those made in Europe, but they must be improved in other ways outside of the essentials of technical excellence and cheapness, if they are to hold their own against similar objects made in Europe.

The Hon. Charles DeKay, late Consul-General at Berlin, has devoted great attention to this subject, and has considered it in all its phases. If the manufacturers in the United States realized what efforts are being made in Europe by the foundation of industrial museums—museums and schools for textiles, wood carving, and cabinet making—they would soon perceive that so soon as the manufacturers of Europe obtain the machines with which we make our goods, they will produce these articles as cheaply, if not more cheaply, than we can do, owing to the lower wages which obtain there, and will add to that cheapness the beauty which the training in art of those who have a natural aptitude for it can give the articles. Mr. DeKay is not an alarmist, but his observations and the testimony of the industrial art periodicals of the world should teach us that we cannot be too quick to forestall the loss of such prestige as American manufactures already possess and prepare for a much closer rivalry in such objects in the near future. Those who visit the great exposition at Paris next year will see for themselves that his note of warning is justified.

THE MECHANICAL ENGINEERS AND THE PATENT OFFICE.

At the recent meeting of the American Society of Mechanical Engineers at Washington, a subject of great importance was brought up and discussed; this was the question of the inadequate facilities of the Patent Office, and it resulted in the adoption of resolutions urging Congress to provide more ample facilities for the conduct of the business of the Patent Office.

Resolved, That the association, as a body and through its individual members, urge upon Congress the necessity of relieving the present overcrowded condition of the Patent Office and providing sufficient room, force, and facilities for the prompt and proper execution of its work.

Resolved, That we further urge that the records of the office, which so largely constitute the legal evidence of title of so many of the large manufacturing industries of this country, should be more safely stored, and that ample appropriations be made for providing incombustible receptacles for the records.

Resolved, That we especially urge that the library of the Patent Office, upon which the efficiency and accuracy of the work of the bureau depend, shall have such ample appropriation for its extension in its special field and for keeping it fully abreast of the progress in the mechanical and manufacturing arts of the day.

Resolved, That this association urge the necessity of giving to the Patent Office the use of the entire building in which it is now located, and that the moneys paid into the Patent Office by inventors be applied so far as necessary to the uses of the office.

We are much gratified to see that this most important matter has been made the subject of resolutions by the distinguished and representative body of men that make up this society. Coming from every section of the country and representing practically every branch of the industrial arts, the members are well qualified to advocate the claims of an institution which has been the most potent influence in fostering and building up the great industrial interests of this country. These resolutions come as a timely indorsement of the efforts of Commissioner Duell and his immediate predecessors to secure, not special favors, but common justice and courtesy at the hands of Congress.

The disabilities under which the Patent Office labors

are so well known to our readers, and have been so persistently presented in the Commissioners' reports, and reiterated in the SCIENTIFIC AMERICAN, as to be thoroughly familiar to our readers. The most crying evils are that the work has to be done in cramped and altogether inadequate quarters, and that the records have long ago overtaken the accommodation for properly filing them. As the Commissioner says, "Many of the records are almost inaccessible, and by reason of lack of sufficient space, so arranged that it requires double the time it ought to find them. A fire-proof safe should be built in which to store those records that cannot be replaced. The legal title to millions of dollars of property would be jeopardized by the destruction of our assignment records."

The justice of the claims of the Patent Office to more consideration is rendered even more evident when it is borne in mind that the office is not a tax on the public, but actually has a sum of over $4,000 000 to its credit in the Treasury.

WIRELESS TELEGRAPHY.

General Greely, Chief of the Signal Corps, has made public the result of recent experiments with wireless telegraphy which have been tried by the Signal Corps of the United States Army. He states that since the announcement of the tests in space telegraphy by Signor Marconi, some two years ago, the subject has been under consideration, and recently experiments have been begun with the object of thoroughly testing the value of this means of communication for military and other governmental purposes. Special forms of apparatus have been designed and constructed for these tests and they have already shown sufficient promise to warrant further and systematic trials.

In the experiments thus far carried on, several forms of transmitters for the generation of the Hertzian waves have been used, and much promise has been realized from the use of a large alternating current coil as a generator instead of the ordinary Ruhmkorff coil employed by Marconi. This coil is energized by a three-quarters horse power rotary transformer furnishing an alternating current at 125 volts, and this arrangement makes a very powerful and efficient source of Hertzian radiation. The former receiver used has been substantially the Brankey "coherer," discovered in 1891, and the signals transmitted are recorded upon a receiving tape. The transmitter has been mounted upon the western elevation of the State, War and Navy building, utilizing the present wooden flagpole as the vertical wire for the transmitter. The receiver was first placed at the old Naval Observatory grounds, about three-quarters of a mile distant, and later moved to the Signal Corps station at Fort Myer, Va. During the experiments constant communication was kept up by heliograph and flags between the transmitting and receiving stations, and this greatly facilitated the work of experimenting. Signals, letters, and words have been transmitted and received between these stations, but the great delicacy required in the present receiver has made the transmission of regular messages as yet unreliable and uncertain. The presence of large buildings and masses of iron and metal, necessarily present in cities, make such places undesirable for carrying out experiments of this character.

The distance over which signals may be transmitted by a given apparatus is governed by the height of the vertical wire used at either end, and this has naturally suggested the use of small balloons such as have already been used for signal and other purposes by the Signal Corps. A supply of these balloons has already been obtained, and will be used for this purpose in the near future. General Greely considers that the value of wireless telegraphy for communication between light houses and lightships and the shore is very great, especially where cables cannot be permanently maintained. For the signaling between ships at sea, and to replace ordinary flag methods in use between naval vessels, it should prove invaluable, since no kind of weather, fog, darkness, nor storm will affect its use, but that it will supplant to a material extent the use of wire for ordinary commercial telegraphy is not believed. The use of metal reflectors to augment and direct the radiation to particular points has already met with partial success, and should be thoroughly investigated. At present the radiation proceeds from the transmitter in all directions, and the same message can be received at any point within a proper radius at which a receiver is placed. A satisfactory reflector and a receiver of the proper electric capacity, or in other words tuned to the vibration of the particular transmitter, will make a great advance in space telegraphy. While secrecy of transmission is among the probabilities, the present stage of experiment does not justify its positive prediction.

Members of the Lighthouse Board stationed at Tompkinsville, Staten Island, N. Y., will in a few days begin a series of experiments intended to test the value of wireless telegraphy for use in lighthouses and lightships. One set of instruments will be set up in a station near St. George, and efforts will be made to communicate with the Scotland lightship. Other experiments will include the Sandy Hook and Fire Island lightships. If the experiments are encouraging, they will endeavor to communicate with the Highland lights. The instruments will be isolated as far as possible from other electrical apparatus and it is not believed that there will be anything in the intervening space between the instruments which will interfere with the signaling. The instruments used will be of the Clarke type, which we have already illustrated.

THE BICYCLE INDUSTRY.

The opening of the wheeling season gives special interest to some figures just prepared by the Treasury Bureau of Statistics. These tables, which present the statistics of bicycle exports during the past few years, show that American wheels are now being ridden in all parts of the world. In the wilds of Mexico and Central America; under the blazing skies of Cuba, Porto Rico, and other West Indian islands; across the pampas of Argentine, Brazil, and other South American states; amid the densely populated areas of China, British East Indies, and Japan; and in the jungles of Africa, the American wheel is making its way. Even in the great manufacturing countries of Europe, where workshops and skilled workmen abound, millions of dollars' worth of American bicycles are sold each year. During the four fiscal years 1896, 1897, 1898, and 1899, the exportations of American bicycles amount in round numbers to $20,000,000.

That such large numbers of a machine requiring such high grades of workmanship in its production should be continuously and successfully exported in competition with the workshops of the most successful manufacturing countries of the world is a factof which American workmen and Americans generally may justly feel proud. Four million dollars' worth of American bicycles will, during the fiscal year about to end, go to European countries—countries in which the manufacturing industries antedate by generations those of the United States. To France, with all her skilled workmen and ingenuity, exportations of American bicycles in the fiscal year 1899 will be more than double in value those of 1897; while the fact there has been a general lowering of prices indicates that in numbers the increase has been very much greater. To Germany the exportations of bicycles in 1899 will be 60 per cent in excess of those of 1897, though something less than those of 1898. To other countries on the Continent of Europe the bicycle exports of 1899 are 50 per cent in excess of those of last year or the year before. To the United Kingdom the bicycle exports of the year are materially less than those of 1898 as measured by values, though the fall in prices probably accounts for much of the apparent reduction, as shown by the figures, which give values exclusively and do not indicate the number of machines exported.

One curious and interesting fact in regard to the exports of bicycles illustrates the general tendency of our export trade in manufactures. This is the fact that a very large proportion of our exports of manufactures go to manufacturing countries. Two-thirds of our bicycles go to countries which make a specialty of manufacturing, and this export to manufacturing countries increases rather than otherwise. It will be remembered that predictions were made a year or two ago that the exports of bicycles to Japan would decrease as soon as the Japanese had obtained sufficient numbers as models for their own factories and had established themselves in the manufacture of wheels. This prediction, however, has not proved true. The exports of bicycles to Japan which in the fiscal year 1897 amounted to $52,179, were in 1898 $88,905, and in the fiscal year which ends next month will reach fully $130,000.

The largest single buyer of our bicycles in the fiscal year 1898 was the United Kingdom, which took $1,852,-166.

Germany's purchase of bicycles from us last year amounted to $1,724,404. Canada came next in amount of purchases in this line, the total being $611,402, while France was next with purchases amounting to $482,682; British Australasia next, $309,906; Netherlands, $251,918; Denmark, $226,370; British Africa, $148,503; British East Indies, $90,388; Japan, $88,905; China, $27,449; Dutch East Indies, $13,-368; and Africa, $11,647. To many of these distant places the exports of bicycles in the present fiscal year will exceed those of last year.

THE HEAVENS IN JUNE.

BY GARRETT P. SERVISS.

With the opening month of summer the magnificent Arcturus comes to the zenith in the early evening, say at 9:30 o'clock at the beginning of the month and before 8:20 at the end. Arcturus is sometimes referred to as a red or reddish star, but in fact it shows very little color except when it is near the horizon. When rising it often assumes a flaming appearance, owing to the unsteadiness of the air, but as it approaches the middle of the sky its ruddiness as well as its flickerings vanish, and it shines steadily with a pale yellowish light. But turn a telescope upon it, even when it is nearest the zenith, and it appears of a rich orange hue, and very beautiful. This is one of the very greatest of the stars, and even Sirius, probably, would make but a poor showing in the comparison if placed at an equal distance. In fact, some of the estimates of the quantity of light and heat sent forth by Arcturus are almost incredible, and if they are correct no planet could survive as near to Arcturus as the earth is to the sun.

While Arcturus reigns in midheaven, another star, whose actual magnitude is not much less, while it exceeds its rival in beauty, Vega, in the constellation Lyra, is the cynosure of the northeastern quarter. I have entertained a "telescope party" for an hour or more, simply by turning the glass in succession from Arcturus to Vega and back again. The contrast of their colors is delightful to look upon. To the naked eye Vega appears brilliantly white—"as white as a diamond"—but in the telescope it assumes a dazzling blue tint which is superb. The change from the deep orange of Arcturus to the piercing blue of Vega, and vice versa, is peculiarly pleasing.

A third great star whose actual magnitude, being unknown, because of its immeasurable distance, may be safely assumed as immense, Antares, in Scorpio, is seen in the southeast while Arcturus is overhead and Vega is sparkling in the northeast. Antares may be correctly enough described as a red star, and yet it, too, when on the meridian in a clear night, often appears nearer yellow than red. In the telescope its ruddy hue is pronounced, and, with a glass of four or five inches aperture, when the air is steady, the amateur observer may catch a glimpse of the little green companion of Antares, one of the most surprising of all double-star views.

THE PLANETS.

Jupiter is now so clearly the prince of the celestial legions that he should be placed first in the enumeration of the planetary phenomena of June. In the constellation Virgo, almost directly south of Arcturus, and some ten degrees east of Spica, he crosses the meridian about 8:30 P. M., in the middle of the month. Being situated south of the equator he comes more readily into view for the casual star-gazer than he would do if further north, although his southerly declination is otherwise a disadvantage. I can only repeat the advice to all owners of telescopes, however small they may be, to study Jupiter with diligence. Next to the moon there is no heavenly body whose features can be so easily discerned, and they are always interesting on account both of the variety of color and form and the gradual changes which they present. The motions of the satellites are a perpetual source of interest. I mention a few of the phenomena connected with them:

On June 5, at 8 h. 24 m. 15 s. P. M., Satellites I and II will be occulted, i. e., will disappear behind the planet, at nearly the same instant. On the 6th, between 6:32 and 8:44 P. M., the shadow of Satellite I will be upon the planet's disk; also on the 13th between 8:27 and 10:39 P. M. On the 14th, at 9:03 P. M., Satellite III will reappear for occultation, while between 7:19 and 9:39 the same evening the shadow of Satellite II will be upon the disk. On the 21st, at 9 h. 44 m. 6 s. P. M., Satellite I will reappear for eclipse by the planet's shadow. About 10 minutes later the shadow of Satellite II will pass upon the disk.

From Jupiter the observer will turn to Saturn, in the constellation Ophiuchus, rising about 8 P. M. at the opening of the month, and sufficiently elevated to be fairly well seen by 10 o'clock. The wings are widely opened, their northern face being presented toward the earth. Saturn is in opposition to the sun on the 11th, and but for its great southern declination would be well placed for telescopic study. A look at Saturn's rings with a telescope is a very convincing argument for people who are skeptical about the wonders of astronomy.

Mars will be found in Leo, setting before midnight, and too faint and far away to be interesting even for telescopic observation.

Venus is a morning star, moving from Aries into Taurus, and gradually approaching the sun. It rises soon after 3 A. M.

Mercury, traveling from Taurus through Gemini, is in superior conjunction with the sun on the 14th, becoming thereafter an evening star, and visible in the twilight about the end of the month. Mercury and Neptune will be in conjunction on the morning of the 15th.

Uranus is in Ophiuchus, rising before sunset, and Neptune is in Taurus and comes into conjunction with the sun on the 15th.

THE MOON.

New moon occurs on the 8th; first quarter on the 16th; full moon on the 23d, and last quarter on the 29th. The moon is nearest the earth on the 24th, and farthest from it on the 12th. A total eclipse of the moon occurs June 22–23, invisible in the eastern United States, but partially visible on the Pacific Coast.

The lunar conjunctions with the planets occur as follows: Venus, on the 5th; Mercury, on the 7th; Neptune, on the 8th; Mars, on the 14th; Jupiter, on the 19th; Uranus, on the 21st; Saturn, on the 22d.

MISCELLANEOUS.

The sun enters Cancer and astronomical summer begins on the 21st at 11 A. M.

There will be a partial eclipse of the sun on June 8th, invisible in the United States, except in Alaska, but visible in Europe.