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, MARCH 31, 1900.

THE ISTHMIAN CANAL SURVEY.

We recently had occasion to protest against the Hepburn bill for the immediate construction of the Nicaragua Canal on the ground that it was stupid and unfair to the President and to the Commission to bring in such a measure before the President's Isthmian Canal Commission, which has been appointed for the purpose of determining which was the best possible route across the Isthmus, had had time to complete its labors and present its report. On more than one occasion we have drawn attention to the fact that the obviously proper thing to do before undertaking any active construction, is to make certain that the location selected is, all things considered, the best that can be chosen. In the first place, it is by no means clear that Nicaragua offers a better route than Panama; indeed the balance of evidence thus far adduced would seem to prove the contrary. Moreover, it is quite possible, as we have frequently pointed out, that careful investigation would show that there is a third alternative route superior to either Panama or Nicaragua.

General P. C. Hains and W. A. Noble, members of the Isthmian Canal Commission, have recently returned to this country, and in the course of a press interview, have made certain unofficial statements which would seem fully to justify even to particulars, the attitude taken by the SCIENTIFIC AMERICAN with reference to the Hepburn bill. The investigations of the commission, we are told, have shown that the underlying strata of the site of the big Ochoa Dam, on the Nicaragua Canal, are not so satisfactory as was at first reported, and though it is still considered practicable to build a reliable dam at that place, it is evident that the cost would be greater than estimated by previous commissions. While the route of the Walker Commission is pronounced feasible, the expectation that serious difficulties would be encountered in the construction of a satisfactory harbor at Greytown is confirmed. Mr. Noble stating that a big jetty would have to be constructed through the shifting sands, and that continual dredging would be necessary to keep the channel clear. Mr. Noble seems to have fully endorsed the statements made by the Panama Canal delegation in the preliminary hearing last year at Washington. The general tenor of Mr. Noble's remarks is to the effect that the American Commission found that this canal company was doing, and apparently is capable of accomplishing everything that it has promised. Particularly significant is the fact that our commission found that the Panama Company had a feasible scheme for controlling the Chagres River, a feat which all the world has considered impossible of execution.

The most significant statement of all, however, is that which refers to the possibility of finding a third alternative route across the Isthmus. Mr. Noble is reported as saying that what is known as the Atrate location presents a "good route, perhaps the best route, feasible and short" and in his opinion, "less expensive to build."

Athough the remarks of the returned members of the Commission were entirely unofficial, and were accompanied with the statement that no report of any kind had yet been made, they furnish much food for thought; and we respectfully commend them to the consideration of those members of Congress, who would rush the country into the immediate construction of a particular canal before they know whether it is the cheapest and best that could be built.

THE DESIGNS OF LAST YEAR'S BATTLESHIPS AND CRUISERS.

The hoped for removal of the deadlock occasioned by the refusal of the last Congress to authorize the armor for the new battleships and cruisers authorized at the last session, has encouraged the Construction Department to proceed with the details of the designs. It is stated by a member of the Construction Board that the battleships will be about 13,500 displacement and 18 knots speed. The main battery will consist of four 12-inch guns in two turrets, one forward and one aft, and four 8-inch guns in two turrets located upon either beam and sufficiently to the rear of the forward 12-inch turrets to escape interference. There will also be fourteen 6-inch rapid-firers carried in broadside. This is an extremely formidable battery, far more powerful than is carried by any existing ship in the world today. The decision with regard to the location of the 8-inch gun is not absolutely final, however, for should the forthcoming gunnery trials of the "Kearsarge" prove to be satisfactory, it is possible that the 8-inch guns will be placed above the 12-inch on the double-turret system.

The armored cruisers are to be magnificent vessels of 14,500 tons displacement and 22 knots speed, the battery consisting of four 8-inch guns in two turrets and an unusually large number of 6-inch rapid-firers carried in broadside.

BREAKING GROUND FOR THE RAPID TRANSIT TUNNEL.

Among the red letter days in the history of New York City, Saturday, March 24, 1900, must ever hold an honorable position as having witnessed the ceremonies inaugurating the actual construction of the great underground Rapid Transit Railroad.

Never has any great city, ancient or modern, undertaken a work of improvement which in its present scope and future possibilities could compare with the vast underground transportation system which is thus begun. Great, in the aggregate, as are the various tunnel roads of London, they have been built as separate and unrelated units, and they have taken many decades to reach their present importance; whereas, the system now commenced in this city has been designed as a single system to meet the carefully considered needs of the city. Having exhausted the possibilities of above-ground transportation, New York, which, by reasons of its peculiar topographical situation, has the most complex and difficult transportation problem to deal with of any in the world, has been driven to the underground system as presenting the only practical and adequate relief from its difficulties.

The spot chosen for turning the first spadeful of earth was immediately in front of the steps of the historic City Hall and above the terminal loop which will encircle the City Hall Park and form the present southern terminus of the road. The ceremony of turning the first spadeful of earth was performed by the Mayor. Addresses were delivered by the Mayor and by A. E. Orr, President of the Rapid Transit Commission, a gentleman to whose indefatigable efforts the present successful issue of the labors of the Commission is largely due. The spot will be indicated to future generations by a plain, bronze tablet, set in position not far from the spot where in July, 1776, the Declaration of Independence was read to the American troops in the presence of General Washington. The tablet will contain the names of the Mayor, the Rapid Transit Commissioners, the Chief Engineer, William Barclay Parsons, the contractor, John B. McDonald, and August P. Belmont, the President of the Rapid Transit Subway Construction Company.

The inaugural ceremonies have a special interest for the SCIENTIFIC AMERICAN, in view of the fact that this month exactly thirty years ago saw the opening of an underground tunnel beneath Broadway, which in some respects anticipated the great work which is now to be undertaken. It is well known to our readers that the late Alfred Ely Beach was early impressed with the advantages of underground transit, and had such faith in the possibilities of the system that he organized a company and built a preliminary length of tunnel which by a curious coincidence lies within a stone's throw of the scene of the present ceremonies.

GERMANY'S NAVAL PROGRAMME—A LESSON FOR THE UNITED STATES.

Whatever may be said of the policy of the present Emperor of Germany in general, it must be universally admitted, that as it effects the interests of the navy and merchant marine, it is farsighted and successful. Of the many momentous problems which the young Kaiser found confronting him on his accession to the throne, there is none to which he has addressed himself with greater zeal than to that of raising Germany to a high position in the strength of its merchant marine and in the numbers and efficiency of its navy. At his accession he found a navy which was only less obsolete than was our own in the year 1883, when we commenced the construction of modern steel vessels and for the first few years of his reign new ships were added to the German fleets in the haphazard methods which were characteristic of the naval growth in that era, and, unhappily, still characterize the provisions for increasing our own navy to-day.

In the year 1898, chiefly through the exertions of the Emperor, Germany inaugurated a system of warship construction which bids fair to become general among the navies of the world. Realizing the great length of time which must intervene between the voting of funds for construction and the actual completion or a warship, and probably being desirous of placing the question of the provision of necessary new ships beyond the accidents of party politics, the Government passed, in the year 1898, what was known as the naval septennate programme. This bill provided for the construction of what was practically a new navy, the cost of which was to be spread over a period of seven years, although a final modification limited the period to six years. In addition to new torpedo boats and gunboats, the bill provided for the raising of the strength of the navy by the year 1904, to that of seventeen battleships, eight coast defense vessels, nine large cruisers, and twenty-six small cruisers. The new construction involved called for seven new battle ships, two large, and seven small cruisers, besides new gunboats and torpedo boats to take the place of obsolete vessels of these classes that will be removed from time to time from the active list. The total expenditure thus authorized was $103,000,000, and the whole of the ships are to be in commission by the close of 1904.

The system providing for new ships in the United States is the antiquated one of authorizing the construction of so many vessels and sometimes none at all, at each annual meeting of Congress. The growth of the navy, a matter of the highest national importance, is, therefore, dependent upon the particular mood in which each Congress may happen to find itself. The perilous uncertainty of the system is shown in the fact that at this moment we are in danger of losing our position as the third naval power in the world to Germany, whose septennate programme gives her at the present moment a long lead over this country. An interesting comparison of the relative strength in 1904, of our navy and that of Germany, has appeared from the pen of Commander J. D. Jerrold Kelley in a recent issue of The New York Herald, in which it is shown that the German and United States fleets will be approximately equal when Germany's septennate scheme is completed in the year 1904. The comparison would be more gratifying were it not for a couple of important "ifs" with which it is prefaced, for it is assumed that Congress will agree to the new construction recommended by the House Committee and commented upon in our issue of last week, and that these ships and the battleships and cruisers of the "New Jersey" and the "California" classes, authorized last year, will be completed by 1904.

As a matter of fact, however, the ships of the latter class are at present held up for want of the necessary armor, and the ships of this year's programme may yet fall a victim, like those of last year, to the political exigencies of Congress. Unless the present Congress take favorable action, the year 1904 will find the German navy preponderating over our own to the extent of six first-class battleships and three large cruisers, representing together an advantage of no less than 110,000 tons in armored ships. A comparison of the number of vessels shows that Germany would possess nineteen first-class battleships against our twelve, and twelve large cruisers against our nine. And it must be remembered that warship construction is so long-drawn-out, that no amount of subsequent energy could compensate for the loss of twelve months' time thus incurred. It is to be hoped that in view of these facts Congress will not fail to authorize the new construction recommended for this year, and the necessary armor for the ships of this and last year's programmes.

So much for the year 1904. What of the years that follow it? Germany is so well satisfied with the septennate scheme that the Emperor has had the farsightedness and courage to have prepared another and much more ambitious programme, which will provide for the growth of the German navy up to the year 1920. The number of battleships contemplated for 1904 is to be doubled by the addition of nineteen new ships, giving a total of thirty-eight, while the navy is to include at that date twenty large cruisers and forty-five protected cruisers, the new ships thus provided for having a total displacement of 400,000 tons. Not only is the continuity of the construction work ensured for two decades, but adequate provision is made for the construction of the necessary docks and harbors. The total cost of this construction will be $465,250,000 which is to be raised by a scheme of loans and revenue taxes.

The question naturally arises if we are in danger of falling so far behind Germany by the year 1900, where shall we stand at the close of the year 1920? To leave such an important matter as the authorization of the new warships to the caprice of the naval committees of each current year, while our competitors, with commendable farsightedness, are establishing programmes that reach two full decades into the future, is to expose ourselves to the danger of being hopelessly outmatched at some future critical period in our foreign relations.

THE STEERING OF MODERN, SCREW-PROPELLED SHIPS.

The statistics of steamship disasters for the year 1898 showed that 42 per cent were caused by strandings alone. Startling as the fact may be to landsmen, shipowners and marine underwriters are well aware of the large ratio of losses due to vessels running ashore, as compared with losses due to collisions, founderings, and other accidents of the sea. After we have eliminated the strandings, known to have been due to fogs

and heavy weather, or to errors of calculation, or to carelessness on the part of the officers in charge, there is left a considerable number of casualities of this kind, of which a satisfactory explanation has never been given, and probably never will be. One of the most recent and significant instances is to be found in the recent loss of the "Mohegan," off the southern coast of England.

The remarkable disparity between the figures representing what we might call deep-sea and shoal water disasters, naturally raises the question as to whether, after we have exhausted the possible and probable causes, or combination of causes, of such an appalling list of strandings, there is not some other and unsuspected force at work against which no amount of care on the part of the navigator can avail. The subject was discussed at considerable length by the late Captain Cornelius W. McKay, in a paper which is published for the first time in the current issue of the SUPPLEMENT. Mr. McKay's explanation of these marine disasters is summed up in the statement, "it is respectfully submitted to the nautical world that the modern twin-screw ship does not always sail as she is pointed; in fact, that she cannot." The author argues that the extreme length of the modern merchant steamer renders it extremely difficult properly to control her course by means of a rudder acting at its rear end; and he argues that under certain conditions as, for instance, when wind and sea are acting on the bow and the helm is thrown over to counteract the effect, the resultant motion of the vessel is in a direction which makes a greater or less angle with the line of her keel. It is pointed out that if a modern Atlantic record-breaker should vary in her course only one degree it would have no serious consequence in the navigation of the Atlantic Ocean, but that "one degree more or less might mean something when dusting the white-wash off the lighthouses on the shores of the English Channel in the endeavor to cut time."

While we are not prepared to agree with all of Capt. McKay's conclusions, the subject is worked out in an ingenious and very readable manner, and the article carries weight, as coming from one so well qualified to speak on the subject. The point is well made, that the enormous disparity in casualties from stranding, as compared with those occurring from other causes, may well make us seek for some unsuspected or little understood cause for this class of marine disasters.

THE HEAVENS IN APRIL.

BY HENRY NORRIS RUSSELL, A.M.

The evening skies during April present the greatest number of first magnitude stars visible at any one time during the year. Twelve of the sixteen brightest stars visible in this latitude are above the horizon at once, and the brilliant spectacle which they afford is well supported by their less conspicuous neighbors.

At 9 P. M. in the middle of the month Orion hangs close above the western horizon, the three stars of his belt forming a nearly horizontal line. Above them is the bright red star Betelgeuse, in the giant's right shoulder, and equally far below the White Rigel marks his left foot. Between the belt and Rigel are three fainter stars in an almost vertical row, which form his sword. All three of these appear in a field glass as interesting double stars; and around the middle one spreads the great nebula, one of the most magnificent of telescopic objects.

The line of Orion's belt points on the left to the brilliant Sirius, and on the right to the ruddy Aldebaran, beyond which are the Pleiades. Above Sirius, and forming an almost equilateral triangle with it and Betelgeuse, is Procyon, the lesser dog-star, while farther north above Orion, starry Gemini displays its twin brilliants, Castor and Pollux, and still farther to the right is the bright star Capella, near the Milky Way.

The Great Bear is almost overhead, in the highest part of its circle around the pole. Farther south is Leo, only too well known to those who watched vainly for the meteors of last November, which is marked by the familiar "sickle" with Regulus at the end of the handle. Arcturus shines at a considerable altitude in the eastern sky, while below and to the right the paler Spica marks the constellation Virgo, and far in the northeast Vega is once more above the horizon, after some months' absence from the evening skies.

THE PLANETS.

Mercury is a morning star in Pisces, rising about an hour before the sun at the beginning of the month, and nearly an hour and a half at the close. On the evening of the 21st, it reaches its greatest apparent distance from the sun—about 27°. This is considerably greater than usual, because Mercury is in that part of its eccentric orbit which is farthest from the sun, its greatest distance being reached on the 16th. This circumstance affords a good view of the planet to those early risers who choose to look for it in the morning twilight, but is partly compensated for by its loss of brightness, due to the fact that at its greatest distance from the sun it is exposed to less than half the light and heat which pour upon it when nearest.

Venus dominates the evening sky, remaining above the horizon for fully four hours after sunset, and far surpassing in brightness its stellar neighbors. During the month it traverses the length of Taurus, passing close to the Pleiades on the 5th. It is very bright, continuing to increase in this respect throughout the month and can easily be seen in the daytime with the naked eye, if one knows just where to look for it.

There is really no difficulty at all in seeing Venus (when near its elongation) on any clear day, even at noon. The difficulty consists in finding so small an object without anything to guide the eye to it. When once found the planet is easily seen, and may be shown to others by getting it in line with the top of a tree or any other object which serves as an object guide.

Such a pointer will be furnished by nature on the afternoon of the 2d, when the moon comes close to Venus. The distance is least about 9 P. M., when it is less than twice the moon's diameter. So throughout the afternoon Venus may be seen, weather permitting, above and to the left of the crescent moon, at a distance of three or four of its diameters.

It will be interesting to note the contrast in brightness between Venus and the moon. In spite of its very small apparent size, Venus appears much more luminous than the moon.

This is explained by the two facts that Venus enjoys a sunlight twice as bright as ours, and that it reflects over half the light which falls upon it, while the moon reflects only about one-sixth.

Mars is a morning star in Pisces, but is distant from the earth and faint. It passes close to Mercury on the forenoon of the 2d.

Jupiter is gradually coming into position for evening observation, rising a little before midnight on the 1st and at about 10 P. M. on the 30th. It is in Scorpio, about 5 degrees north of the bright star Antares.

Saturn is a morning star in Sagettarius, rising about 1 A. M. at the beginning of the month and two hours earlier at its close. Its rings are very widely opened out, but it is too far south for favorable observation. Uranus is in Scorpio, quite close to Jupiter, and Neptune in Taurus, but too faint to be seen without a telescope.

THE MOON.

First quarter occurs on the afternoon of the 6th, full moon on that of the 14th, last quarter on the morning of the 22d, and new moon on the night of the 28th.

The moon is nearest to the earth on the morning of the 11th, and most remote on the night of the 26th.

Besides the conjunction with Venus, already mentioned, the moon passes Jupiter (quite closely) on the morning of the 18th; Uranus the same afternoon; Saturn on the morning of the 20th; Mercury on that of the 27th, and Mars the same afternoon.

Princeton University Observatory.

THREE TYPES OF AUTOMOBILES.

At a meeting of the New York Electrical Society, held in this city on the 22d instant, talks by representatives of three different kinds of automobiles was given, accompanied by illustrations, for the purpose of enabling those present to form an opinion as to which was the superior.

The first speaker was Mr. A. L. Riker, the inventor of the Riker Electric Vehicle and Running Gear. He stated that the advantage of electric power was that it was like the horse, in giving a great quantity when needed, easily and quickly. Then he explained three plans for connecting up the storage battery for producing different speeds by using sections of the whole battery and connecting them up in multiple or series, according as a rapid or slow speed was desired.

For pleasure vehicles, from 12 to 15 miles an hour was the fastest speed.

This plan of the subdivision of the battery is more economical than the use of resistance coils in cutting down the current, and has the advantage, in case of a rupture in the high-speed circuit, of enabling the vehicle to be taken home on the remaining cells grouped for the slow speed. Illustrations were shown of the controller operated by a single lever; when moved forward from a zero point the vehicle moved forward, and when moved backward from zero reversed the motor and moved the vehicle backward.

Special devices are provided to lock the lever at the zero point. On the front dashboard is placed the voltmeter and ammeter indicating the condition of the battery when discharging. In a battery of 44 cells the voltmeter should show 80 volts. Starting at this figure the vehicle may be run till the voltage falls to 68 volts, then the battery should be recharged. In going away from home it was well to return when the voltage dropped to 74

The charging plug was shown, and is constructed in such a way as to prevent any mixing of the battery pole terminals. In New York, the Edison Company would soon establish electric hydrants in front of their stations for the purpose of facilitating carriage charging. There were illustrations of storage battery crates showing the plan of burning the lead terminals together, also of the motor, the single and double gear equipments, the double-gear steel frame being very flexible. The differential gear is located in the hub of one of the wheels of the rear axle, on the single-gear frame, which allows a solid steel axle to extend between the two wheels. The gear wheel meshing into the pinion of the motor is supported upon a tubular axle, within which is the solid axle. This construction is much stronger than the old system of having the axle divided and the differential gear located in the center.

The steering gear was explained, also the two plans of applying the brakes and several illustrations of completed vehicles of different styles were shown.

Mr. C. J. Field discussed the "Present Development of the Gasoline Type of Automobile," showing by diagrams the general construction of the four-cycle flanged-jacket motor. He thought the reason why these motor carriages were used abroad more than in the United States was on account of the more general production of electricity here, the facilities for the charging of batteries of electric vehicles being better, but for pleasure touring over long distances he regarded the gasoline-driven vehicles as superior. The four-cycle type of engine was preferred.

Ninety per cent of the difficulties in starting or operating gasoline engines was due to the imperfect electrical construction or insufficient electric power to produce the proper spark. The jump spark and wiping spark are preferable and mostly used. Special flanged cooling tanks are provided, through which the water flows from the water jacket of the engine and is cooled by the air impact. This improvement allows a smaller weight of water to be carried.

The most approved carburetor for heating the vapor gas is called the Areile; heated air surrounds the outlet of the gasoline vapor, mixes with the latter, heats it, and further on is mixed with cold air, then passes on to the engine. The devices for obtaining variable speeds from a constantly running shaft, he stated, were still crude and clumsy.

Some of the hydrocarbon racing machines abroad had engines of 24 horse power, and made records of 35 miles an hour, some going above 40 miles.

He spoke of the Belgium system of combining gasoline and electricity in the same vehicle in connection with a small storage battery which had some promise of value and economy.

Succeeding Mr. Field, Mr. J. A. Kingman reviewed the history of the steam carriage, showing a picture of Cugnot's carriage, invented as early as 1769. Many other steam coaches and stages were shown, until the era of liquid fuel brought the speaker down to the latest improvements of Whitney, a relative of Eli Whitney, the inventor of the cotton gin, and Stanley, known as the locomobile, where the miniature boiler is located under the seat. The pressure carried is 160 pounds to the square inch and steam can be generated within five minutes. The fuel is vaporized and combustion is promoted by compressed air.

After the presentation of the three forms of vehicles there was a brief interesting discussion. The opinion expressed was rather more favorable to the electrical vehicle, one member stating that he did not fancy the idea of sitting over a boiler under a pressure of 160 pounds to the square inch.

MUTUAL AID SOCIETIES FOR FRENCH SCHOOL CHILDREN.

A great many mutual aid societies called "petit-cavés," from their founders, MM. Petit and Cavé, are now being organized among the school children of France. They are established under a law of 1856, and made operative by a law of 1898. The object is to accord assistance to the child members during sickness and to furnish a pension fund for old age. The maximum amount which can be obtained as a pension is only $69.48 per annum. The children deposit 2 cents per week, one cent going to the fund for aid in sickness and the other to the pension fund. This money is placed in the government repository where it is invested in government bonds. The government aids these societies; for every child who contributes during an entire year, the state gives a franc, or nearly 20 cents to the common fund. It also gives a sum equal to the entire amount deposited by the children. The one cent deposited weekly which goes to the pension fund can never be reclaimed except in the form of a pension. The money derived from the reserve fund passes to the next of kin in the event of the death of the depositor. Each child is given a bankbook in which the deposits may be entered and which gives tables and information regarding the plan. The aim of the children's societies is to aid parents by paying them an indemnity during the sickness of their children of 10 cents per day during the first, and five cents per day during the second and third months of their sickness; also to create annual pension funds and to imbue all children at an early age with the element of economy, to accustom them to the use of a bankbook, and to the consciousness of having money at work earning something for them and held in reserve for their old age. The society is spreading rapidly throughout France, specially among the working classes. The savings banks at the present time are being overrun with deposits; the money limit for any one depositor at present is $386, but after August of this year this will be reduced to $289.