

a Weekly Journal 0f practical information, art, science, mechanics, Chemistry, and manufactures.

|  | NEW YORK, JANUARY 7, 1899. |  |
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The New East River Bridge.
Length between terminals, 7,200 feet; length of main span, 1,600 feet; extreme width of bridge, 118 feet; height of floor above high water, 135 feet; height of cables at top of towers above high water, 332 feet.

2.-Anchor Plates for Inside Cables, Before the Girders are in Place.

4.-Air Lock Hoist.

3.-Anchor Platform for Side Cable, with Flooring of Steel Deck Beams to

6.-A Completed Pier on the Brooklyn Side.
construction of the new east river bridge.-[See page 10.]

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NEW YORK, SATURDAY, JANUARY 7, 1899.

## A RETROSPECT OF THE YEAR 1898.

 The year which has now drawn to a close will go down to history as marking one of the three great epochs in the history of the United States. The year 1776 saw the birth of this Republic ; in 1865 its unity was proved and declared to be forever indissoluble; and, unless the present signs miscarry, the year 1898 will mark the era of its worldwide expansion. At each crisis the guidance of the good ship of state was in the hands of men o unquestioned patriotism and integrity, who acted for a strong majority of the people. The brilliant history which records the making of this, the latest and most virile of the great peoples of the earth, proves that in 1776 and 1865 the majority was right. And what of 1898? The chief executive of the nation declared war upon Spain with the practically unanimous consent of the country, and in less than thirty days we found the widespread colonial possessions of Spain within our grasp, and the tremendous problem of world wide empire confronting us. In the contemplation of the onl alternatives of advance or retreat we have deliberately and with, we believe, a clear sense of the grave and al together untried responsibilities involved, decided tobreak away from the traditions of the past and take our stand as one of the great colonial powers of the world.
Whether this momentous step will redound to our profit or lead to our undoing will depend upon the spirit in which we enter upon our new possessions and administer their affairs. "Men at some times are masour stars but in ourselves" if we fail to bring peace, contentment, and prosperity to the new and strange peoples that have become subject to our administration. We believe, however, that the very magnitude of the trust imposed will impress upon Congress the
necessity of abolishing so-called "politics" from our colonial affairs and administering them with a single eve to the fair name of America and the best interests of the races which we have rescued at the cost of much blood and treasure from a burdensome despotism.
By no means the least fortunate result of the war is the repairing of those bonds, "strong as steel, yet light as air," which once again unite Englana and America -bonds of common lineage, language, laws, religion, and feeling, the severance of which the great Burke so eloquently deplored a century and a quarter ago. The best guarantee of the depth and permanence of the present understanding is the fact that its existence
is not now and probably never will be imperiled by is not now and probably never will be impe
embodying it in the terms of a formal treaty.

Brief as it was, the war served greatly to increase the prestige of our navy in respect of its discipline, personnel and material. As regards the army, it proved that the fighting qualities of the American soldier of to-day ate battlefields of the Civil War. Manila and Santiago take rank with Mobile Bay and the Mississippi, while take rank with Mobile Bay and the Mississippi, while
San Juan and El Caney are comparable in the desperate bravery of the combatants to Antietam and the fina charge at Gettysburg. If we except the monitors, our ships acquitted themselves adıirably; we do not
know of a single case, among the larger vessels, of absolute breakdown, and the failure of the torpedo boat was only what everyone looked for. Guns and mounts gave general satisfaction; and the breakdowns, both in ships and guns, were in matters of detail only and were easily repairable. The,war has brought home to the country the absolute necessity for an increase in ou naval and military forces. and it is likely that before the year is many weeks old our standing army will have been increased to $100,000 \mathrm{men}$, and a general appropriation will have been authorized for new battleships and cruisers of the most approved construction
Next to the Spanish-American war the most notable occurrence of the year is the remarkable victory which was gained by the British forces in the Soudan. The overthrow of the Mahdist forces is a triumph of civili zation over barbarism, and it brings the fairest of the equatorial provinces of Africa under the dominion of a
people who have proved to be the most successful and
beneficent colonizers in the history of the world. The Eastern Question has shifted from Constantinople to the far East, and has resolved itself as belits the spirit of the times from a military problem to a problem of
trade and commerce. "The open door" is the watch trade and commerce. "The open door" is the watch-
word of that side of the controversy to which our interests and the logic of events appear to be insensibl leadiug us.
The new year opens auspiciously for the prospects of industry and trade, and the improvement is the more encouraging because it has been gradual and gives promise of being permanent. The most gratifying fact is the secure hold which we are obtaining upon foreign markets, as evidenced by the increasing demand fo goods of American manufacture. The increase in our exports is being accompanied by a marked decrease in imports, and we are evidently fast approaching a time when we shall be absolutely independent of the Euro pean markets except in a few special and limited lines of manufacture. Very significant events in the trade between this country and Great Britain were our ship ments to that country of coal and ship plates and the recent order for American locomotives. It is true the recent order for American locomotives. It is true the
orders coal are stated to have been die to the coa strike, and the shipment of hhipbuilding material and ocomotives to the inability of British manufacturer to keep up with their orders; but the ground has been broken, and it is more than likely that these orders wil prove to be an open door of a permanent trade in these commodities.
Again we have to record a dearth of new construcion of any magnitude in the sphere of civil engiueering. The Siberian Railroad continues to be the reatest engineering project under way, and through the past year it has been pushed forward with tireles reater This colossal work, moreover, has taken on rreater significance because of its being the actual key
to the Eastern Question as far as Russia is concernedEvery rail that is laid, every spike that is driven, is an other link in the chain by which the Russian Empire seeks to bind the destinies of Northern China to its own. The latest estimates place the completion of the road as far off as the year 1903 to 1904 . The United States are concerned more with betterments of existing railroads than the construction of new lines, although a total of 1,652 miles was added during the last fisca ear, the total length of all roads being now 184,42 miles. The largest bridge under construction is the new suspension bridge across the East River, New York, which will have a length between towers of 1,600 feet and a width of 118 feet. The foundations of the towers are all completed and the anchorages are under construction. It is likely that the stringing of the cables will commence some time in the summer or early pacity of the existing New York and Brooklyn suspen sion bridge by double-decking the floor system and adding four supplementary cables above the present cables. It is not unlikely that another brillge will be commenced across the East River to the north of the new bridge now under ronstruction. The year has seen the erection of a new pin-connected bridge across the St. Lawrence, at Montreal, in place of the famous Robert Stephenson, and a handsome steel arch ha also been built below Niagara Falls, replacing the old suspension bridge, the site of which it occupies. In his connection it may be wentioned that early in the present year, work will be commenced on a sus-
pension bridge to replace the old Lewiston bridge, which was wrecked several years ago. The massive drawbridge across the Harlem River on Third Avenue New York, which weighs 2,500 tons, has been opened
for traffic, and preliminary steps have been taken toward the erection of a similar structure over the same river. The great North River suspension bridge exists as yet only on paper. Badly as it is needed great as would be the benefit conferred, the estimated cost of $\$ 60,000,000$ is evidently regarded as prohibitive We have to record one of the most fatal bridge acci dents of recent years in the fall of the new Cornwal bridge, when a river pier and two 370 -foot spans fell into the river. The failure was probably due to erosion of poorly designed foundations.
Under the head of transportation there has been very little development of an abnormal character. Locomotives and trains have continued to grow in weight, and the records of one year are regularly exceeded in the next. As regularly as the prophets de clare that the limit has been reached, the locomotive builders prove that it has not, by making big increase in cylinders, boilers and total weight. Early in the year the Brooks Locomotive Works produced for the Great Northern Railway a monster freight locomotive weighing 106 tons, with cylinders 21 by 34 inches and 3,280 square feet of heating surface; yet a few months later, this was exceeded by the Pittsburg locomotive of 115 tons, with cylinders 23 by 32 inches and 3,322 square feet of heating surface. The fact that practically nothing is being done in this country in the way of nove and experimental locomotives goes to prove that loco motive engineers are well satisfied that finality of type
vival of interest in four-cylinder locomotives, no less than four different roads having placed engines of this sind on the road. In France the Heilmann electric locomotive is still on trial, but nothing very definite has been given out regarding results. Railway speeds have remained stationary, the credit of running the fastest regular train in the world still belonging to the Philadelphia and Reading Railroad, a train from Philadelphia to Atlantic City making the run of $551 / 2$ miles at the rate of $66 \cdot 6$ miles an hour.
The last year has not been marked by the sensational performances in ocean transportation which character zed the preceding year. The "Kaiser Wilhelm" of the North German Lloyd has not surpassed her record of 22.35 knots an hour for the whole trip across the Atlantic, although she is said to have steamed for one whole day at an average speed of 23 knots, a feat which was about equaled by an older ship, the "Lucania." which maintained 22.9 knots for an all-day run. The "Kaiser Friedrich," which is practically a sister ship to the "Kaiser Wilhelm." and was designed to exceed the atter vessel in speed, has been somewhat of a disappointment, having failed to come within $11 / 2$ knots of the speed of the earlier vessel. The Hamburg-American ine are building a 16,000 ton ressel to steam 23 knots and the "Oceanic" of the White Star line, of 17,000 tons and 704 feet long, will be in service during the coming summer. The greatest interest at present at taches to the huge freight ships which are being con structed in increasing numbers and of ever-increasing dimensions. Several of these will draw 32 feet of water, and a strong movement is now on foot to have the government deepen the entrance channel to New York Harbor to 35 feet, so as to accommodate the expected increase which will yet take place in the draught of future ships. The year has been fruitful in disasters at sea. The shocking loss of life in the foundering of the "Bourgogne," the "Mohegan," and the "Portland," proves that with all our boasted improvements in ships and seamanship, we have yet to learn how to render ocean travel reasonably secure.
Electricity continues to assert itself as the most suit able power for city and suburban traffic. In the former it is supreme and for suburban travel it is growing in favor. The interest of the great railroad systems in the question of substituting electric for steam traction on their suburban and branch roads has not been so marked as it was in the preceding year; but experimental work in this direction is being carefully watched with a view to future developments. The uccess of the existing underground eiectric roads in London has led to proposals for the building of several other important lines of this kind. Orders for the equipment of these roads continue to find their way to this country. The most remarkable electric system at present under construction, in this country, is that of the Metropolitan Street Railway Company, in New York city. During the year underground trolley ines have been built on two of the avenues, and the well known Broad way and Lexington Avenue cable roads are being electrically equipped. The many advantages of the new motive power over the old are self-evident to the traveling public, and the underground trolley has evidently come to stay for good, or until some unthought of and better system shall take its place. Undoubtedly the most important develop, ment in transportation has been the remarkable success of the automobile carriage in this country. The horseless cab has established itself as a thoroughly practical and popular means of travel with the general public in New York, while its high speed, its ease of control, its comparative noiselessness and its conven ence for use in the city in place of the two-horse carriage is rendering it increasingly popular with the wealthier classes. The electric cabs of New York are standing the test of winter work, and, during the recent snow-storms, they ran under conditions which dis. couraged even the horse cabs.
No record of the year would be complete without mention of the very successful Trans-Mississippi and Omaha Exposition which was held during the summer nonths in the flourishing Western city from which it took its name. The enterprise was conceived and car-
ried out with characteristic Western zeal and enterried out with characteristic Western zeal and enter-
prise. In thirteen months irom the day on which the first spadeful of earth was turned the work of preparation was completed, and this in spite of the prevailing commercial depression. Some $\$ 2.000,000$ was spent upon the grounds and buildings, and these were laid out with a landscape and architectural effect that rivaled that of the Chicago Fair. The Exposition was in every respect an unqualified success.
The record of new naval construction during the year is particularly gratifying when we bear in mind that it was carried on in spite of the severe pressure put upon our resources by the Spanish war. In the twelve months we launched no less than five first-class battleships of 11,525 tons displacement, making a total of 57,625 tons in battleships alone, thereby more than doubling the battleship force of our navy in one year's addition. The ships are the "Alabama," " Illinois," Wisconsin," "Kearsarge," and "Kentucky ;" the
been reconstructed, refitted, and rearmed, the changes making them thoroughly up-to-date vessels; and the improved plans of the new "Maine," "Ohio," and "Missouri" have been passed and the contracts let. The opening of the year finds us with eight first-class The opening of the year finds us with eight first-class
battleships, aggregating 95,125 tons, under construcbattleships, aggregating 95,125 tons, under construc-
tion for the navy, and it is gratifying to know that the tion for the navy, and it is gratifying to know that the
whole of this work is being done in private yards. Our whole of this work is being done in private yards. Our
latest battleships of the "Maine" class will be or rather are now the most powerfully armed vessels of their class, and their speed of 18 knots is up to the present standard of other navies.
The most notable fact in connection with our ordnance is the decision to use smokeless powder exclusively in our future guns, and the proposal to make 3,000 feet per second the standard velocity for all the large rifles. Great interest also attaches to the Hobbs single-forging gun and the fratling cast steel gun, both of which have shown good results in tests at the government proving grounds. Krupp armor still continues to hold the first place against all competitors. The government has wisely decided to adopt the Krupp system in the manufacture of its plates, and both Carnegie and the Bethlehem companies have produced plates of phenomenal endurance, the latter plate, 6 inches in thickness, having resisted the attack of six 8 -inch armor-piercing projectiles without failure. Science has again been enriched by the discoveries of Prof. Ramsay. In June of last year Ramsay was able to announce the discovery of "krypton" as one of the gaseous elements of air, the new gas being recovered from some liquid air which was being made the subject of experiment. Shortly afterward the same brilliant experimentalist, with the help of his assistant, Maurice Travers, discovered two other elements of the atmosphere, which were named respectively "neon" and "metargon." This result was made possible by the discovery, jointly, by Lord Rayleigh and Prof. Ramsay last year of argon, the new elements being obtained from a quantity of liquefied argon. Prof. Dewar, whose name is associated with the liquefaction of air, also succeeded in liquefying hydrogen at a temperature of -20.5 degrees Centigrade. M. and Mme. Curie report the discovery of an element which they call "polonium." It resembles bismuth, but is of far rreater radiating power than uranium. Mr. Charles F. Brush announced at the Boston meeting of the American Association for the Advancement of Science that he had succeeded in eliminating from the atmosphere a gas which he calls "etherion." Its conductivity of heat is a hundred times as great as hydrogen. Sir William Crookes, in examining some rare earths used in the manufacture of the Welsbach mantle, discovered a new element, which he named "monium." It is heavier than " yttrium," but lighter than "lanthanum," its atomic weight being estimated at 118 .
A notable event of the year was the production of liquid air in commercial quantities by Mr. C. E. Tripler, of New York. This is done by the development of the method of expansion in an ingeniously devised apparatus. The liquefaction is produced by the "selfintensification of cold," produced by the expansion of compressed and cooled air, no other substance being
used to bring about the result. The boiling point at atmospheric pressure is $-191^{\circ}$ Centigrade, and the value of such a liquid, produced in commercial quantities, for laboratory purposes is obvious. Just how much commercial value liquid air will possess has go to be decided. Attempts are already being made to produce a liquid air motor.
In connection with our mention of Boston as the meeting place of the American Association for the Advancement of Science, it should be recorded that the past year was the golden anniversary of this wel known institution, which at present boasts of a roll o 1,610 members
The obituary of the year contains many names that will be sadly missed from the various fields of scienc and art in which they labored. Sir Henry Bessemer who has had more to do with the industrial develop ment of the nineteenth century than any other man died on March 14. At the time the fiftieth anniver sary number of the Scientific American was pub lished, the readers of our journal put themselves on record as considering that the Bessemer process wa the greatest invention of the last fifty years.
Dr. John Hupkinson was another Englishman whose death leaves a considerable gap in the front ranks of science. There is scarcely a branch of electrical work that does not owe something to his thought and labors. Hiṣ improvement of the Edison dynamo, and his three wire patent, which he disposed of to the Westinghouse Company for $\$ 100,000$, are among his well-know achievements.
The death of Colonel George E. Waring, Jr., is la mented, not alone in the United States, his native land but in every part of the civilized world where his writings have made him known. This soldier-engrineer was distinguished by his work in many fields of indus try and occupation; but his most brilliant success was reputable state of filth in which Tammany corrup-
tion had permitted it to lie, and systematizing a street cleaning force which was a model of system and efficiency. He is to be reckoned as one of the martyrs of the war, having contracted yellow fever during his inpection of Havana with a view to its sanitation.
The death of Latimer Clark has reduced the number of those who are connected with the earlier development of land and submarine telegraphy. Together with his partner, Sir Charles Bright, he acted as engineer in the making and laying of the second and third Atlantic cables, and in all his firm was connected with the laying of 60,000 miles of submarine cables.
Prof. James Hall was a scientist whose death was noted with regret, not only in his native land, but in the many foreign countries where he was honorably known. He was the State Geologist of New York for sixty-one years, and one of the most industrious men in an industrious age. Although he died at the age of eighty-seven, he was able during the last ten years of his life to write 250 papers on scientific subjects. His life work was paleontological study
In the lamented death of Joshua Rose, who was one of the editors of Appleton's "Cyclopedia of Applied Mechanics," "Modern Steam Engines," "Modern Machine Shop Practice," and numerous other well known works, the Scientific American lost one of its early contributors. Mr. Rose was an accomplished writer and a voluminous contributor to the technical press. We close our review of the year with mention another distinguished engineer among those we have
mentioned as having passed away-Sir John Fowler, perhaps best known for his work as the designer of the great Forth Bridge in Scotland. His work covered almost every branch of engineering, for much of it was done in the earlier half of the century when specializa tion had not been carried to the extent which characterizes the present day

## REMARKABLE USES OF PEAT.

y oliver c. farrington.
One of the most interesting and attractive exhibits at the Vienna Exposition of last year was a building containing the most diverse articles made from peat. Everything in the building, from the carpets on the the wall, had been made from peat These were but representatives of what will undoubtedly soon become a great industry and give to the peat bogs of the world a value never before dreamed of
Credit for the discovery of the possibilities of pea belongs chiefly to a Vienna gentleman, Herr Karl A Zschörner. His investigations into its nature began some twelve years ago with a study by means of the microscope of what is called in Austria "torfstreu.' This is the layer of moss which covers the surface of most peat bogs. It has hitherto, by those who have made use of the peat for fuel, been at considerable expense removed and thrown away. Herr Zschörner's examination showed that the plant remains which make up this layer abound in hollow, spiral cells, These absorb water and other fluids with great avidity While ordinary straw cannot absorb over four time ts weight of fluids, this peat straw will absorb ten times its weight. The peat straw, moreover, possesse the antiseptic and disinfectant qualities of peat, quali ties which have long been known, but of which little use has been made. Herr Zschörner accordingly hit upon the idea of drying the straw and using it as an absorbent in stables, breweries, and various manufac tories. For such purposes it proved most admirably adapted, and the demand for the product soon grew large. Having greater absorptive power than ordinar straw, the peat straw can be used much longer in any given place and yet will have proportionally greater manurial value. It gives a healthy, resilient footing
also for animals. For packing of both perishable and also for animals. For packing of both perishable and
breakable articles it is also better than ordinary straw, since it is more elastic and less easily penetrated by heat and cold. Another form of peat which was found to be a better absorbent for some places was the peat itself, dried and ground to a powder. This is especiall adapted for use in earth closets and about sinks and drains, its absorbent power and disinfectent properti making it admirably adapted for these uses.
Herr Zschörner did not rest his investigation here. A further study of the peat itself showed tha it was very largely made up of fibers. These fiber come from the remains of reeds and grasses, which, growing and dying in successive generations, form the ered no anatomical change, but their physical and chemical character became entirely different. The organic substance of the plant became inorganic, so that nothing capable of fermentation or decay was left while the fibrous structure remained intact. Thes fibers then were found to have unusual physical prop erties. They were found to be very durable, very
elastic, to be non-conductors of heat and non-combustielasti
ble.
If a fabric could be woven from them, it would be one possessing unique properties. To the toughnes of linen it would add the warmth of wool, an absorbent
bility of asbestos. It must, however, be woven without the aid of oils or water, or much of its value would be lost.
After twelve years of experimenting, Herr Zschörner succeeded in making the peat fibers weavable. There is now, therefore, scarcely any textile article which cannot be made from peat. Coats, hats, carpets, rugs, ropes, matting, and pillows are some of the articles which have been made, and have been found useful. What superiority these will prove to have in practice over fabrics made from other fibers, only time will tell. Some of them have, however, already been proved to be immensely superior to any other fabrics. This is especially true of the blankets and other coverings used for horses and cattle, for they greatly excel in warmth, absorbent power, cleanliness, and durability. The unspun fiber promises to be a valuable substi tute for absorbent cotton, since it will not only absorb a much greater quantity of blood and other fluids than cotton, but it possesses powerful antiseptic properties as well. The coarser fiber it is expected will come into favor for use in upholstery work, its extraordinary elasticity making it most valuable for this purpose.
The latest achievement of the discoverer of the uses of peat has been the making of paper from its fiber This has been carried to such an extent that paper of almost every variety of weight and quality can be made, while the tourhness and durability of each is equal to that of paper from any kind of vegetable pulp. The above are but a few of the uses to which this re markable fiber can be put, but they indicate possibili ties which may yet rank peat bogs among the mos valuable of the world's resources

## AUTOMOBILES FOR FIFTH AVENUE.

For many years the last relic in the way of stage lines in New York has been the Fifth Avenue line, but the service has not been very satisfactory to the public and the franchise has now been acquired by the Third Avenue Railway Company. This line will be equipped in a short time with automobile carriages o some kind. If this is done, the line will be a valuable feeder to the various crosstown lines owned or leased by the Third Avenue Railway Company. The present service is slow and irregular, and for a long time the stage company had been examining various method of traction. It is not probable that tracks can eve be laid in any part of Fifth Avenue, as public opinion as well as property holders are entirely opposed to it
There is no objection, however, to the noiseless and cleanly horseless omnibus or stage, which will leave the treet in a good sanitary condition. Of course, the Fifth Avenue line of stages must necessarily compete with the Madison and Fourth Avenue electric lines, and for a long distance it runs parallel with them; but while automobile vehicles cannot be operated as cheaply as the underground trolley, still the margin of difference is not so great as to prohibit their use, and as we have already stated, the line would be valuable as a feeder to the various crosstown lines. There are many people who have used the stage line for year and who will probably continue to do so, and from a scenic point of view nothing can be finer than a ride up Fifth Avenue in a modern omnibus. There is no crush of travel as there is on many of the adjacent treets, so that the trip is more enjoyable, and th ine will certainly come in for a considerable per entage of the "short haul" business, which pays very well and it is admirably adapted for this kind of trans portation.
During the storm on November 26, the electric automobile vehicles behaved remarkably well. They ran throughout the entire night, and the last one only came in about six o'clock in the morning, when the snow must have been from eight to ten inches deep, and the carriages had no difficulty whatever in forcing their way through drifts which were much deeper than this. Horse cab companies turned over order to the electric company rather than fill them then selves. Of course, the mileage per charge of battery was reduced. The motors and batteries acted admir ably. One reason of their success was undoubtedly due to the large pneumatic tube tires, which are five nches in diameter and give a large and resilient bear ing surface.

A burnished finish on the journals of axles for rail way carriages and locomotives has given good service and has been used on many roads for a long time, say The American Engineer. The advantage of it is to smooth the surface of the journal after the finishing cut, and to shorten the period of breaking in. The burnishing is done by three rollers carried on a tool rest and bearing against the journal, considerable pressure being obtained by a screw. The rest is fed along so that the finishing cut and the burnishing are done at the same time. Mr. Atkinson, of the Canadian Pacific, uses the burnisher on piston rods, and intends to use it on valve rods, as well as on journals. He stated, at the recent Master Mechanics' Convention, rods.

AN IMPROVEMENT IN CLAY-CUTTING TABLES It has hitherto been possible only with costly and complex machinery, to cut clay and other plastic mate rial, into any desired length. It is the purpose of an invention recently patented by Arphad Snell, of Tice, Ill., to obviate this difficulty by providing an inexpen sive machine which is of simple construction, which can cut clay into any length, and which so delivers the material that it can be safely carried to a baking oven.
The machine comprises essentially a table made in two sections mounted upon flanged guide rollers, one section being capable of end movement only, and the other section of both end and rotary movements. The rotary section has a number of grooved receiving faces; a hand-wheel, through the medium of which the faces may be revolved; and an adjustable gage. On the re ceiving faces, extensions are carried which support a board upon which the moulded clay is carried away Stop devices on both sections of the table limit the end movement of the sections
When it is desired to use the table, the section hav ing end movement only, is carried as close as possible to the delivery end of the mold; and the inner end of the rotary section is shifted as close as possible to the first-named section, the parts being held in this posi tion by the operator's pressing on a foot-lever control ling the stop-devices of the rotary section. After the outer end of the molded clay has reached the gage, both sections of the table are allowed to travel on their rollers, until the stops on the sections having end movement only, limit the movement of that section. The molded clay is then cut by hand at the point where the two table-sections meet, whereupon the rotary section is turned by means of the hand-wheel, and the clay deposited upon a board previously placed in position against the extensions on the upper receiving face of the rotary section. Another board is then placed in position; the two sections of the table are returned

snell's clay-cutting table.
to their original position; and the operation is repeated The apparatus is particularly designed to cut clay into lengths suitable for fence-posts. The material, it will be observed, can be cut and discharged without interrupting the molding process or the delivery of the material.

The Eclipse of the Moon.
The total eclipse of the moon on December 27 was viewed with considerable success at the United States Naval Observatory at Washington. Owing to partial cloudiness, several of the occultations could not be observed. The moon was scheduled to enter the shadow at $4: 57$ o'clock and the totality to begin exactly one hour later. The actual time was a few seconds later. According to the arrangement made by the Observatory at Pulkowa, Russia, one hundred and three occultations were to be observed in different parts of the world and twenty-one were assigned to the National Observatory at Washington. Seventeen of the twenty-one occultations were observed and the rest were obscured by clouds. The scientific value of the eclipse will be chiefly verifying the knowledge which has already been obtained by other methods regarding the same diameter of the moon. Observations were also made at New Haven, Conn., at Columbia, by Prof. Rees, and at Princeton, N. J., by Prof. Young.
The eclipse was viewed with great success in Berlin at the Treptow Observatory by Prof. Archenhold, who photographed it in all its phases. At Berlin the moon entered into totality at a quarter to twelve o'clock, when the colors became brighter than previously. It was first a dark brown with a streak of yellow; next a reddish brown, and lastly a beautiful combination of colors, as though pierced by the rays of the sun. The silver-white line then kept spreading, and at twenty-five minutes past twelve it was at the maximum. In every phase the delineation of the moon was visible; that of the shadow of the earth was much less clear. It is stated that Mars became very red during the period, becoming more intense according to the color assumed by the earth's shadows.

## A CONVERTIBLE vEHICLE.

In the annexed illustration, we present a vehicle having a wheeled frame within which the horse is harnessed, the frame being provided with removable parts by means of which the vehicle may be converted into a coach, buggy, or wagon.
The frame has two horizontal side bars, upon each of which standards are mounted at the front and rear. The rear standards project below the side bars, and receive the rear axle of the vehicle. At the lower portions of the front standards, forks are tions of the front standards, forks are mounted to turn, between which forks
the front wheels are carried. Vertical spindles on the forks move in slotted casings at the lower ends of the front standards, and are engaged by arms having movement relative to the forks and held in place by pins. Should the frame be slued laterally at its front end, by the pressure of the horse on the frame, the pressure of the horse on the frame, the
front wheels will be slued in a corresponding direction. By arranging the parts of ing direction. By arranging the parts of
the frame in various ways, it is possible to transform the vehicle into a buggy, a coach, or a light wagon, as shown respectively to the right, center, and left of the accompanying engraving. When used as a coach, the vehicle is provided at the top with seats, to which the passengers may ascend by means of a folding ladder. When the vehicle is used as a buggy, or as a wagon, the seats and the intermediate standards are removed, and the front standards rigidly braced by crosspieces. In order that the horse may be readily nabled to slue the frame to the right or to the left under the action of the reins, the inventor employs a strap passing from the horse's collar to the front standards. Check reins secured to the bridle of the horse are reeved through rings carried by the body of the ve hicle. The vehicle is the invention of Thomas J. Cox, Enon, Ala.

The Weather Bureau in cuba.
The Secretary of Agriculture has directed the Chief of the Weather Bureau to move the headquarters of the present West Indian storm warning service from Kingston to Havana, to establish complete meteorological stations at Cienfuegos and Port au Principe, and as rapidly as possible to extend the climate and crops service of the Weather Bureau over the island, so that within a period of not more than two months complete information can be given of anything meteorological and agricultural in various parts of the island, and reports will be made as to the progress of the rehabilitation of the industries which during the recent strife were either suspended or completely annihilated. The Secretary of War has been requested to assign buildings and grounds for the headquarters of the service in Havana. The cost of the entire United States Weather Service in the West Indies, including observatories on the north coast of South America, will probably be much less than was expended by Spain
in maintaining inefficient and almost useless meteorological service over the island of Cuba.
Some months ago the Chief of the Weather Bureau began the establishment of a complete climate and crop service in the island of Porto Rico. The Weather Bureau system of gathering crop and meteorological reports has now been so well extended throughout the island that it is thought by the first week in January a full crop report showing the conditions of the crops in all of the provinces of the island will be published for the benefit of interested parties in the island and in the United States, and this service will be continued weekly.

## How Santiago Was Cleaned.

Robert P. Porter, special commissioner for the United States to Cuba and Porto Rico, in his report to the Secretary of the Treasury, tells what he saw in recent visits to those islands. Speaking of improvements made at Santiago, Mr. Porter states that the disagreeable smells of the typical Cuban city are less pronounced in Santiago, while whitewash, limewash, fresh paint, and all sorts of disinfectants have deodorized the sur rounding atmosphere and made the old town quite habitable. The streets are no longer used as sewers, and the unhappy individual who may violate the law and who escapes the lash of the sanitary commissioner's whip is compelled to work on the street for thirty days. Sanitary Commissioner Barbour has under him one hundred and twenty-six men dressed in spotless white and thirty-two mule teams and carts. This force of men have dug out from the streets the filth of ages, and they are now kept absolutely clean. By the aid of petroleum the garbage of the day is burned. The work of sanitation is not confined to the streets, but
extends to the dwelling houses and other buildings. In many cases the doors of houses had to be smashed in and the people making sewers of the thoroughfares were publicly horsewhipped in the streets. These measures were drastic, but were entirely warranted by the flagrant carelessness of the people. Some of the the flagrant carelessness of the people. Some of th
most respectable citizens were haled before the com


## A CONVERTIBLE VEHICLE.

manding general and sentenced to aid in cleaning the streets they were in the habit of defiling. The campaign has resulted in a complete surrender to the sanitary authorities, and the inhabitants of Santiago have had their first object lesson in the new order of things which came with the close of the war.

## AN AUTOMATIC ACETYLENE-APPARATUS.

An acetylene gas-generator has recently been patented by Milton D. Keiser, of Mitchellville, Iowa, in which the gasometer, coacting with a water-filled pressuretank, is made to flood the generating-chamber according to the volume of gas required.
The apparatus comprises essentially a large pressuretank containing water, and a smaller gasometer-tank connected with generating-chambers. Both tanks communicate with each other and with a common blow-off chamber. A pipe leading from the gasometer to the bottoms of the generating-chambers supplies the carbide with water. The gas formed rises and is conducted to the gasometer by a pipe leading from the generating-chambers. Within each generating-chamber two or more perforated carbide buckets are placed, one above the other, the purpose of this arrangement being to prevent the simultaneous contact of the water with all the carbide, as well as to prevent the contact of the decomposed carbide with that which has not yet been acted upon.
The gas generated by the carbide passes into the gasometer, and is then distributed by a service-pipe. As the gasometer and carbide-chamber communicate with each other, the pressure in both must be the same. When the volume of gas in the generator decreases, the water from the pressure-tank causes the water in the gasometer to rise and to force the water in the bottom of the generating-chambers into contact with the carbide. The gas thereby generated, upon entering the gasometer, depresses the water therein, and withdraws


KEISER'S AUTOMATIC ACETYLENE-APPARATUS.
the water from the carbide, thus stopping the further generation of gas. By these means the apparatus acts automatically to regulate the generation of gas. The pressure-tank coacts with the gasometer to control the gas-pressure. Should the pressure become excessive, the surplus gas is blown off by means of the blow-off chamker and vent pipes.

## THE GIANT WHEEL OF PARIS.

The newspapers recently informed us that a trial of the gigantic wheel had been made in the presence of M. Blanc, prefect of police.. An emulator of the 300 meter tower erected upon the Champ de Mars, this apparatus is commonly styled the "Great Wheel of Paris." It stands on Avenue de Suffern, opposite the celebrated gallery of machines of the Exposition of 1889. The idea of such a construction is due to Mr. Graydon, an officer of marines of the United States navy, who took out a patent for it in 1893. The present project emanates from an English society The operation of mounting took place under the direction of Mr. Slitkins, an English engineer. The general work of construction, the installation of the material necessary to revolve it, and the lighting of it were confided to Mr. W. B. Basset. The first wheel of this kind was constructed for the Chicago Exhibition, but it did not attain the dimensions of the one under consideration.
The metal entering into the structure of the French wheel is steel, furnished by the Societe des Forges et Acieries de Haumont (Nord). The weight of the metal employed is no less than 800 tons.
The wheel is designed to revolve around a horizontal axis situated at 220 feet above the level of the ground, and moving in two bearings that rest, through the intermedium of a heavy oak beam, upon two frames. At its periphery there is a series of cars that are carried along in the rotary motion of the apparatus.
The diameter of the wheel is exactly 93 meters ( 305 feet). At the lowest level to which the cars can descend they will be 10 feet above ground, and the highest point that they will reach will consequently be 315 feet above the surface. Between the two external fellies are suspended a certain number of cars designed to be used as saloons, parlors, dining saloons, reading rooms, concert halls, etc.
The total weight of the wheel, inclusive of the empty cars and exclusive of the axis and frames, is $1,430,000$ pounds. The axis weighs 79,200 pounds and the two frames 873,400 . The total weight of this architectural monument is, therefore, $2,382,600$ pounds. Each car is capable of accommodating 30 persons, and the number of cars is 40. Supposing the average weight of each passenger to be 154 pounds, the total load upon the foundation will be 1,167 tons.
The foundation is of concrete made of Portland cement. Two excavations, 18 feet square and 39 feet deep, were made in the earth and were filled with a mixture of sand, pebbles,
and pure cement without the addition of any hydraulic lime. Each of the monoliths thus formed has a weight of 230 tons. It is upon these beds that rest the two steel frames that support the wheel. Each of these frames consists of four lattice girders connected by heavy steel cross braces and diagonal tie beams. They were mounted in detached pieces that were bolted and riveted together.
The axis, which is of first quality Martin steel manufactured in England, is a heavy hollow piece about 50 feet in leugrth and of an external diameter of 36 inches.
The shaft revolves in steel bearings lined with a metal of peculiar composition-a mixture of lead, tin, and various other substances. This alloy is designed to prevent the friction of steel upon steel, the coefficient of which is very high. From each side of the axis radiate 160 flexible cables of steel wire 2 inches in diameter, which are attached to the fellies of the wheel and are provided with stretchers for stiffening them
after being put in place. The rotary motion of the after being put in place. The rotary motion of the
wheel is obtained through a double cable, which emwheel is obtained through a double cable, which em-
braces it and winds around windlasses actuated by a 120 horse power steam engine. The security of the operation of the apparatus is assured by several instantaneously acting brakes, which also control its motion. The engine also runs a dynamo, the current of which will supply arc and incandescent lamps.
The electric communications, starting from the ground, are effected through cables that follow one of the frames and end at the axis. From this point the current is transmitted to the periphery by cables, and to the different posts of electric distribution by circular plates and contact brushes. The processes of illuminating every part of this huge structure furnish a means of obtaining all the plays of light desirable. As the
wheel revolves, the shining of the lamps in space will


## the giant wheel of paris.

give it the aspect of a piece of fireworks. The wheel wakes one revolution in twenty minutes, inclusive of stoppages. Access to the cars is obtained through a systen of stairways and landings so arranged that eight cars can be filled and emptied simultaneously, without any blockade, in less than one minute. Each car is $421 / 2$ feet in length.
For the above particulars and the illustration we are indebted to the Encyclopédie du Siècle.

## A New Chemical Element.

Dr. Becquerel has announced to the Academy of Sciences at Paris the discovery of a new supposedly elementary substance which has a close affinity to barium. The correspondent of The New York Sun who cables the news states that its discoverers, MM. Curie and Bremona, have named it "radium." It is so sensitive to light that it will take photographic impressions.

Great Consumption of quinine in America.
lt is estimated that, during and since the war with Spain, over $125,000,000$ grains of quinia have been issued to American soldiers suffering with fever. In some cases men who were in the hospitals were dosed with as much as 300 grains per week, and almost every man in the army took the drug at some period of his service, either for its curative or preventive effect. Yet, as large as these figures are, they are hardly as surprising as those for the entire population of the United States. We are a race of quinine eaters, and the people of this country consume one-third of the quinine of the world. Although such doses as prevailed in Cuba and Porto Rico are seldom taken in the States, here are few people here who do not at some time during the year take quinine in some form or other. The drug is used in the preparation of many patent medicines, tonics, bitters, cold cures, etc.; even in hair tonic for external application. The official figures of the Treasury De partment show that last year there were imported into the United States 1, $539,056,750$ grains of quinia This means a consumption of something like 20 grains for every man, woman, and child, as there were practi cally no exports of this article.
The cinchona tree, which furnishes quinine, Peruvian bark, and calisaya bark, is a native of the western South American coast countries, more par ticularly Peru; yet but a comparatively small portion of the world's product now comes from that re gion. For many years all the quinine of commerce came from the wild trees of Peru, but with the present great demand, the refined product obtained from the wild trees of its native habitat would supply but a small proportion of the world's requirements. At the present time two-thirds of the quinine used is produced in Java, an island of the East Indian archipelago, corresponding closely in size to Cuba, and having with it many features of soil and climate in common. The history of cinchona culture in Java is interesting. For thirty years the Dutch government, which owns Java, was urged to undertake in the island the introduction of this plant from Peru, and finally, in 1852, it employed the botanist Hassharl to explore the cinchona forests of Peru. He procured a large number of varieties and took them to Java, where plantations were started, which have succeeded to the extent already indicated. The government of India was not to be behind in this matter, and the cinchona plantations and factories of that region produce now their share of this important drug. The importance of sending trained explorers to find and import new and rare plants is shown in the early efforts of the Indian government to secure cinchona trees. Seven years of governmental correspondence failed to secure a single living plant of this species, when the government engaged Clement R. Markham to visit the mountains of Peru, at the risk of his life, and he succeeded in establishing in the British East Indies in a single year 9,732 cinchona trees.
The price of quinine has, of late years, steadily decreased, so that now it is considered a cheap drug. In 1897 the import price in the United States was a little over sixteen cents per ounce. When it is considered that an ounce avoirdupois contains $4371 / 2$ grains, it is seen that the quinine in a dozen 2 -grain capsules does not cost much. The total value of refined quinine and cinchona bark imported into the United States last year was $\$ 725,457$.

Meetings of Scientific Societies in New York.
Five of the eleven scientific societies which met in New York during the holidays for their winter meeting held their sessions December 28 in the halls of Columbia University, while others met at the College of Physicians and Surgeons and other places. Prof. W. J. McGee delivered an interesting address before the Anthropological section of the American Association for the Advancement of Science. Perhaps the most exhaustive philosophical paper of the section was presented by Major J. W. Powell, Director of the Bureau of American Ethnology. Major Powell's subject was "Aesthetology, the Science of the Senses." Mr. James Mooney, of the Bureau of Ethnology, gave an account of the Indian Congress at Omaha during the TransMississippi Exposition. From an ethnological point of view, he said, the congress was not what was ex pected. There were twenty tribes and twenty-five languages represented, but most of them were Indians of the plains. Several other papast meeting will be held in Columbus, Ohio.
The American Folk Lore Society held their eleventh annual meeting in Fayerweather Hall. The meeting was enlivened with Indian songs under the direction of Alice C. Fletcher and others. The graphophone was used to present an Omaha war song. It seems that the modern talking machine is of considerable use to folk lorists. Prof. Henry Wood, of Baltimore, President of this Society, delivered an address on "Folk Lore and Metaphor in Literary Style," and other papers were presented
The Geological Society of America opened its eleventh annual meeting on December 28 in the large lecture room of Schermerhorn Hall and was welcomed to the University by President Low. Prof. J. J. Stevenson, of the New York University, President of the Society, presided, and after the transaction of business, the vote for officers for the ensuing year was announced The following were elected: President, Benjamin K. Emerson, Amherst, Mass.; First Vice President, George M. Dawson, Ottawa, Ont.; Second Vice President Charles D. Walcott, Washington, D. C.; Secretary, H. L. Fairchild, Rochester, N. Y. ; Treasurer, I. C. White, Morgantown, W. Va.; Editor, J. Stanley-Brown, Wash ington, D. C.; Librarian, H. P. Cushing, Cleveland, O Councilors, W. M. Davis, Cambridge, Mass., and Joseph A. Holmes, Chapel Hill, N. C.
A memorial of the late Prof. James Hall was read by Prof. Stevenson, who then proceeded to deliver the President's annual address to the society.
A large number of papers were read on this and en suing days. The annual dinner took place on Thurs day, December 29.
In the rooms of the Department of Psychology Schermerhorn Hall, the American Psychological Society opened its seventh annual meeting and proceeded at once with the reading of papers, Prof. Hugo Muen sterberg, of Harvard, presiding. The papers presented were, in part, as follows : "The Development of Voluntary Movement," E. A. Kirkpatrick ; "Report on th Effects of Cannabis Indica," Prof. E. B. Delabarre "Certain Hindrances to the Progress of Psychology in America." Prof. George T. Ladd; "Reason a Mode of Instinct," Henry Rutgers Marshall: "Nature o Animal Intelligence and How to Study It," Prof. Wesley Mills; "Psychological Classification," Miss Mary Whiton Calkins. Prof. Hugo Muensterberg, the Pres ident of the association, delivered the annual address, taking as his subject, "Psychology and History." An interesting discussion on the "Relations of Will to Belief " was arranged for.

In the same building the Society of Plant Morphol ogy and Physiology also held their session, and, afte a brief business meeting, the reading of papers was of Cornell University. Dr J. W Harshberger, of the University of Pennsylvania; Dr.W. F. Ganing, of Smith College ; Prof. B. D. Halsted, of the New Jersey Agri cultural College; F. E. Lloyd, of the Teachers' College Charles H. Shaw, of the University of Pennsylvania R. E. B. McKenny, of the University of Pennsylvania Miss Amelia B. Smith, of the University of Pennsyl vania; Dr. M. A. Howe, of Columbia University ; Dr Henry Kraemer, of the Philadelphia College of Phar mace.
The American Morphological Society met in the zo ological lecture room. Prof. Henry F. Osborn, of Col umbia University, presided. Among the papers read were : W. Patten, "Gaskell's Theory of the Origin of Vertebrates from Crustaceans;" Rashford Dean "Notes on Myxinoid Development;"F. B. Sumner, "Notes on the Early Development of the Catfish;" J Reighard, "On the Develcpment of the Adhesive Organ of Amia;"W. E. Ritter, "On the Reproduc-
tive Habits and Development of the California Land tive Habits and Development of the California Land Salamander, Autodax" (presented by G. H. Parker) C. H. Minot, (1) "Notes on Mammalian Embryology, (2) "Prof. O. Van der Stricht's Researches on the Human Ovum, the Nervous System of Amphioxus, and the Development of Thysanozoon," with demon strations; S. P. Gage, "Notes on the Morphology of
the Chick's Brain;" W. A. Locy, "Review of Re-
cent Evidence on the Segmentation of the Primitive Vertebrate Brain ;" C. J. Herrick, "Metameric Value of the Sensory Components of the Cranial Nerves;" W. A. Locy, "New Facts Regarding the Development of the Olfactory Nerve;" N. R. Harrington and E. Leaming, "Action of Different Colors upon Protoplas mic Flow of Amoeba."
The eleventh annual meeting of the American Physiological Society also took place in the physiological laboratory and a number of papers were presented.
The annual meeting of the American Mathematica Society was held in Fayerweather Hall in the lecture room of the Department of Physics. Among the papers presented were the following
"On Multiple Resonance," Prof. M. I. Pupin, Columbia University ; "On the Development of the Pertur bative Function in Terms of the Eccentric Anomalies, Dr. A. S. Chessin, New York; "On Some Points of the Theory of Functions, Dr. A. S. Chessin, New York; "On the Transformation of Straight Lines into Spheres," Prof. E. O. Lovett, Princeton University A Generalization of Appell's Factorial Fu
The American Chemical Society also accepted the generous hospitality of Columbia University for their meeting. The chemists were welcomed to Columbia by President Low, and the meeting was held in Havemeyer Hall. They were also welcomed by Prof. Charles F. Chandler, the head of the Departwent of Chemistry, and former President of the Society. Papers on various industrial and scientific subject were read, and the members were entertained at luncheon in the laboratory of Columbia University
The meeting was held under the direction of Dr Charles E. Munroe, President
One of the interesting features of the session was a paper by A. C. Langmuir, the subject being "The Deermination of Arsenic in Glycerine.
F. W. Clarke read the sixth annual report of the committee on atomic weights. "I have here," he be gan cheerfully, "forty pages, mostly figures"-a sigh of profound resignation from the chemists-" which I on t propose to read." This assurance caused the body of scientists to thaw with a celerity hitherto unapproached. The speaker said that fully two-thirds of the work on atomic weights of the year 1898 had been done in this country. When he had finished, Dr McMurtrie moved that a committee of five be appointed to confer with committees which might be appointed by other chemical associations of the civilized world and endeavor to agree on a uniform standard of atomi weights. The chair later appointed the committee. The Society attended a lecture by Charles E. Trip ler in the College of the City of New York, and some intensely interesting experiments with liquid air wer shown.
The most novel one, conducted by Prof. R. Ogden Doremus with liquefied oxygen, furnished by Mr. Trip. er, was placing the oxygen in a cup just below a huge magnet and witnessing its attraction by the magnet As the shadow of the gas was cast by a calcium light on a white screen, it was seen to leap up to the mag net. "This," said Prof. Doremus, "is Faraday's experiment, proving oxygen to be magnetic."
In the evening the Society dined at the Waldorf-As toria, Dr. William McMurtrie, chairman of the New York section, presiding. Among the various toasts was one responded to by President Seth Low, of Co lumbia University, on "Our Higher Education." He said in part: "The development of higher education means much for mankind, because institutions of
higher teaching are giving opportunity to men to become acquainted with new laws of nature. That is my appeal for your support of the higher education. A union meeting of all the scientific societies was held in the evening at the American Museum of Natural History, all of the various societies being the guests of the American Society of Naturalists. The meruber of the Society roamed at will through the great halls until they were summoned to the large lecture hall, where an address of welcome was delivered by Mr.
Morris K. Jesup, president of the Museum. He pre dicted that the time would come when New York would take her proper place in the scientific world as a scientific and educational metropolis. Prof. Osborn also made an address, and a reception at Prof. Osborn residence followed.
The meetings were continued on December 29, and a large number of interesting papers were presented, but pace forbids even a list of titles. The annual meeting of the Society of Naturalists, with which the societie epresenting the special branches are affiliated, wa held in Schermerhorn Hall, and President Low wel comed the members with an appropriate address. W.
G. Farlow, of Harvard, was elected President; H. C. Bumpus, of Brown University, Vice President; T. H Morgan, of Bryn Mawr, Secretary; and J. B. Smith, of New Brunswick, Treasurer. The general meeting took for the subject of joint discussion "The Advances n Methods of Teaching." The third annual meet ing of the State Science Teachers' Association took place in the Teachers' College, in the morning, Presi dent Low welcoming them. In the evening a recep
tion for the stranger teachers was given by the Trustees of the College. The annual dinner of the American Society of Naturalists was held at the Hote Savoy, Prof. H. P. Bowditch, Dean of the Harvard Medical School, presiding, and he delivered the annua address as President.

The Export Trade for the Year 1898.
The exports from the United States for the calendar year 1898 will exceed those of any year. Only twice in the history of American commerce have the exports of year passed the billion dollar line, but in 1898 they will reach the enormous sum of a billion and a quarter the total for the first eleven months of 1898 being $\$ 1,117,681,199$, and it is apparent that the December statement will bring the grand total of the year above $\$ 1,250,000,000$. The figures of the Treasury Bureau of Statistics show that the November exports are not only the largest in November, but the largest in any month in the history of our commerce; while, as already in dicated, those of the eleven months ending with November are larger than those of any full calenda year prior to 1898.
The import record of the year 1898 will be as re markable as those relating to its exports; but, of curse, by reason of a decrease, the total imports of the year are less than those of any calendar year since 885. F'or the month of November they were $\$ 52$, 109,560, which was slightly less than those of Novem ber, 1897. For the eleven months ending with November they were but $\$ 579,844,153$, while those of the corresponding months of 1897 were $\$ 691,089,266$, which nakes it apparent that the imports for the full calen dar year of 1898 will not exceed $\$ 640,000,000$-a sum less than the calendar year of 1897 and fully $\$ 100,000$, 00 less than that of the year 1897. With the larg st exports in our history and the smallest import or many years, the year 1898 will naturally show the largest balance of trade in our favor ever pre sented in any calendar year. The figures for the eleven months show an excess of exports over imports amounting to $\$ 537,837,046$, and it is quite evident that the December figures will bring the total of excess of exports for the calendar year above the $\$ 600,000,000$ ine, making an average excess of exports for the year more than $\$ 50,000,000$ a month, while the highest exces oxports in any preceding calendar year was $\$ 357$, 990,914 in 1897 and $\$ 324,263,685$ in 1896.

## " "Bacteria" Engine.

N. P. Melnikoff, the editor of the Russian journal Technologue, published at Odessa, informs us that he has made a little model of an engine which depends or its motive power upon the fermentation of bacteria Although the engine in itself has no practical value, it nevertheless furnishes an interesting example of the power which can be derived from fermenting bodies Mr. Melnikoff decomposes glucose into its constituents. Glucose Alcohol Carbon dioxide $\mathrm{C}_{6} \mathrm{H}_{12} \mathrm{O}_{6}=2 \mathrm{C}_{2} \mathrm{H}_{6} \mathrm{O}+2 \mathrm{CO}_{2}$
One hundred and eighty parts of glucose will give ninety-two parts of alcohol and eighty-eight parts of carbon dioxide gas. In a copper vessel, glucose, an acid phosphate, acetic acid, gelatine, water ( 75 per cent), and yeast, are mixed together. After twenty-four hours, the gas within the vessel, at a temperature of $20^{\circ} \mathrm{C}$., will have attained a pressure of four and onehalf atmospheres. The inventor states that, if the ves sel containing the yeast-bacteria be large, and the engine cylinder be correspondingly proportioned, enough power can be obtained to operate an engine uninter-
ruptedly for twenty or thirty hours. The fermentation of different bacteria will inirty hours. The fermentan produced depending upon the quantity of carbon dioxide or other gases generated by each species of bacteric. Mr. Melnikoff is at present engaged in experimenting with ${ }^{*}$ bacteria giving ethylene, hydrogen, and other gases.

## Aconcagua Again Ascended

Sir William Conway has been the third to ascend Aconcagua. He reached the summit on December 7. and was four days in making the ascent. The weather was perfect, and in this respect the ascension had a great advantage over Fitz Gerald's party of 1896-97. No particulars of Sir William Conway's trip are available as yet. He has now gone to Terra del Fuego, where he hopes to reach the summit of Mt. Sarmiento, the high peak on the south coast. A number of early attempts to conquer Aconcagua have failed, but Mr. Vines and the Swiss guide Zurbriggen succeeded in making the ascent. The leader of the Fitz Gerald expedition did not reach it. Aconcagua is entirely in Argentine, and is in plain view from the Pacific. When Mr. Vines was on the summit of Aconcagua, the thermometer registered thirty-five degrees below the zero point. He found at the highest point an almost square platform, extending about 225 feet on all sides, and sloping slightly to the north. To the south and southwest the sides were precipitous, and to the southeast there is an enormous precipice of nearly 10,000 feet, covered with great masses of snow and ice, forming a sight which was indescribable.

## Sorrespondence.

## Turret Versus Barbette.

To the Editor of the Scientific American :
I notice one peculiarity in your description of ships of the British navy, in your issue of Nov. 26. The heavy guns, or main battery, in almost all of them are not mounted in turrets, after the fashion in the United States navy. Why is this? Is it a fact that, when the turret is deranged, the gun is also deranged, and that we have had instances of this difficulty in our navy in time of peace and also during the late war? Why do the American authorities continue to use the turret, if it is liable to seriously affect the working qualities of the ships in question?
What is the object of the British authorities in using such light armor as you mention for the so-called "Canopus" class? It seems to us that ships of that class could more consistently be called armored cruisers than battleships.
A. B. C. Chattanooga, Tenn.
[The system of mounting "en barbette" was adopted in the British navy because of the superior "command" (height of guns above sea) thereby secured. Compare illustrations of the "Resolution" and the "Hood," in the issue referred to. The guns in the barbette ship are $\Omega 7$ feet above the sea and in the turret ship only 19 feet. The turret and the guns turu together and rest upon the same turntable; hence the blocking or displacement of the turret would probably disable the guns. These disadvantages, however, are offset by the complete protection afforded by the turret, not only to the delicate breech-mechanism, but to the gun crew, whose morale cannot but be favorably affected by the fact that they are shielded by a complete wall of 12 or 18 inches of armor. The English have compromised the matter by mounting a sloping gun shield, of a maximum thickness of 6 to 10 inches, upon the gun carriage, which rotates with the guns.
The reduction in thickness of the armor on later British ships (and, indeed, on all other ships) is due to the improved quality of the armor. The 6 -inch side armor in the "Canopus" has behind it a sloping 3 inch deck, the two together being equal to $101 / 2$ inches of Krupp, or say 13 inches of Harvey armor. The "Canopus" is what the Italians call a cruiser-battle ship. She has the speed and protection of the one with the armament of the other.-ED.]

## The British Navy.

To the Editor of the Scientific Amprican :
I have read with much interest the two articles in the issues of November 26 and December 10 upon our our navies to act in conjunction in the not very distant future, it is as well that intelligent discussion should be had, so that we may each profit from observing the good and bad points in the other. But in making
your criticisms and comparisons, I venture to submit your criticisms and comparisons, I venture to submit
that you have fallen into the common error of critics of that you have fallen into the common error of critics of
our navy, by failing to realize that it occupies a unique position among the navies of the world, and therefore cannot fairly be compared with thein ton for ton. The navies of the United States, France, Germany, Italy Russia, being on the same plane can fairly be thus com pared; the duties that their ships would have to per-
form are more or less similar ; they are, after all, only a part of the scheme of national defense; they are not the life blood of the nation. But with Great Britain and her navy it is different. It is not our first line of defense, it is our only line. If our shores bristled with fortifications and we kept a standing army of five million men, of what avail would they be if our navy was defeated and scattered? The victorious would not have to come near us, to reduce us to abject submission, and that in very short order.
This being the case, our navy must act on the aggres sive and keep on the aggressive. The enemy's shores
must be made our frontier, their fleets must be sought must be made our frontier, their fleets wust be sought
out and defeated or driven into their harbors and kept there. To do this it was recognized that our ships must have sea-going and sea-keeping qualities in a greater degree than the corresponding ships of other nations, to enable them to maintain their positions outside an enemy's port in all kinds of weather and for a long time. So when we design a ship with an eye to matching a rival's ship, we make the armament about the same and then we add on two or three thousand tons to give us room for the extra supplies of coal, ammunition, and stores. Now if we were to pile on arma-
ment in proportion to the extra tonnage, we could only do so at a sacrifice of that which is a fundamental law in the designing of our, ships. Thus it comes about that if a war breaks out, the "Jena," with her 12.052 tons and her four 12 -inch and eight $6 \cdot 4$-inch guns, will be matched with the "Majestic," with her 14,900 tons and her four 12 -inch and twelve 6 -inch guns. And the "Gueydon," with her 9,517 tons and her two $7 \cdot 6$-inch and eight $6 \cdot 4$-inch guns, will be somewhat overmatched by our "Cressy," with her 12,000 tons and her two $9 \cdot 2$ -
inch and twelve 6 -inch guns. This seems to mea fairer
way to judge our navy, not ton by ton, but by the ships they would be pitted against in the event of hostilities. Again, it never seems to strike critics that there are two sides to every question. Is it not just possible that the other ships may be overgunned? We know that a Russian cruiser split her decks across while at gun practice on the Black Sea. We know that some of the guns in the French ships could not be fired because the blast of disciarge would stun the crews of other guns, and I believe something similar happened on the "Brooklyn" recently.
Such guns are worse than useless. Besides, every ton added above a certain level reduces a ship's steadiness in a sea. This was strikingly illustrated when the Czar visited England. On leaving he was escorted to mid-channel by the British battleships at a 14 -kno the French battleships his yacht had to slow down to 9 knots, and the French ships were wallowing in the cross seas. What was the "Indiana"doing when her guns had to be lashed? She must have been rolling heavily, as big $\dot{\mathrm{a}}$ mark as ever, but of no value as a gun platform. To drive the argument home, here are some figures

## pounders 11,525 tons; four <br> Oregon," 10.288 tons; four 13 -inch, eight 8 -inch, four 6 -inch, <br> twenty 6 -pounders, six 1 -pounders.

The newer ship has 1,237 more tonnage and carries, $i$ anything, a lighter armament. Either the "Oregon" is overgunned or the "Alabama" is uadergunned. You warn us in your article to remedy this defect in our future ships. It looks as if you were remedying yours the other way.
In your article, speaking of the large guns of the Royal Sovereign" class, you say, "the gun crews are intirely exposed." Mr. H. W. Wilson, in his "Ironclads in Action," Vol. 2, page 235, speaking on the same subject, says, "Her (the 'Royal Sovereign') guns are, of
course, much exposed. On the other hand, the men course, much exposed. On the other hand, the men
working them are most adı irably protected." It is elear that one of you gentlemen is in error, and I am not accurately enough informed to say which, though I am inclined to think Mr . Wilson is in the right; for I think the gun crew work below the level of the barbette, the breech of the gun being depressed for load ing, etc.
Touching speed, you say that the enemy's commerce destroyers of over 21 knots could only be open to at tack by the "Powerful" and her sister, and further on you think the supply of coal of these two ships exces sive. It must always be remembered that our speed tests are very severe. conducted as nearly as possible under service conditions, and that the ships are rated for speed at the mean of their natural draught. This is not always the case in other navies, the result being that our ships show a disposition to maintain their averages, while those of other navies fall off. 'Take, for instance, the commerce destroyer "Columbia." She
was specially prepared forher trip across the Atlantic was specially prepared for her trip across the Atlantic
and was ordered to steam at full speed with natural and was ordered to steam at full speed with natural
draught until the last day, when she was to use forced draught. She did not average 19 knots. When th "Blenheim" was sent to Madeira to bring home the body of Prince Henry of Battenberg, she was in no way specially prepared, and without using forced draught she made the run to Portsmouth at an aver age of a fraction over 20.5 knots. I see that the "Ar gonaut," who has just completed her eight hours' na ural draught contractors' stean trial, averaged 2117 knots, although she is only supposed to be a 20.75 knot boat. In connection with the coal supply of the "Ter rible," I should say her usefulness depended more
upon her ability to maintain herself at sea in upon her ability to maintain herself at sea in running
down her quarry than in the number of our coaling down her quarry than in the number of our coaling
stations. I note that on the 15 th of September last the "Terrible," on her four hours' forced draught trials, reached the high average of $25 \cdot 9$ knots.
I am afraid I have been somewhat prolix, but our navy is very near to every Englishman, and I thought I might venture to point out that in some of your riticisms you had approached the subject from a mis Pan standpoint.
Philadelphia, Pa., December 20, 1898.
[Our correspondent has failed to see that we dwelt at considerable length upon the very facts which he ac cuses us of ignoring in an article which was intended to be commendatory. We stated in the second article on this navy (issue of December 10) that it was the policy of the British navy to produce vessels "with a moder ate number of guns, thoroughly protected and well supplied with ammunition, rather than with an excessive number of guns poorly protected and carrying a limited supply of ammunition. The policy is well has been pushed a little too far. If the "Powerful" could throw overboard 1,000 out of her 3,000 tons of coal, and replace it with four 8 -inch and four 6 -inch rapid-fire guns, she would be sure of any cruiser she could overtake, which is more than can be said of her
at present. The reputed $25 \cdot 9$ knots speed of this ship is

Miscellaneous Notes and Recelpts.
Construction of a Grotto.-A box of suitable height and width forms the foundation. On the upper part, small pieces of a lath are nailed, inside, over the cor ners, so as to give the necessary arch. Next lay out the box with reed, in a suitable manner, allowing the protruding leaves to remain. The box with the reed is now studded with small nails. Next prepare in a ves sel enough gypsum, stirred in water, as is thought necessary. This plaster pour into the box and shake the latter to and fro, so that the gypsum enters all the crevices, and especially covers the reed. When it is found that the plaster commences to "set," the box is set up, so that the gypsum can incline downward in the nature of stalactite (filtering stone), and is allowed to harden. When the gypsum has become hard, paint it with suitable size paint, coat a spot hereand there with glue, and throw on crushed glass, paste a little moss in some corners, and the Loretto group is done.
If the grotto is not, as is usually done, placed in a niche in the wall, but is to stand free, the outside walls of the box have to be treated in the same manner as the interior.-Der Dekorationsmaler.
Decorating Crude Iron Ware.-This patented process has the purpose of covering crude iron ware with a hard, non-cracking varnish, which is impervious to fire and can be decorated in a new and unique manner by simply coating with a gold solution. The iron varnishes heretofore employed showed the drawback that the colored varnish was not fire-resisting, but turned the colored varnish was not ire-resisting, but turned
black in the heat, so that it has been impossible before to obtain a varnish covering other than black for iron ware subsequently heated in fire.
To give iron articles a fire-resisting, brown varnish coating, proceed as follows : Mix pulverized potassiun sulphide, such as is used for galvanic baths, with pul verized copal, pulverized crystalline potassium cyan ide, and pulverized sodium bicarbonate. After these substances have been intimately intermixed, a simple coloring body, e. g., Vandyke brown (Cassel brown) is added and mix the whole thoroughly again.
The quantity of the coloring matter is dependent upon the shade of the color which is desired. After hat, the compound is so far saturated with absolute alcohol as to form a paste, which is coarsely filtered to separate the undissolved particles. The moist paste, which constitutes a colored mass, is applied on the heated to $200^{\circ} \mathrm{C}$., but may be heated to $300^{\circ}$ without losing its color.
After the objects have been taken from the furnace and cooled off, a brush is passed over them, which has been dipped in a gold solution. A painting of the surace or certain parts of it is not aimed at, the object being to have the gold solution appear subsequently only in some places, which gives the article a nove and unique appearance.
Of the constituents forming the varnish, the potas sium sulphide effects the firm combination of the varnish with the iron, the copal completes the gloss, the potassium cyanide prevents the oxidation of the iron in the heat and hardens the varnish so that, after it is burnt in, it cannot be removed from the iron, even by the use of steel brushes. After the gilding has bee applied in the indicated manner, the object is onc nore placed in the oven and baked again, so as to per manently unite the varnish and the gilding. The mission of the sodium bicarbonate is to render the varnish easy of working, it being very difficult to apply it on the article without this mixture. If any other than a brown shade is desired, add to the varnish, before baking, some other fire-resisting color or one which changes as desired in the heat, and proceed otherwise as pointed out above.-L. Edgar Andes, in Neueste Erfindungen und Erfahrungen.

## Horseless Vehicles for Europe.

It was announced on December 28 that the Fisher Equipment Company, of Chicago, had contracted to furnish a large number of electric vehicles for exportation to Europe during the next ten years. Contracts have been closed with the Holyoke Works, Holyoke. Mass.; Stanley Automatic Carriage Company, Newton, Mass., and the Overman Wheel Company, Chicopee Falls, Mass., to furnish a thousand vehicles a year for ten years. The Massachusetts factories are to turn out steam, gasoline, and petroleum motors, while the Chicago concern will manufacture electric carriages and motor cycles. It is said that 1,500 vehicles are to be made per year by the combined companies, and it is said that the aggregate price to be paid will not be far from $\$ 15,000,000$. The first vehicles will be shipped in January, and the Paris office will be opened on the Champs Elysees, and branches will be established in London, Berlin, Vienna, and Brussels. The Count de Jotemps, who closed the contract, said: "The American patents on horseless vehicles are the only ones of practical value on the market. In Europe we have nothing that can compare with the American motorvehicles, either in lightness, easy running qualities, igidity, or stability. We are satisfied that America will furnish the horseless carriage of the future, and it
is our idea to control the supply."

## the new east river bridge.

Work upon the new East River Bridge is so far ad vanced that the completion of the piers for the steel towers is within measurable distance and the masonry of the anchorages inshore is assuming definite shape. On the New York side the piers are completed and capped ready for the steelwork, and the anchorage is well under way. On the Brooklyn side one of the piers is completed (this pier is shown in the illustration), while the foundations of the other pier have been carried down to bed rock and the masonry is being built up to its finished level. The first few courses of masonry in the anchorage have been laid and the anchorage plates and girder platforms have been built in place.
The new bridge will be the largest, the strongest, and the most handsome of the large suspension bridges of the world. Its entire length between terminals will be 7,200 feet, the length of the main span, center to center of towers, will be 1,600 feet, and the extreme width of the floor, from railing to railing of the outside sidewalks, will be 118 feet. The next argest suspension bridge is the famous structure a mile and a half down the East River, which is $1,5951 / 2$ feet between towers and 3,455 feet long between the anchorages. It is in the great width of the floor and number of railway tracks carried that the new bridge exceeds the older structure. The present bridge is only 80 feet wide as against 118 feet, and carries only four tracks as against six. The new bridge, moreover, having the advantage of later improvements in the materials and methods of bridge building, will be a much stiffer and, relatively to the loads it will carry, a much stronger structure
The foundations of the towers are timber and concrete caissons sunk in every case to bedrock. Above these are solid masonry piers, two for each tower, which are carried up to 23 feet above high water. Upon each pier, one at each corner, will be laid four massive pedestal blocks of dressed granite to form the footings for the four legs of the towers. The towers consist of four corner posts or legs strongly braced together, the two groups of four on each pier being connected by massive transverse lattice trusses and diagonal ties. The tops of the towers will be 335 feet above the river and 442 feet above the lowest foundation. The center span will be carried upon four 18 -inch steel wire cables which will extend inshore 590 feet, where they will be anchored to masonry anchorages. The inshore portion of the cables will not, as in the Brooklyn Bridge, carry the shore spans, but the latter will be supported by the tower, the anchorages, and an intermediate pier. The arrangement is shown very clearly in our front page engraving.

A further point of difference from the Brooklyn Bridge will be the method of stiffening the floor against deformation. In the Brooklyn Bridge this is accomplished by six shallow trusses assisted by a series of stiffening cables running from the panel points of the trusses to the tops of the towers-an unsatis factory and unscientific arrangement, as the recent buckling of the trusses has proved. In the new bridge stiffness is imparted by two continuous lattice trusse 40 feet in depth and of great solidity. At each panel point of the trusses a deep plate-girder floorbeain, reaching clear across the floor, will be riveted to the trusses. The stiffening trusses will be 67 feet apart, and to support the floorbeams at the center, vertical ties will be carried up from two points on the floorbeams to connect with light transverse trusses which will con nect the stiffening trusses overhead.
The new bridge will not have any terminal stations, the purpose being to provide a broad, continuous thorough fare over which trains, vehicles, and pedestrians may pass without any in terruption, the bridge thus forming a part of the street system of Greate New York.
The construction of the piers of the Brooklyn towers is similar to that of the New York piers, which was de scribed in an illustrated article in ou issue of August 7, 1897. The only dif ference is in the depth of the founda tions, which in the case of the second of the two piers were carried down to 107 feet below high water. The caissons are, consequently, deeper than thos on the New York side, and it was not necessary to introduce the heavy stee tiffening girders which are a feature in the first-named caissons. The las caisson to be sunk passed through 50 feet of water, 20 feet of sand, gravel,
and bowlders, 30 feet of hard clay and hardpan, and 12 feet of rock. The rock excavation was rendered necessary by the steep slope of the rock. The rock was

6.-DETAIL OF ANCHORAGE GIRDERS FOR INSIDE CABLES.

7.-ANCHORAGE PLATE-WEIGHT, $113 / 4$ TONS.

8.-METHOD OF ATTACHING CABLE STRANDS TO

ANCHOR CHAINS.

9.-PLAN SHOWING ARRANGEMENT OF LOWER ANCHOR CHAIN BARS FOR ALL CABLES

The sinking of this caisson, which was carried out under Mr. James Tabor, was a very rapid and successful piece of work, especially in view of the great depth to which the caisson was carried. The sinking and concreting was done in three months and six day of actual work. The caisson measures 63 feet by 79 feet and contains 74,700 cubic feet of timber and 98 tons of iron, chiefly in the form of drift bolts. It weight, without the concrete, is 1,965 tons. Above the roof of the working chamber are 6,000 yards of con crete. Above the caisson was a cofferdam 50 feet deep, which contained 29,000 cubic feet of timber and 32 tons of iron. The sinking was accomplished by a gang of men, who worked in shifts of eight hours each, down to a depth of 55 feet. Below this the shifts were short ened, being six hours long down to 70 feet, four hour down to 80 feet, two hours down to 90 feet, one and a half hours down to 107 feet. The shifts were latterly divided into two, each of which was only forty five winutes long. The pay of the men who carry on this arduous work is increased in proportion to the depth, varying from $\$ 2.50$ for the eight-hour shift up to $\$ 3.75$ for the short shifts at the lowes level. One of our illustrations shows an air-lock hoist of the kind used for taking out the excavated material. Another hoist for the men carried a cage $51 / 2$ feet in diameter, which has brought up as many as eighteen men at a time. The air pres sure at the 107 -foot level was 46 pounds per square inch, yet there was very little sickness, and only one case was serious.
The piers are built of limestone masonry up to the low water level, above which they consist of granite facing with a limestone backing. The piers are finished with two heavy coping course of simple but handsome design, and one pedesta course, consisting of four selected granite block measuring 8 feet by 8 feet by 3 feet in thickness.

The anchorages for resisting the pull of the cables will be extremely massive and imposing structures. They will measure 182 feet in width 158 feet in depth, and 120 feet from the foundation to the coping. Forty feet of the mass will be below the street level, above which it will ris some 80 feet. The excavation at the Brooklyn anchorage was first concreted to a depth of from 18 inches to 3 feet (see view, Fig. 10). Abov this was built a platform of four layers of timber strongly bolted together, while over the platform was laid a great mass of concrete from 6 to 10 fee in thickness, reaching up to high water level Above this the masonry commences. It is laid in 3 -foot courses, and the blocks, as can be seen from the engravings, are several ton in weight. Altogether there will be in one anchorage 44,597 cubic yards of masonry and the total weight, including concret platforms, etc., will be 125,000 tons
The total pull of the four cables will be 20,250 tons. The anchorage could only move by being rotated about its toe, or by sliding bodily forward. To resist rotation the masonry is massed at the rear (see illus tration, Fig. 10), the forward half being of
rped out and the lower side of the slope was con whole of the working chamber being ultimately filled with concrete and grouted up with liquid cement

10.-LONGITUDINAL BECTION THROUGH BROORLYN ANCHORAGE OF THE EAST RIVER BRIDGE
hollow construction. Sliding is resisted by the mass of earth 40 feet deep at the toe and by the frictional resist ance between the great mass and the earth upon which it rests. The latter is increased by stepping the bottom of the foundation

The pull of the to the foundation by eight sets of anchor chains, two to each cable. The trands are separated as they ente the masonry and passed around large spools carried at the ends of the ancho chains. The distribution of the strands is shown in the accompanying cut The chains are made up of steel ey bars 2 inches thick by 9 inches deep They are carried through curved tun nels in the masonry down to massive anchorage platforms located at the base of the masonry, where it rests on the concrete. The platform are made of deep and very heavy intersecting girders of steel. There is a single plat form for each outside cable and a larger double platform for the two in side cables. The outside platforms are 24 feet by 36 feet and weigh 100 tons each, and the inside platform is 36 by 50 feet and weighs 225 tons. The chain pass down through the platforms and are pinned into massive cast ancho plates of the form shown in Fig. 7. These are strongly ribbed to enable them to stand the great pressure to which they are subject. The object of the platforms is to distribute the upward pull of the chains throughout the mass of the masonry. To furthe distribute the pull of the chains, the are divided into two sets, one above
the other. At each link the chains rest up on the mason ry, either di rectly by means of pedestals or by means of short transverse transverse gir ders, which transmit the pressure to the side walls of the tunnels in which the chains are laid. Our illustration, Fig. 2, shows the four anchor plates anchor plate in the centra pit before the anchorage girder platform has been built over them. In Fig. 3 is shown a side platform completed, with deck beams in place beams in place ready for th masonry
We are in
debted to the chief engineer, Mr. L. L. Buck, for the plans from which the present article is prepared.

## THE ARMED FORCES OF THE WORLD.

The plan of the Czar to disarm the stand-ing-armies of Europe, admirable and humane though it be, is, perhaps, too indefinite in character to enable us to form any judgment as to its chances of success, or as to its ultimate results, should it prove successful. Universal peace may be a chimera, a mere dream, but one thing at least is certain-the imperial autocrat's manifesto to the Powers calling for a general con vocation for the disarmament of European troops has concentrated the attention of the world on the trated the enormous mases of men supported by the European governments. Time and time again it has been said that all Europe is but
a vast camp, that every man is compelled

to spend part to spend part
of his life in a of his life in a
barracks. The barracks. The evil, instead of decreasing, has become more menacing with each succeed ing year. For in the endeavo of a nation to bring its armbring its arm-
ies to as high ies to as high
a state of effa state of effi-
ciency as that of some riva power, it is compeiled to augment the number of its troops each troops each year by a con stantly increas ing ratio. In the struggle fo martial supre macy some na tions have nat urally surpassed others. It would be a most difficult most difficult task to ascer tain exactiy what army is the strongest


IN GERMANY, 17 CIVILIANS ARE DEFENDED BY A SINGLE SOLDIER.
for the efficiency of a force depends no upon numerical strength alone, but upon the discipline of the men constituting that force, upon the manner in which these men are armed, upon the term of service, and upon many other factors. It is, therefore evident that no statistics, however accurate can exactly indicate how much greater the efficiency of one army is when compared with another. So far as mere numbers are concerned, it would not be difficult to ascertain which army is the largest, and this we have endeavored to do in the present article According to the best information at hand the peace-armies maintained by the princi pal nations exclusive of native colonia troops may be tabulated thus:
TABLE I.-ARMIES ON A PEACE-FOOTING.

| Ruse | 860,000 | Italy .............. 231,355 |
| :---: | :---: | :---: |
| France | 615,413 | Great Britain....... 169,569 |
| German Empire | 585,440 | United States . . . .. 25,000 | German Empire .... 585,440

Austria-Hungary.... 385,697

in france, one soldier guards 15 civilians.

in england, one soldier defends 72 civilians.


A russian soldier defends 37 civilians.

in the united states, one soldier defends 445 civilians.

From this table it is evident that Russia's army in time of peace exceeds that of any other nation. France and Germany are about equal in numerical strength, France, however, having the larger force. Our own army of 25,000 men appears but a handful when compared with the hundreds of thousands of men main tained by the European Powers.

Although Congress enacted last spring that the stand-ing-army of the United States shall, in cases of emergency, be increased to $62,507 \mathrm{men}$, we have nevertheless retained the legal peace footing of 25,000 men, as the strength of our army under norinal conditions. Our newly acquired territories will probably require a force considerably in excess of the 62,597 men already mentioned.
In endeavoring to estimate the number of men in the various armies when on a war-footing, it is somewhat difficult to obtain accurate figures. In time of war the entire male population of a European country may be drafted into the army. Of the war-strength of Gerınany no official statistics can be obtained; but with her present organization, Germany, in case of invasion, can muster an army of $3,000,000$ men. AustriaHungary has a "Landsturm" of $4,000,000$ men, in which all citizens not members of the army, navy, or ErsatzReserve are obliged to serve from their nineteenth to their forty-third year. The following table gives the war-footing of the various countries
table in- Armies on a war footing.

| Russia........ | 00 |
| :---: | :---: |
| German Empire |  |
| France. |  |
| Austria-Hunga | $1,827.178$ $1,268.308$ |
| Great Britain |  |
| ted States | 140,627 |

Our own army, even on a war-footing, again seems small when compared with the million men that constitute an Old World force. In arriving at the warstrength for the United States in the foregoing table, we have added together the number of men in our standing-army and in our drilled militia, these being the only effective forces of trained men at our disposal in cases of emergency, and therefore corresponding more nearly in character with the European war-armie than a force composed largely of volunteers.
The ariny of one country, in the relation which it bears to the population of that country, may be comparatively larger than the army of another nation. The proportion of inhabitants to the number of soldiers gives one a better conception of the enormous size of a European force than a mere statement of its numeri cal strength. In Table IV. these proportions of population to the various armies are given:



What enormous armies France and Germany main tain, is shown by the fact that France requires one soldier to defend every fifteen of her citizens; and the Kaiser one soldier to protect seventeen of his subjects. The marked disparity between the conditions in Europ and in the United States will be appreciated, by com paring the figures in the foregoing table.
Of the relation of the armies to population, Table V will give still further information

TABLE V.-NUMBER OF SOLDIERS TO EVERY THOUSAND INHABITANTS.


A nation with a large expanse of territory requires larger army than a smaller country. A vast country like Russia would, no doubt, be more difficult to de fend against invasion than a country of comparatively small dimensions. What relation the armies bear to the territories which they defend is shown by the fol lowing tables


TABLE VII.-NUMBER OF SOLDIERS PER 10 SQUARE

|  | MILES-PEACE. |
| :---: | :---: |
| France. | $\begin{aligned} & 30 \cdot 154 \\ & 2 \cdot 1034 \end{aligned}$ |
|  |  |
| Austria-Hungary | 14.846 |
| Great Britain. | 93 |
| Russia. <br> United State | 0.993 0.084 |

TABLE VIII. - NUMBER OF SOLDIERS PER 10 SQUARE

| German Empire. | 143.657 |
| :---: | :---: |
| France | 494 |
| Austria-Hıinga | - 114.681 |
| Great Britain. | ${ }_{43} \cdot 497$ |
| Russia | ${ }^{4.042}$ |

On a peace-footing France provides a larger number f men for every ten square miles of territory than any other nation. On a war-footing, however, Germany, with her larger army, is enabled to assume the lead Russia, by reason of her enormous possessions, can
provide barely one man on a peace-footing and four
men on a war-footing for every ten square miles. The smallness of Italy, coupled with her large army, has enabled her to assume the third place in both tables Great Britain in ail these lists occupies a low posi tion ; but it must not be forgotten that her large navy compensates for the smallness of her army. In the tables, Russia's Siberian army has been included, be cause the European and Asiatic possessions of the Czar constitute one, unbroken realm.
The expense incurred in maintaining these large armies is enormous. It enervates a nation, drains its resources, imposes upon the people taxes which cannot but breed discontent, and paralyzes the productive forces and the elements of social well-being. What the maintenance of a standing army means to the youth of a country is well shown by a passage in a recently revived speech made by Lord Randolph Churchill. He aid in part

Out of the life of every German, every Frenchman, every Italian, every Austrian, and every Russian, the respective governments of those countries took three years for compulsory military service. If they estimated these years at eight hours a day for six days a week, they would find that it came to this-that out of the life of Europeans in those nations . . . no less than 7,500 hours were taken for compulsory mili tary service, during which time the individual so de prived was, for purposes of contribution to the wellbeing of the community, as a whole, by his labor, as idle, as useless, as unprofitable, as if he had never been born."

## The Current Supplement

The current Supplement, No. 1201, has many inter esting articles. "A Problem in Shipbuilding" describes the lengthening of the "Spree." "The Cox Type-Setting Machine" deals with an ingenious typesetting and justifying machine. "The Mining and Minting of Gold and Silver" is a full paper. "A Short History of Scientific Instruction" is by Sir Norman Lockyer. There are a number of other interesting articles and the usual short notes.

Contents.


## RECENTLY PATENTED INVENTIONS.

## Agricultural Implements.

CULTIVATOR AND DRAFI-EQUALIZER.illiam F. NATsCEEE, Cissnapark, Ill. With thie horses abreast, means being provided to direct the course of the cultivator in accordance with the direction given to the horses. A vertical frame has upright side bars connected at their upper ends by a top bar. A horizon-
tal frame is provided with ways and slides thereon below tal frame is provided with ways and slides thereon below
the top bar. The horizontal frame can be adjusted in the top bar. The horizontal frame can be adjusted
position by means of a lever and detent-mechanism. COMBINED hay rake and loader.-Peter Mca. Leonard, Lac du Flambeau, Wis. This invenloaders in which a rake and endless traveling carrier are mount. $d$ on an inclined frame supported by transportingwheels. The machine is connected with the rear end of a wagon, and when drawn across the field the rake-teeth
will gather the hay and pass it to the endless carrierwill gather the hay and pass it to the endless carrier-
belt. After the hay has been dumped into the wagon, reet. After the hardly -projecting arms or presser bars act to prevent
rese the hay's being blown away.

## Electrical Contrivances.

COIN-FREED A PPARATUS FOR GENERATING X-Rays.-Maurice Vidal, Paris, France. This apparatus comprises a mecbanical. automatic system con. nected with a fluoroscopic chamber provided with an cally illuminated. A coin dropped into the apparatus canses the dark, fluoroscope chamber and the Crookes tube to be simultaneously operated. The apparatus contains an accumulator for supplying the current to a Ruhmkorff coil, the poles of which are in communication with the vacuum or Crookes tube. The circuit of the accumulator is
operated by a coin
SyStem of electric traction.- Michelanarlo Cattori, Rome, Itaiy. The traction system de-
vised by this inventor vermits the continuance on the lised by this inventor permits the continuance on the
same track of whatever system may have previously been employed. The railway is provided with two parallel sectional conductors arranged in two circuits. In each circuit an independent generator is included. Terminal switches enable one pole of each generator to be connected with the corresponding terminal of either con-
ductor of the same circuit. By means of junction. ductor of the same circuit. By means of junctionswitches, the other pole of each generator may be con-
uected with the other end of eitler conductor of the same circuit

AUTOMATIC MAGNETIC CIRCUIT-BREAKER.Charles M. Clark, New Yurk city. The purdose of this invention is to provide a circuit-breaker which can be set to break a circuit automatically in case of an
overload, nnderload, or a combination of both, on single, overload, nnderload, or a combination of both, on single,
two wire, or multiple circuits. Within the casing of the apparatus, a shaft consisting of two sections is mounted. A pawl is carried by one of the sections, and is adapted for locking connection with the other section: A disk is mounted on one of the shaft-sections, and is rotated by a spring. A contact-block carried by the disk is engaged by brushes in the electric circuit. A solenoid is placed in the circuit, and contain3 a core which ope-
rates to release the disk upon an overload, and to move the pawl out of its locking position. The block's being moved out of engagement with the brushes, by the action of the disk, will cause the circuit to be broken.

## Bicycle Appliances.

SUPPORT.-William F. Whuiams, London, Eng-SUPPORT.-WILLIAM F. Wrulisms, London, Eng-
land. By means of this improved device. a bicycle may
be held in an upright position when traveling very slowly he held in an upright position when traveling very slowly or when stopped altogerber, so as to avoid the necessity of the rider's dismounting when stopped. 'The support, when brought down upon the ground, projects lateralls at each side of the machine in position to act as a broad base, and to afford the desired stabinty. When raised, the tion ard operation of the support being such that the vertical and turning motions are independent, the latter motion being always performed when the support is out of contact with the ground.

## Engineering Improvements.

GOVERNOR-WILLIAM E. Brown, Aral, Mich. To of an engine thise device for controlling the slide-valve is provided with a casing secured on a shaft. A slide is fitted to slide in the casing and is pressed by a spring, the tension of which may be regulated. Weighted arms, fulcrumed in the casing, have segmental gear-wheels in
mesh with racks on the slide. When the weighted arms swing outwardly by centrifugal force an eccentric is operated by the arm to swing across the shaft and to operate the valve-gear accordingly.

## Mechanical Devices.

veneer-press.-Axel K. Hatteberg, Mattoon, Wis. This invention seeks to provide a veneer-press ar-
ranged to press the veneers quickly, to insure good work, and to permit the handling of a large amount of work in
a comparatively short time. The invention consists principally of a bed, a platen over the bed; a pressing platen to press to be temporarily connected with the platen to press the veneers held on the bed, and means mit the removal of the pressing device and to keep the veneers locked between the bed and platen until the glue is set.
diamond - polishing machine. - avgust Wauters, New York city. The inventor of this ma chine has endeavored to provide a means whereby the dop of his apparatus can be adjusted according to the desired number of facets to be formed on the diamoud, and to insure a proper polishing relative to the desired inclinof the diamond. The invention conists essentially of a dop provided with a ball-and-socket joint ; one member carries the diamond and the other is adjustably held in the supporting arm.
ditching-machine. - William Wilgus, Lafayette, Ind. In this ditching-machine, a scoop of semicircular shape is employed and operated to enter the
ground at one point, to pass through the ground, and to find exit at the opposite point, means being provided for forcing the scoop into and tbrough the ground. The
scoop is provided with a semicircular cover, both cover and scoop being pivoted upon the same shaft, so that when the cover is over the scoop, a cylindrical receptacle is formed for the dirt removed from the ground. The cover and scoop may be locked together when the scoop has received its load. The cylinder. comprising the scoop and cover, may be released from its support, and rolled from the opening in the ground to any point where the manner a ditch of moderate depth may be made section by section, each time the scoop-section of the cylinder has been made to enter the ground.

## Railway Contrivances.

LOCOMOTIVE COALING DEVICE - William M. Price, Elisworth. Iowa. The purpose of this invention
is to enable a locomotive to be coaled while under way and thus save the time otherwise lost. This result is obtained by means of an apparatue, comprisung a dis-charging-bin suspended on inwardly-inclined links, means for supporting the links, an operating lever, and
a link connecting the lever and bin, by which the bin a link connecting the lever and bin, by which the bin may be swung to one side and tipped. The device is mounted uron the tender of a locomotive, or upon a car. to which it is attached, is to run upon a track parallel with the track carrying the locomotive to be coaled, and,
regulating its speed to that of its neighbor, discharges its coal into the tender of the locomotive to be coaled. Car-Coupling.-Seth Bedford, Charleston, Mo. This car-coupler is so constructed that the jaws may be automatically set in position to receive each other as the cars come together; that the jaws may be uncoupled by means of air-pressure; that air-pressure may be utilized
to control the passage of air to the uncoupling devices under the control of the engineer, in order to enable him to uncouple a train of cars at any point; and that the couplings for the air pipes may be automatically united when pressed together by the meeting bumpers. Varying pressure is employed to effect the uncoupling at different points, such varying pressure being supplied to commonly employed on locomotives.

## Miscellaneous Inventions.

heating-Drum.-Herbert E. Harrington, Walden, Vt. A drum has been devised by this inventor which conducts the heated currents by centrifugal force
to the outer surface of the drum, causing the hot air and products of combustion to be utilized to the utmost. The drum is self cleansing and is desizned to arrest sparks, it being well-nigh impossible for a burning particle $w$ pass through. When set up, the drum may be turned out of the way
means for racking beer.-Emil Kersten, Richmond, Va. During one stage of the manufacture of beer the liquid is cleared in large casks partly filled with
chips and shavings, After having been cleared the beer is filled into kegs, during which process a filter must be used to remove the sediment which has been shaken up during the filling. To avoid this the inventor of this new method draws the beer through an outlet vessel contained in the bottom of a cask having two inflows at different levels, so that the fine and clear portion of the beer above the sediment level is caused to flow through
the outlet vessel ; the remaining portion is subsequently the outlet vessel ; the remaining portion is subsequently
withdrawn from the cask through the outer vessel oy the inflow below the sediment level. By this arrangement the sediment is not disturbed, and the last portion of the beer contains impurities too small in amount to clog the filter.
COMBINATION ARTICLE FOR HOUSEHOLD USE.-Charlie E. Kuhn, Mont Alto, Pa. An improvement in combination articles for household use has been herewith provided, which improvement has for a
base a frame provided with corner posts secured tobase a frame provided with corner posts secured to-
gether by cross bars. The end frames are joined by suitable braces, so that the frames may be folded when desired and may be provided with means by which various
attachments can be secured thereto, so as to adapt the
device to various uses. To this framework as a base are secured attachments which adapt the device for use as table, a flower-stand, and a clothes-rack.
bUCKLE.-John C. Rosenkranz, New York city Tu provide a buckle especially adapted for use upon trousers, waistcoats, and garments generally, and so to
construct the buckle that it will be simple capable of be ing convenienily manipulated, and of firmly gripping the fabric, are the purposes of this invention. The buckle consiste of a frame having a toothed surface. and a sf, ring tongue pivoted to the frame to swing parallel to the plane thereof, and with a tension at right angles to the plane of the frame, the tongue having a tooth at its
free end adapted to enter the spaces between the teeth on the frame.
Cartridge-belt.-Louis Sanders, New York city. In this belt two or more rows of cartridges may be
carried. The cartridges in the several rows may be carried. The cartridges in the several rows may be pendent of the other. A separating device between transversely alining pockete is provided, which may be made of metal or similar hard material. In connection with the separating device, another device is employed, which is designed effectually to prevent cartridges fron leaving the pockets, even should the dameter of the sions required to hold the cartridge in place.
Pastry-board. - William L. Stanley and board is designed to be placed upon the kitchen or pantry table. The board is principally characterized by several layers of sheet metal forming the body of the board, and producing a durable and efficient structure.
non-Refillable bottle.-Henry Weil, New York city. The nerk of the bottie is contracted to forn ed provided with a spring-pressed flap valve. The ball the refilling of the bottle
Wagon-loading device--Leonard c. Wood Alden, Ohio. By means of this improved device, a wagon may be quickly loaded by means of scrapers and a team o
horses. 'The device comprises an inclined plane having hinged extension adapted to extend over the end of a gon-box bottom, and an inclined guide adapted to e gage the double-trees of
toy-boat. - Josiah T. Crawley, Honolulu Hawaii. The hull of this toy-boat is partly filled wit
water, which may be discharged through a minute pipe leading frum the bottom of the hull A support is ranged within the hull above the liquid, and upon it $i$ placed sodium carbonate, or sodium bisulfate, mixed with an acid. The resulting gas will press against the
surface of the water, and force it out of the dischargepipe to propel the boat.
egg-carton.-Robert J. barkley, Chanute Kans. This inventor provides a folding carton whic ed to contain a dozen eggs, and to obviate the necessity of counting and of the danger of breaking the egge by frequent handling. The cartons are of such form as to be readily used in packing eggs into the wooden case ordinarily employed in the egg-trade.
COMBINED HOLDBACK AND WHIFFLETREE.William B. Frost, North Lavising, Mich. The novelty of the present invention resides in the use of an arched singletree, which is pivoted between its ends, and which
has its extrensities carried forward and nnited with the ends of the breeching-piece, arched to receive back pres sure when the horse is hacked or is holding back. The pivot of the combined device permits the proper application of the back pressure for the purpose desired. The
improvement can be used on light-draft vehiclee or on improvement ca
heavy wagons.
CON'IINIJOUS BRICK-KILN.-Edwin T. HARris Ridgway, Pa. This invention is in the nature of kilns connected by snitable underground trunk-fues an ranged so that a part of the kilns may be burning while the rest are being filled or relieved of their burnt bricks The heat of a burnt-out kiln may be used to "wate steam "or dry ont the bricks in the nest kiln. The in
vertion also seeks to control the furnace-draft, and to "water-steam" the green hri
dish-washer.-Hiram h. Tuttle, Washington D. C. The dish-washer consists of a body in which a
plunger moves, having a perforated bottom plate ; a side or rim ; and an upwardly projecting, perforated, tubular column having at its lower end an enlarged collecting chamber in which water may be collected and forced up the column on the descending stroke of the plunger, the plunger being operated by a lever. The water, as it is discharged by the plunger through the perforated column, streams ove
apparatus.

## Designs.

bag-TiE.-William M. Clark. Boscobel, Wie. The leading feature of this design is found in an elongate bent to form eyes. These eyes are carried in opposite directions, one eye having its terminal bent to form a hook.
MONUMENTS.--Edwin O. Townsend, New York city. The first of these designs consists of an altar-like body, surrounded by a stone cushion baing barbase for ornaments. The base of the alsar, forming artially rough, aud is also decorated by battlement ornaments. The
surbase for the sarcophagus ornamented with molding and panels; and a plinth for the surbase, decorated by rough panels separated by plain surfaces.
COVERED DISH.-Adolphe Paroutaud, New York city. The characteristics of this design are a body of
plain contour, flaring upwardly and outwardly; and a cover, having a scalloped, peripheral contour
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(7540) B. N. L. asks : Will the zinc sold in the hardware store for use in the bell batteries answer tific American of August 31, 1889, that is are they amalgamated as described? A. The zincs for bichromate battery should be flat plates as large as will slide freely into the glass cells, and about five-sixtenths inch
bick. These platescan be purchased all ready for use bat is amalgamated, but it is easy to amalgamate the (7541) C. F. M. says : 1 would like to have a good receipt to make glue for tabbing note heads, etc. I want the kind that will enable one to reach into the remaining ones. A. The composition not disturb be prepared as follows: Glue, 4 pounds ; glycerine pounds ; linseed oil, $1 / 2$ pound ; sugar, $1 / 4$ pound aniline dyes, q. s . to color. The, glue is softened by
soaking it in a little cold water, then dissolved together with the sugar in the glycerine, by aid of heat ver a water bath. To this the dyes are added, after which the oil 18 well stirred in. It is used hot. Another as follows: Glue, 1 pound; glycerine, 4 onnces; glucose sirup. about 2 tablespoonfuls; tannin, one-tenth ounce, Give the compositions an hour or more in which to dry or set before cutting or handling the pads.

## INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted DECEMBER 27, 1898,

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Pinters stick frame, H. Goldzier.
Puller. see Nail pulier.
Pulleg
Pulleg for power transmission, J.C. Pratt
Pulp







 rations by means of, J. Wertheimer.
Roiler. See Drawng roller. Land roller.
Rolling tie plates, A. Morriso Roof valleys, machine for makink, $\mathbf{c}$. $\boldsymbol{A}$. Sturte

Rotary engine, J. Goehring
Rotary engine, E. Brine
Rotary motor, G. Sivestri.
Rudders, means for mounting, R. Runeberg
Rawmild dog, A. D. Lane




 shears.
Shee me mean, E. Barrath.
Shirt, S. Deutsch.............







 Stove or furnace. coal, J. Bon
Stove or ranne. A. A. Peale...
Stovepipe shelf w



 Testing apparatus, W. C. McK
Thill coupling. A. Bixiby
Threa holder S. G.




Tire valve, pneumatictic, C.
TTire, wheel. J. Harden
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