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Contents.

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TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 594,

For the Week Ending May 21, 1887.

Price 10 cents. For sale by all newsdealers.

THE MAGAZINE GUN AS A MILITARY ARM.

Military authorities are by no means agreed that the magazine rifle is superior to the breech-loader for the use of the soldier; and though Europe is hurriedly exchanging the former for the latter, the voice of indignant protest is making itself heard in the military journals, and with no uncertain sound. Who does not remember the *zundnadelgewehr*, or needle gun, and the great victory it won at Koniggratz (Sadowa), where, after a campaign of only forty days, the finest army Austria ever set afield was hopelessly beaten?

Though one of the first captains in Europe, Gen. Benedeck was no match for "Gen. Needlegun." This was in 1866. In 1870, the needle gun had another triumph, and backed by discipline and the power of rapid mobilization, it proved too much even for the much vaunted chassepot and mitrailleuse. Remembering what has been done by the needle gun, it is not surprising that there should be strong opposition to its withdrawal in favor of a successor of uncertain utility. At the first blush, it would seem as if a gun capable of being fired a dozen or more times without reloading ought to take precedence over one which must be reloaded after every discharge. Theoretically, it has a great advantage over the single firer; but as a military arm, to be used in the heat and amid the excitement of battle, there is a firm belief in some quarters that it will be found wanting. In some recent articles and letters in our German contemporary, the *Militar Wochenblatt,* the defects of the magazine gun as a military arm have been carefully pointed out; and while they have doubtless occurred to every one who is at all familiar with the school of the soldier and the art of war, it is interesting, in the light of present events, to review them.

The friends of the new arm, "M. 71–86," like to point out that it is the old, reliable "Mauser" single-loader fitted with a magazine; but the mechanism of the old gun is simple, and of the present one complex.

It is not necessary for us, following our German contemporary, to discuss the imminency of another Franco-German war and the consequent danger of adopting an arm which requires familiarity with new tactics. It is enough for the present purpose to look only at the possible relative advantages of the magazine and single firing gun. Even under the most favorable conditions, the magazine gun changes its range after each fire, because it is lighter by the weight of the fired cartridge. It is, of course, evident that, in the hands of a skillful man, a cool and intelligent man, the magazine gun is a powerful weapon. But the average soldier, especially him from the rural districts, is awkward, stupid, and excitable. Once let him get to work on the lever of the magazine gun, and it is ten to one he fires every shot in his magazine regardless of range, or breaks the lever; and if, as is likely, it should prove difficult to restrain his ardor, the quick handling of troops, change of front, and the like might be seriously impeded.

Whoever may have followed the various trials that have been made with the magazine gun in the hands of the common soldier, or at least those few which have been published, can scarcely fail of surprise that the great powers, one and all, should have decided to adopt it. Of course, it is to be expected that continual handling will bring a certain amount of precision; but in these days of great armies, when a million men are set afield by a single power, it is necessary to count the cost of learning to use a new weapon, and to learn whether or no it may be relied upon in times of excitement, when roughly and awkwardly handled. It was only a few weeks ago when the 132d of the line had a trial with the magazine gun. Now, this corps is to the general staff of the German army what the Black Watch is to the English army, what the Old Guard was to Napoleon, and the Tenth Legion to Cæsar. They fired over the target, and under it, and to one side of it, and, as if there was no such thing as keeping anything like a range, they no sooner refilled their magazines and started again, than the same observed differences were recorded. If the target could have fired back, even with single loaders, there would not have been any hope for them. Surely, if whole corps practicing at the butts with single firers had exhausted ammunition in this reckless way, we should long since have been compelled to establish powder factories for each regiment, or go back to the crossbow and the sling.

THE CELESTIAL WORLD.

THE CONJUNCTION OF VENUS AND SATURN.

The near approach of two large planets is a noteworthy event on astronomical annals. Such an event occurs on the 30th of May, at noonday, when Venus and Saturn are at their nearest point, Venus being 2° 15′ north of Saturn.

The planets are invisible to the naked eye at the time of conjunction, but powerful telescopes will bring them out even in the full sunlight. The western sky, however, will present a charming picture on the evenings of the 29th and 30th. Venus, the largest and most beautiful star that shines in the sky, is as easily recognized as the sun or moon. Saturn may be easily found by means of the two first magnitude stars, Castor and Pollux, a few degrees north of the planet. On the 29th Saturn will be east of Venus, and on the 30th he will be found on the west of his brilliant rival.

The reason for the meeting and parting of the two planets may be easily explained. Venus is an inferior or inner planet, and as seen from the earth is moving eastward or from the sun. Saturn is a superior or outer planet, and seems to be moving westward or toward the sun. When two planets are traveling, the one toward the east, like Venus, and the other toward the west, like Saturn, unless there be a change in their course, they must meet and pass on the celestial road. There comes a point when they are in the same right ascension or longitude. This condition of affairs takes place on the 30th, and the planets are then said to be in conjunction.

It is not only a pleasing spectacle to behold the queen of the stars and the ringed wonder of the skies in near proximity, but the interest of the meeting is increased by the near neighborhood of the stars Castor and Pollux. The beaming planets and two first magnitude stars form a rare picture of planetary and starry beauty, the shining quartet illustrating the contrast between inherent and reflected light.

The moon in her first quarter will add her soft light to the starry show, and the exhibition will continue until 10 o'clock, when the planets will slowly disappear behind the western hills.

It will be almost equally interesting to watch the planets as they approach each other before the 30th or as they recede from each other after the 30th.

THREE PLANETS VISIBLE IN VIRGO.

Jupiter, Uranus, and the asteroid Vesta are now in the constellation Virgo, and are all visible to the naked eye. An observer glancing at the eastern sky in the early evening will behold Jupiter in his most superb aspect as he slowly rises with stately step toward the meridian, holding as prominent a place in the east as Venus holds in the west. It will not be as easy to find his two companions with the unaided eye, and an opera glass will be an efficient aid in pointing out their position. But the feat may be accomplished if the moon be out of the way, the sky cloudless, the atmosphere pure, and the star-gazer possessed of good visual power. The bright star west of Jupiter is Spica. The distance between star and planet on the last of May is about 5°, which will be a guide in celestial measurement.

Uranus, the second star of the trio, may be looked for about 20° northwest of Jupiter and a little more than 2° south of the third magnitude star Gamma Virginis. Vesta may be found about 12° north of Jupiter and a few degrees northeast of the third magnitude star Zeta Virginis.

Uranus and Vesta shine as stars of the sixth magnitude, the smallest stars perceptible to the naked eye. Vesta is the largest of the family of 265 asteroids, and the only one visible to the unaided eye. She is less than 500 miles in diameter and yet looks to terrestrial observers as large as the giant planet Uranus, who is more than 31,000 miles in diameter. The great difference in the distance is the reason why the planets appear to be of the same size. Vesta circles round the sun at a mean distance of 230,000,000 miles, while Uranus makes his vast circuit at a distance of more than 1,800,000,000 miles. Therefore the tiny asteroid and the huge planet appear to mortal eyes of the same size. Both are shining points barely perceptible to the eye.

Jupiter, Vesta, and Uranus form an isosceles triangle, or one that is nearly so, of which Jupiter and Vesta are the base and Uranus is the summit.

A New System of Boot Making.

The London (Eng.) *Shoe and Leather Record* describes a system of fastening the soles to boots and shoes, in which the fastenings are driven from the inside, the fastenings being first placed in the insole and then the upper lasted over them. The fastening is of brass, with a conical front, barbed all around the point, and the head is flat and neatly formed. A machine is used to feed and drive the fastenings at regular distances through the insole. The insole is then laid on the last, with the barbed points standing erect. The upper is lasted over these points and pushed down, leaving sufficient of the point still above the upper to pierce half way through the sole. The sole is then laid on as though upon blinders, hammered down, and the process is complete. The heeling and finishing are performed in the ordinary way.

THE A. A. GRIFFING IRON CO., of Jersey City, N. J., have issued a handsome illustrated catalogue of the Bundy patent radiators, which they make in so many sizes and styles, and in such great quantities, that it requires a very extended manufacturing plant to enable them to keep up with the demand. The facsimile testimonials and lists of users of these radiators given in this volume, as to the excellence and efficiency of this method of heating, render further commendation simply superfluous.

The Hudson River Tunnel.

After a resting spell of four and a half years, this great undertaking has been again opened, and one of the headings is being extended as rapidly as possible through the bed of the Hudson. Although all of the four headings will be worked simultaneously, the principal endeavor will be to complete and open the north tunnel, which is about one-third finished. The method of building the tunnel has not been changed. Compressed air is relied upon to keep the heading free from water, and the tenacity of the wall of silt is depended upon to separate the air and water. The heading is excavated as fast as the plate sheathing and masonry can be put in, while the pilot is kept from fifteen to twenty feet in advance of the heading, and thus serves as an explorer into the nature of the material ahead.

The work is of decided interest from an engineering point of view, as it introduces and, what is more important, practically tests a new and novel system of tunneling, which, so far at least, has proved to be efficient and economical. The tunnels once completed will be invaluable to the commerce of this city, as they will provide sure and rapid connection with all the great railroads terminating on the west side of the Hudson River, opposite this city.

We understand that all the capital necessary has been secured, and that all financial stumbling blocks have been removed. We congratulate Mr. D. C. Haskin, the inventor of the system employed in the tunneling, upon his indomitable energy and perseverance in surmounting the many difficulties he has encountered, and hope that his anticipations in respect to the result of his grand engineering enterprise will be fully realized.

Elsewhere in this issue will be found a description with illustration of this great work from its inception up to the present time.

Printing Plates from Photographs.

A method of reproducing photographs in copper plate, lithographic, or printing presses has been realized by Capt. Louis Collardon, of Cordoba, Buenos Ayres. The relief surface for the photographs is a specially prepared surface of gypsum, which is composed of 1 to 6 per cent chalk and 50 per cent water to each 100 parts gypsum, the latter, together with the chalk, being finely powdered and well worked with the water to obtain a homogeneous mass, which is then pressed into plates of suitable size, having a polished surface when dry. The pigment paper is prepared as follows: Common black pigment paper is placed in a bath composed of 4 per cent bichromate of potash to 100 per cent water for from one to five minutes, as required, and then dried in a temperature of 60 deg. to 70 deg. C. The paper is then exposed to the daylight for from ten minutes to two hours, according to the strength of the light, and then placed in cold water for about an hour, and then in another bath composed of about 6 per cent pyrogallic acid to 100 per cent alcohol for about ten minutes, when it is placed in a frame or on a plate and dried. As soon as completely dry, it is covered with powdered oxide of zinc or oxide of bismuth, which is rubbed in with the palm of the hand, thus pressing it into the deep parts, and leaving the upper parts or lines of the figures free, the surplus powder being removed. The pigment paper thus prepared is placed in front of the camera, and a negative produced in the usual way. This negative is removed from the glass and placed between the negative of the photo. to be reproduced and a pigment paper, which has been prepared with a strong solution of gelatine containing only a small quantity of pigment, and then copied as usual, thereby producing a positive on the pigment paper with the same irregular surface as that on the negative, which is necessary to print from. The printing block is prepared as follows:

The gypsum plate is placed under water, and upon it the positive, also under water, then the plate with the positive is removed from the water, and the positive pressed against the plate by an India rubber roller or squeezer to remove any air that may be between, the positive closely adhering to the plate. It is then pressed slightly in a press, and then placed in a bath composed of water and 10 per cent sulpho-cyanide of ammonium, which will dissolve those parts which are not or only partially developed. When removed from this bath and washed in cold water, it is placed in a bath composed of 5 per cent chrome alum in water for about five minutes, then removed and washed, and immersed in a bath of concentrated alcohol and dried, and then impressed into a plastic mass composed of bone dust, albumen, blood, and silicate of soda, the proportions depending on the hardness required. Any other plastic substance may be used, such as celluloid, cyanoid, etc., by means of a hydraulic press or other suitable means, steam being introduced during the operation. When cold, it is removed from the press.

THE great war ship built under the name Renown by Messrs. Armstrong, Mitchell & Co. for the British navy was launched recently, and named the Victoria in honor of the Queen's 50th year of reign. Her length is 340 ft., breadth 70 ft., mean draught 26 ft. 9 in., displacement 10,500 tons, and horse power 12,000.

STEAM CRUISER ATLANTA, U. S. N.

In 1883 the government entered into contract with the late John Roach for the building of the twin screw steam cruiser Chicago, single screw steam cruisers Boston and Atlanta, and the dispatch boat Dolphin, the construction of which had been authorized by act of Congress. The contract price for all the vessels was $2,440,000, which included the hull, machinery, and fittings, but excluded the masts, spars, sails, etc. In the SCIENTIFIC AMERICAN SUPPLEMENT, No. 432, may be found accurate and spirited sketches of each of these boats, together with a description of their principal features.

The accompanying frontispiece illustrates the Atlanta, which now lies, complete and perfect in every detail, at the Brooklyn Navy Yard. The other three boats are finished as regards their machinery and hulls, but have not yet received their armaments.

The principal dimensions of the Atlanta are as follows:

Length between perpendiculars	270 ft.
" on water line	276 "
" over all	283 "
Extreme breadth	42 "
Mean draught at load water line	16 " 10 in.
Displacement at water line	3,000 tons.
Sail area	10,400 sq. ft.
Indicated horse power	3,500
Speed at sea	13 knots.
Capacity of coal bunkers	580 tons.

The ship is built of steel, and is divided into nine main compartments by eight complete transverse bulkheads, extending to the main deck. The boilers and machinery are protected by a coal armor 8 feet thick above the water line and 5 feet below, the coal bunkers being formed by longitudinal bulkheads extending on each side through the machinery space. The doors closing the compartments can be operated from below or from the main deck. In addition to the 580 tons of coal carried by the bunkers, about 200 tons more can be taken on board if necessary, thus enabling the vessel to steam 2,500 miles at full speed, or 5,300 miles at the rate of 10 knots an hour. For 100 feet the machinery spaces are protected by a steel deck, one inch and a half thick, and at the bottom of these spaces is a water-tight double bottom, containing twelve water-tight cells. The outside plating is 23 pounds to the square foot, and is doubled from the stem to near the stern at the water line.

The motive power consists of a three cylinder compound horizontal engine of 3,500 horse power; the high pressure cylinder is 54 inches in diameter and the two low pressure 74 inches, the latter being arranged at either side of the former, and the stroke is 42 inches. The steel shaft is 16 inches in diameter at the journals, and is made in three interchangeable sections. The low pressure cranks are set at right angles, while the other is placed between the two at angles of 135 degrees. The screw is four bladed, 17 feet in diameter, and has a pitch of 20 feet. Steam is supplied by eight horizontal return tubular boilers, located forward of the engine, and separated into two groups by a transverse bulkhead. Each boiler is 9¾ feet long, 11 2-3 feet in diameter, and is provided with two cylindrical furnaces having a grate surface of 25 square feet. A forced draught is obtained from six blowers, each having a capacity of 12,000 cubic feet per minute, which creates an air pressure in the air-tight boiler room equal to one or two inches of water. The boilers were tested to 160 pounds.

From the accompanying engravings a comprehension idea may be obtained of the disposition of the battery. 1 is a stern chase 8 in. breech-loading rifle, 2 a Gatling gun, 3 a Hotchkiss tower and single shot 3 lb. 47-millimeter gun, 4 Gatling machine gun, 5 search light, 6 8 in. long range breech-loading rifle on forward deck, 7 armored pilot house, 8 Gatling gun, 9 search light, 10 37-millimeter Gatling gun, 11 broadside breech-loading 6 in. rifle. At 12 the remarkably perfect wave line of the ship at full speed is shown.

The first trial trip of this boat was from the Brooklyn Navy Yard up the Sound and back, when some trouble was experienced with the water relief valves of the high pressure cylinder and with the heating of the thrust bearing. The second trip was to Newport to adjust the compasses, and the bearing again heated. Upon the return this bearing was entirely overhauled, when it was found that the rings had not been properly fitted, and the pressure brought upon them was, consequently, unevenly distributed. After having been carefully refitted, the third and last trip was made, the vessel leaving the Navy Yard at seven in the morning, and running continuously until seven in the afternoon, the course being out to sea and return. The pressure in the fire rooms ranged from 1·1 to 1·5 in. of water, the steam pressure in the engine room averaged 88 pounds, and the vacuum 26 in. The average speed attained was $15\frac{46}{100}$ knots for six hours, the maximum being $16\frac{83}{100}$. The maximum indicated horse power was 3,506. The boiler pressure varied from 94 to 96 pounds, the safety valve being set to blow off at 100. The shaft made an average of 68 revolutions per minute.

During the entire trip the engines were not stopped, and no trouble whatever was occasioned by any part of the machinery, everything worked easily, smoothly, and satisfactorily. The vessel itself gave evidence of great strength and rigidity.

Previous to this the wrist pin of the high pressure crank had heated more or less, the lubrication being imperfect, owing to the oil being thrown out by the rapid revolution. This was perfectly remedied by providing the bearing with a telescope oil cup, one of which will now be placed upon each of the other wrist pins.

The tests of this cruiser have resulted most satisfactorily, and her engines have developed the full power called for in the specifications, which contained no clause concerning the speed to be attained, although the repor has been widely circulated that, before being accepted, she would have to make a certain number of knots in rough and still water. There was no provision relating to speed. She has shown that a speed of sixteen knots is possible, and this is considered excellent.

The guns of the boat will next be tested, and the crew drilled in their handling. In an early issue we purpose to present engravings of the various guns, showing how they are mounted and manipulated and how the ammunition is handled.

Payment by the Hour.

In the "Declaration of Principles" adopted and promulgated by the national association of master builders, it is stated that "this association earnestly recommends to all its affiliated associations to secure as soon as possible the adoption of a system of payment by the hour for all labor performed, other than piece work or salary work, and to obtain the co-operation of associations of workmen in this just and equitable arrangement." In some cities where the system of paying for labor by the hour is not in vogue, there is some query as to just what the system includes.

In Chicago, ever since the great fire of 1871, nearly all contractors have been in the habit of paying for their labor by the hour instead of by the day. By the old custom of paying by the day, still in almost general use, the day was made the unit of time and of payment. A quarter of a day was made the smallest division of this unit. If a man did not work a quarter of a day, he received no pay. If he worked over a quarter of a day, he received pay for half a day, etc. This is unjust to the laboring man who works but an hour and is suddenly called away. It is equally unjust to the contractor who pays for half a day when he only receives but a little over a quarter.

In the payment by the hour system the hour is made the unit of measure, and all time is kept by the hour. If a man works less than half an hour it is not counted. If he works over half an hour, he is credited with an hour.

The number of hours in a day's work does not affect the system at all, and all contractors reserve the right to work as many hours as is necessary and agreed. Overtime is credited as time and a half, and Sundays as double time. A man leaving work without permission is discharged, but when he leaves with permission he is paid for exactly the amount of work he has accomplished. This is all there is to the payment by the hour system. Those who have tried it like it infinitely better than the old method.—*Sanitary News.*

Phosphates from Rock.

A process lately patented in Germany by Haenisch and Schroeder, for the manufacture of precipitated phosphates from any kind of the ordinary crude rock, is as follows:

The rough material being first reduced to a very fine powder, is treated with just sufficient sulphuric acid to transform the carbonate and any free lime into sulphate. The mass is then subjected to the action of aqueous sulphurous acid, which dissolves only the tricalcium phosphate and leaves the other constituents as a sediment.

The clear liquid is decanted and subjected to a gentle heat. Sulphurous acid is given off and reabsorbed in water, by means of a simple mechanical device, the phosphate itself being precipitated, washed, dried, and passed through a disintegrator.

Th preliminary treatment prevents the combination of the carbonate or free lime which would otherwise take place with the sulphurous acid, and averts the formation of a mixture of calcium sulphite in the final product.

Asbestos in Russia.

From Orenburg to Ekaterinburg, the country is declared to be thickly dotted with asbestos deposits, while near the Verkni Tagil iron works is a hill, called the "Sholkovaya Gora," or Hill of Silk, which is stated to be entirely composed of asbestos. The mineral is said to be of the best white quality, and adapted for all important purposes to which asbestos is applied. In the Goroblagsdat district of Perm similar deposits crop above the surface, and any quantity can be obtained for nothing, the mineral possessing no value in the Ural region.