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 Monthly (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, New York.

NEW YORK, SATURDAY, FEBRUARY 27, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SALT WATER FIRE PROTECTION FOR NEW YORK CITY.

Irreparable as is the loss occasioned by such disasters as the theatre fire at Chicago, and the recent conflagration at Baltimore, it is probable that the ultimate benefit to the general public far exceeds the local blotting out of life and destruction of property, great as it may be—and to this extent, if the sufferers can be so philosophical as to see it that way, they are paying the price for an enormous, never-ending benefit to humanity at large. The great theatre fire resulted in an immediate and sweeping investigation of theatre conditions, not merely throughout the United States, but, as we now learn, in every country in which adequate protection had not already been made against theatre fires. And now the aftermath of the Baltimore fire is seen in the widespread investigation which is being made to ascertain how far other great cities are exposed to the danger of a similar sweeping conflagration, should a fire once get a thorough hold in a congested district. Already there is, even among conservative engineers, a doubt as to the ability of fireproof buildings to act as fire screens, and protect the buildings that are to leeward of them from the onrush of a big city fire, driven by a gale of wind. It is also generally accepted that in the present state of our fire-fighting apparatus, the security of New York depends entirely upon the ability of our very efficient fire department to smother a fire before it becomes a conflagration; and the conviction is growing that, should a conjunction of unfavorable circumstances, such as a heavy fall of snow, a fire in a congested district of old buildings, and a sweeping gale occur, rendering it impossible for our fire department to smother a fire at the outset, it might easily grow to an extent which would render even our admirable New York city force helpless to stop it. Hence the need for some auxiliary system of fire protection, by which it would be possible to flood a threatened district with an immense volume of water.

The system that is finding the most favor is one that has been frequently proposed in past years for installation in New York city. But in this, as in many other advanced municipal improvements, while New York has been talking, the provincial cities have been acting, and Philadelphia is to-day equipped with a system of salt-water mains and powerful pumping plants, by which water may be drawn from the Delaware and delivered in great volume and under high pressure at a fire in any part of the principal business sections of the city. Cleveland also has a similar installation. Here in New York, the configuration of Manhattan Island is extremely favorable to the installation of such a system, and we are much pleased to see that our very wide-awake and capable Mayor has added to the many excellent suggestions that he has made in the few weeks of his term of office, by writing a strong letter to the Fire and Water Commissioners and the Board of Fire Underwriters, recommending that a system of mains be laid through the streets of the downtown portion of the city, and that separate pumping stations be established, thereby giving the city an entirely new and powerful supply of fire-fighting apparatus independent of the present city water supply. There is much to be said in favor of the plan, although the average citizen may well gasp at the contemplation of the widespread tearing up of the streets which will be involved in carrying out such a scheme. If Mayor McClellan's suggestion be acted upon, the work should not be started until the plans are thoroughly matured, and it should then be rushed through with all the expedition that unlimited capital and men can secure.

THE PROPOSED NAVAL APPROPRIATION.

To everyone who is at all familiar with the present trend of events in the design of ships of war, the character of the additions to our navy which are proposed by the Naval Affairs Committee will be in every way satisfactory. There was a division of opinion in the committee as to whether the proposed increase should include a considerable tonnage of fast unprotected cruisers, or less of these and more vessels of the battleship and armored cruiser class. We are gratified to see that the advocates of armored ships prevailed, and that it is proposed to increase our navy by one first-class battleship of 16,000 tons, to cost $7,775,000; two first-class armored cruisers of 14,500 tons, each to cost $6,505,000; and three scout cruisers of not over 3,750 tons displacement, each to cost $2,200,000, and two colliers to cost each $1,250,000. Of the total tonnage of warships thus proposed of 56,000 tons, four-fifths will be heavily armed and armored vessels capable of taking their place in the front line of a fleet engagement. This is as it should be. We have long believed that one ton of displacement in a battleship or heavily armed and armored cruiser is worth more as a determining factor in the issues of war than many tons in unprotected vessels of the cruiser and scout class. It takes but a glance at the list of ships now built and building for the United States navy, to see that we are relatively very strong in armored vessels. Thus, out of a total tonnage built and building of 616,275 tons, 496,000 tons, or over two-thirds, consists of armored vessels, of which more than sixty per cent are first-class battleships.

The new battleship, which will be a sister to the "Louisiana" and "Connecticut," will be one of the largest ships in the world, displacing 16,000 tons. She will have the American characteristic of carrying a heavier battery than any vessel afloat, not even excluding the 16,350-ton British battleships of the "King Edward VII." class. For defense she will rely upon an 11-inch waterline belt, a 4½-inch protective deck, 10 inches of steel on the heavy gun positions, and a broadside protection of 7 inches of steel carried from the main belt up to the main deck. She will mount four 12-inch, eight 8-inch, twelve 7-inch, twenty 3-inch, and twenty-eight smaller guns. This ship will be considerably the most powerful fighting unit afloat. Equally effective in the armored cruiser class will be two new vessels of the "Tennessee" type, of 14,500 tons displacement and 22 knots speed, with a 6-inch waterline belt, and 9-inch and 5-inch protection for the gun positions, carrying four 10-inch, sixteen 6-inch, twenty-two 3-inch, and twenty-four smaller guns. If the 5 inches of side and battery armor had only been 6 or 7 inches in thickness, these ships with their four 10-inch guns in the main battery, would be as much entitled to rank as battleships as do the three vessels of the "Pobieda" class in the Russian navy.

The cruiser scouts will probably be of the new class of boats which was introduced by the "Novik" of the Russian navy, a 3,000-ton scout of 26 knots speed, carrying half a dozen 4.7-inch guns. The "Novik" has been termed the destroyer of destroyers, in recognition of her supposed ability to run down and sink torpedo-boat destroyers. She showed up rather ingloriously at her first opportunity, which occurred recently at Port Arthur, for she was among the vessels disabled in that engagement. The two colliers which it is proposed to build are a type of vessel that is recognized as absolutely essential to the proper mobility of a modern fleet. They are really floating coaling stations, and we look to see a great development of this type in the future.

ELECTRICITY IN MINES.

The departmental committee appointed by the British government to investigate into the subject of the utilization of electricity in mines for the purpose of promoting precautionary and safety regulations concerning the same has issued its report. In this, the committee realize the extent to which electricity will be used in mining, and they favor the alternating current as being the best adapted to the work. They point out the greater safety attending the use of electricity if properly controlled. Concerning the potential of the current employed, they suggest 650 volts as the maximum at the face, but higher voltage in other parts of the mine. The necessity of a first-class installation is emphasized, and they state that electrical power must always be regarded as a powerful danger, and the current switched off and all subterranean machinery instantly stopped upon the slightest detection of gas, to prevent the possibility of explosions, accidents, and so forth, by short circuits, etc.

The general principles governing installations of electricity in mines which the committee suggest are as follows: (1) That explosives should always be treated as a source of potential danger. (2) That explosives and all apparatus connected with their use should be of thoroughly good character, and that all of bad quality should be immediately discarded. (3) That the handling of explosives should be limited to competent persons. (4) That in the case of danger from the presence of gas, precautions should be taken to insure thorough ventilation in order to remove the source of danger, and that no shot should be fired until all gas has been removed. Though we do not wish to imply that the risks attendant on the use of electricity where an installation is properly put in in the first place, and maintained in good order, are comparable to those which are and must be attendant on the use of explosives, at the same time we cannot shut our eyes to the fact that if an installation is not of thoroughly good quality and also maintained in a state of efficiency, it must add one more to the several dangers which it is the lot of the miner to face in his daily occupation. To follow out the above analogy, we think the general principles which should govern the employment of electricity in mines are as follows: (1) The electric plant should always be treated as a source of potential danger. (2) The plant in the first instance should be of thoroughly good quality, and so designed as to insure immunity from danger of shock or fire, and periodical tests should be made to see that this state of efficiency is being maintained. (3) All electrical apparatus should be under charge of competent persons. (4) All electrical apparatus which may be used when there is a possibility of danger arising from the presence of gas should be so inclosed as to prevent such gas being fired by sparking of the apparatus.

With regard to cables, there are special rules for guarding against the introduction of water within the insulating material in damp places; also for the substantial fixing of cables in shafts and for special protection where the cables in underground roads cannot be fixed at least a foot beyond the reach of any tub or tram. Cables, when suspended, are to be so fixed that in the event of a fall they will break away without damaging themselves, and trailing cables for portable machines are to be heavily insulated and armored. A coal-cutting motor is not to be kept continuously at work beyond a maximum time, to be fixed in writing by the superintendent. Current supplied for use on trolley wires with an uninsulated return is to be generated separately and not taken from lines used for any other purpose. Provision is made for the guarding of arc lamps against the possibility of ignited carbon falling. Arc lamps are not to be used when there is dangerous coal-dust. Vacuum lamps alone may be used, inclosed in gas-tight fittings. There is also provision for the supply of safety lamps in case of failure of the light. One section deals with shot-firing. The cable is in no case to be less than 25 yards long and the handle or plug of the firing apparatus is to be detached when not in use. Lighting and power cables are not to be used for firing shots except with the provision of special locked boxes for the firing plug or button.

EMISSION OF N-RAYS BY THE HUMAN BODY, ESPECIALLY THE MUSCLES AND NERVES.

M. Charpentier's discovery that the nerve centers and muscles of the human body give off a special kind of radiation has already been discussed in last week's issue. A few additional details have been sent to us by our Paris correspondent, which go to supplement what has thus far been published. Whatever may be the ultimate bearing of the discovery, the facts alone are of value, and further progress in investigating these phenomena will be watched with interest. The experimenter presents an account of his first work at a recent meeting of the Académie des Sciences.

While repeating in his laboratory some of M. Blondlot's experiments on the production and effects of the N-rays, M. Charpentier had occasion to observe a series of new phenomena which seemed to have considerable importance from a physiological standpoint. One of the most convenient methods of observing the N-rays is to receive them in the dark upon a phosphorescent substance of small luminosity, and the rays show themselves by increasing the light given off by the body. Fluorescent substances answer very well for the test screens, and one of the best methods is to use a platino-cyanide of barium screen whose luminous intensity is regulated by a radium salt covered with black paper and placed at a variable distance. The rays from the radium thus excite the screen and make it more or less brilliant. Such a screen then serves to reveal the presence of the N-rays by increasing in brightness when the latter are allowed to fall upon it.

The phosphorescent or fluorescent screen is found to increase in brightness when it is brought near the human body. The effect is strongest in the neighborhood of the muscles and nerves. Contracting the muscle heightens the effect. In the case of nerves or nerve centers, the phenomenon is shown more clearly as the degree of working of the nerve or center increases. In this way the presence of a surface nerve can be recognized and the path of the nerve can even be followed by exploring it with the test body. These effects are not only observed on contact with the skin, but can be perceived at a distance. The action takes place through substances which are transparent for the N-rays (aluminium, paper, or glass), and it is stopped by screens which are opaque for the rays, such

as lead or wet paper. The effect is not due to an increase of temperature in the neighborhood of the skin, as it keeps up when several sheets of aluminium or paper are interposed (separated by layers of air), and thus screen off the heat.

The rays given off by the body are reflected and refracted like the N-rays, and M. Charpentier was able to produce foci, which were indicated by the maximum brightness, by means of glass lenses. The index of refraction of the rays seems to be near that of the N-rays.

It may be thought that the body only receives and stores up the rays during the day, like the bodies which M. Blondlot exposed to the sun. But after remaining for nine hours in complete darkness, the phenomena showed themselves as usual.

The remarkable fact seems to be demonstrated that the human body gives off the N-rays. It is the tissues of the organism whose activity is the strongest which emit the rays in the greatest degree. These phenomena seem to be of capital importance in studying nervous action especially, as the nerves or brain are now found to exert an action on the exterior which remained unknown up to the present.

One striking experiment as to the effect of the muscles is that the area of the heart can be defined by exploring the region with a small test-screen. As this organ is in great muscular activity, its effect is considerable. When the small luminous screen is moved about the surface of the body in the region of the heart, the outline of this organ and its surface are manifested by the variations in brightness. Similar experiments are now being carried on with the brain and the rest of the nervous system, and the results are awaited with interest.

FLEETS IN THE FAR EAST—AN ENGLISH REVIEW OF THE POSITION OF RUSSIA AND JAPAN.

BY ARCHIBALD S. HURD, OF LONDON, ENGLAND.

It has not yet been realized seemingly by the world that Russia in the immediate future is determined to be essentially an Asiatic rather than a European power and that Port Arthur and Dalny will be her front doors and not, as was at one time supposed, her back doors. She is turning her face toward the sun, which has been denied to her hitherto in Europe, and her energies will be directed increasingly to the exploitation of the slice of China which she has secured and which it may be accepted as certain that, unless it be wrested from her by Japan, she will give up under no threats by whomsoever made. Plans which have been unfolding for several years past and have swallowed up several hundred millions sterling depend upon the ability of the Muscovite power to retain her nominal hold on Manchuria until the moment comes when she feels strong enough to throw off all reserve and, on one pretext or another, to annex this territory, one of the richest sections of China, wherein lies buried mineral wealth of untold value, with a population of about nine millions near at hand for its recovery.

In reviewing the naval situation it is not without interest to glance back over the course of events in the Far East—surely a unique record. In 1894, when Japan had defeated China, Russia, with the support of Germany and France, intervened and refused to permit Japan to hold Port Arthur, which she had captured from the Chinese after a long and most costly campaign. It was claimed that the integrity of China must be preserved in the interest of the peace of the world. Great Britain, though she did not throw in her lot with the other three powers, found their policy in agreement with that upon which she had insisted, and America stood aloof on similar grounds. Desiring the maintenance of China as an independent power, neither nation could with grace assist Japan to rob it of one of its best *points d'appui*, even by conquest. Not very many years had passed when the world was astonished to learn that two of the protectors of China had obtained "leases" of Chinese territory. Germany, in November, 1897, seized Kiau-Chau, and Russia obtained Port Arthur in the following January, and these examples were imitated by France and Great Britain. This was followed by the announcement that the Tzar had devoted £9,000,000 sterling from the War Chest to the carrying out of a great shipbuilding programme. It was subsequently ascertained that this sum was in addition to the ordinary navy votes, which had been rising for several years. The world heard next that Russia had obtained important concessions in Manchuria and that she planned to bring her trans-Siberian railway down to Port Arthur. In 1900 China proved a useful instrument toward the furtherance of Russian policy. The "Boxer" troubles gave the Russians the opportunity of pouring troops into Manchuria, nominally to guard the railway, then fast creeping down to the long-desired warm water. These troops have not been withdrawn and their number has been increased month by month. Since she first obtained her hold on China, "Russia," in the words of Dr. Morrison, of the Times, "has transformed Manchuria from a Chinese province to a virtually Russian possession."

Diplomacy has been supported at every step by naval power, often more imposing in array than dangerous in warfare. Since 1895 practically every battleship as it has been completed for sea has been commissioned, not for service in the Baltic, but for the Far East. With amazing rapidity Russia, which hitherto has had one fleet in the Baltic, frozen up for six months of the year, another in the Black Sea, nominally at least immured by the provisions of the Treaty of Paris, and a small force in the land-locked Caspian Sea, has created yet another squadron, more powerful than either of the others, and at Vladivostok and Port Arthur naval bases have been equipped, with a large dock at each place, and building facilities for torpedo craft at the latter. Meantime the great shipyards of Russia and of France, Germany, and the United States have been busy building for Russia additional men-of-war of the most powerful types.

A point which is often overlooked is that the development of Russian plans has been so hurried that the work has not yet been rendered sufficiently strong to bear the strain of a contest. In the Russian fleets in the Black Sea and the Far East are embodied pushful diplomacy—diplomacy with a mailed fist; but they are distinct and entirely separate, with over 12,000 miles of sea intervening. The ships which are built in the Black Sea remain in the Black Sea. Ships pass from Europe to the Far East, it is true, but they can travel from the Baltic to the Pacific only with the aid of coal obtained at British coaling stations. At Port Said or Suez, at Aden and at Singapore, Great Britain holds the lines of communication between these two fighting forces of Russia; and France, her ally, can render no assistance after the eastward-bound ships leave the Mediterranean. For the transport of stores and ammunition, Russia has the trans-Siberian railway. Is it realized by those who make much of this wonderful engineering achievement that the distance from Russia's arsenals at Moscow and St. Petersburg to Port Arthur is twice as great as from New York to Liverpool, or again more than twice as great as from Montreal to Vancouver by the Canadian Pacific Railway? Moreover, the trans-Siberian railway has been hastily and not too well laid. Consequently, under the most favorable circumstances stores sent from St. Petersburg or Moscow to Port Arthur take three weeks to reach their destination if sent by the best passenger train shown in the latest time table issued by the Russian government. This line would have to serve, after the commencement of war, for the transport of all stores for the army and navy, and those who are familiar with the difficulties attending the working of a long length of single rail in time of war will appreciate its value under such circumstances. Another point to be borne in mind is that its course through China must be heavily guarded by troops and that thousands of the Chinese would risk a good deal, if Russia were on the defensive, to cripple this line of communication by destroying a portion of the permanent way or blowing up one of the numerous bridges.

When it is said, therefore, that Russia's position as a naval power is unique, it will be admitted that her difficulties are of no ordinary character. Up to the present war she has triumphed. Every step in her programme of empire building in the Far East has been carefully planned years ahead, every preparation made, and only when she has assured herself that everything is in readiness has she, as opportunity has offered, taken the world into her confidence and stood firm by her intentions.

Since she obtained the "lease" of Port Arthur, Russia has made wonderful progress; but the scheme is not complete, and herein lies the explanation of her evasive diplomacy when she has been approached by one or other of the powers seeking assurances that she will withdraw her troops from Manchuria. It is now common knowledge that while these undertakings have been freely given, ships and men have been quietly massed in Far Eastern waters, stores have been accumulated, and every preparation made to hold what she has obtained.

Russia has already unostentatiously assured her military position by drafting something over 100,000 troops into Manchuria, but she clearly realizes that her future in the Far East depends less upon her soldiers than upon her ships and sailors. In the latter respect she is not yet ready. It was reported repeatedly in cablegrams, mostly coming through Shanghai, that Russia had "ninety warships" massed at or near Port Arthur. Though Russia has made the most of resources, this is a gross exaggeration. She has accumulated a large number of non-fighting ships in the Far East because she realizes that the Asiatic judges the menace of naval power less by guns and armor than by the number of funnels and the general impression conveyed by an array of ships of all types. Wise in her knowledge of the eastern mind, Russia has borrowed merchant ships and acquired many of the volunteer fleet to swell the fleet in Far Eastern waters, and she has succeeded not only in impressing the Asiatic, but, what she can hardly have hoped for, the European as well. What, then, is the strength of the naval forces of Russia in Chinese waters available for action? Below is a list of all the ships which Russia and Japan have ready.

RUSSIA.	JAPAN.
Battleships (8).	*Battleships* (6).
"Peresviet,"	"Fuji,"
"Poltova,"*	"Yishima,"
"Petropavlosk,"	"Asahi,"
"Pobieda,"	"Hatsuse,"
"Retvisan,"*	"Shikishima,"
"Sebastopol,"	"Mikasa."
"Osliabia,"	
"Czarevitch."*	
Cruisers (18).	*Cruisers* (24).
"Rossia,"†	"Asama,"†
"Rurik,"†	"Tokiwa,"†
"Gromoboi,"†	"Azuma,"†
"Bayan,"†	"Kasagi,"†
"Dmitri Donskoi,"†	"Chitose,"
"Aurora,"	"Kasagi,"
"Boyarin,"*	"Takasagi,"
"Pallada,"*	"Yoshino,"
"Askold,"*	"Akashi,"
"Bogatyr,"	"Yakumo,"†
"Novik,"*	"Idsumo,"†
"Razboynik,"	"Iwate,"†
"Djigit,"	"Niasin,"†
"Zabiyaka,"	"Yayeyama,"
"Diana,"*	"Chiyoda,"
"Variag,"*	"Hashidate,"
"Korietz,"*	"Itsukushima,"
"Yenisei."*	"Matsushima,"
	"Suma,"
	"Akitsushima,"
	"Isuma,"
	"Naniwa,"
	"Takachiho,"
	"Sai-yen."
Torpedo Craft.	*Torpedo Craft.*
2 gunboats.	4 gunboats.
19 destroyers.	20 destroyers.
12 torpedo boats.	38 torpedo boats of the first class.
Russia has in addition a number of transports, gun vessels and non-fighting ships.	39 torpedo boats of the second and third classes. Japan possesses many other non-fighting ships.

(To be continued.)

SCIENCE NOTES.

The English Board of Agriculture and Fisheries recently completed an interesting research concerning the swimming powers of fish. On May 8 last year, a number of marked fishes were liberated in the North Sea. On January 28 last a steam trawler landed a plaice, which according to the mark upon it was one of the liberated fishes. It had traveled 136 miles from where it was released to the place where it was caught.

It is said that the Navy Department will establish a branch naval observatory in Samoa, and that $8,000 has been allotted for this purpose. The justification for such an institution is that it will afford astronomical observation in a field almost undeveloped, such as discovering a list of 500 of the 1,597 stars adopted for publication in the Nautical Almanac of the United States, Great Britain, France and Germany at a conference of the directors in 1896, for the accurate determination of time for the use of navigators in that far distant section of the national domain, and for the determination of the magnetic elements, knowledge of which is so important to navigation.

The late Dr. John Hall Gladstone, before his death, carried out an investigation of fluorescent and phosphorescent diamonds. Chaumet, Dr. Gladstone pointed out in two brief papers read before the British Association, had recently announced that violet light renders diamonds, especially the more valuable stones, phosphorescent; a yellow stone which would not fluoresce, turned brown after an exposure of a few minutes, but was restored to its color and brilliancy in 24 hours. This phenomenon was described by Dr. Gladstone at the Aberdeen meeting of 1859; three stones of a ring which he then exhibited were somewhat fluorescent in daylight and phosphoresced in the dark; exposure to violet and ultra-violet rays produced the strongest phosphorescence. As not one of a collection of other valuable diamonds showed any phosphorescence, Dr. Gladstone was inclined to attribute the peculiarity to some unknown impurity not usually found in stones of the first water. The ring mentioned was exhibited again a few years ago by Prof. Silvanus Thompson at the Royal Institution; it lost its phosphorescent power completely afterward, and regained part of it after having been kept in the dark for a year. An accidental fire has finally put an end to this investigation.

* Since this article was written by the well-known English authority the ships marked with a star have been either destroyed or disabled. The "Variag," "Askold," and "Korietz" are supposed to be beyond repair.

† These ships have armored belts.