SCIENTIFIC AMERICAN

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Displacement, 15,200 tons. **Speed,** 18.6 knots. **Guns:** Four 12-in.; Fourteen 6-in.; Twenty 3-in.; Twelve small rapid-fire guns.

ADMIRAL TOGO'S FLAGSHIP "MIKASA" LEADING THE JAPANESE FLEET INTO ACTION.—[See page 270.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, APRIL 2, 1904.

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

THE BLINDNESS OF THE SUBMARINE.

The loss of the British submarine, that was recently struck by a merchant steamer, and sent to the bottom with its hapless crew of eleven officers and men, proves once more, in a very dramatic way, that the most serious fault of the submarine in its present stage of development is that it is blind. In saying this we refer to submarines as a whole, and do not wish to be understood as saying that in the great activity which is now being shown in the development of this most interesting craft, there may not be some one type that is able to maneuver under water with its eyes open most of the time; indeed, there is reason to believe that in this country the "Lake" submarine, which was recently indorsed so strongly by a United States army board, is provided with an improved form of "periscope" that is greatly superior to anything of the kind that has been used up to the present at least in these waters.

The British submarine disaster happened to one of the new and larger vessels of the Holland type, which have recently been constructed by the Admiralty. It was lying submerged off the Nab lightship, awaiting the approach of a battleship, when it was run down by a South African liner. Inasmuch as the accident happened at a time when a special lookout was being kept, it is natural to conclude that the failure of the submarine to detect the approach of the liner was due to the limited range of her periscope. We are not aware what means of vision is being used by the British submarines; but if it is the same as that with which we are familiar in this country, the field included by the glass is limited to a narrow angle of vision ahead. It can readily be understood that if the instrument was of this type, and was being directed steadily toward the approaching battleship, the merchant steamer might have run down the submarine from astern, the crew of the submerged boat having no warning of the impending disaster until they were struck and rolled over by the big ship.

An improved type of periscope, recently described in the Scientific American Supplement, contains five separate lenses, four of which look to the four quarters of the compass, and convey a reduced image, sufficient for observation all around the horizon, to the navigator in the submarine, while the fifth lens looks ahead and presents the image in its true size, without distortion. So far, so good—provided the weather be clear and the water calm; but the troubles of blindness begin to overtake all submarines when the winds freshen and the sea rises. Then, with the pitching of the boat, which, even when submerged, must be more or less affected by the waves, the periscope tube begins to rock with a reversed pendulum motion, and the field of vision caught by the lenses varies from sky to water and from water to sky, while the salt spray blown against the glass begins further to destroy the sight of the little submerged fighting ship. It will be a brave step in the right direction when someone discovers a means of automatically maintaining the line of sight of the periscope lens in the level position.

The recent disaster will necessarily, for a time at least, shake the public faith in the submarine; but that it will seriously hinder its development, we do not believe. It was only a few days before this accident, during another series of submarine maneuvers in which a fleet of British battleships was attacked, that a decision was given in favor of the submarine; some of the battleships being ruled as torpedoed and put out of action. Moreover, the crowded condition of the field of operations when the boat was lost, the maneuvers being carried out in one of the most busy maritime thoroughfares, would never occur in war time, except on the rare occasion of a general *melée* at the close of a hard-fought naval engagement.

HIGH-EXPLOSIVE PROJECTILES.

The frequent reports from the Far East to the effect that many of the shells thrown into Port Arthur fail to burst, naturally renders the question of our own projectiles one of great interest.

At the time when maximite was undergoing tests by the Ordnance Board of the United States Army, just prior to the purchase of the secret of its manufacture and its adoption by the government as a bursting charge for projectiles, as full particulars as were permitted to be published concerning this explosive appeared in the Scientific American. Since that time its extensive employment has afforded ample opportunities for further studying and verifying its valuable qualities.

The explosive is melted in steam-jacketed kettles, and shells are filled with it by the simple process of pouring. On cooling, it forms a very hard and dense mass, firmly adhering to the walls of the projectile, which renders it incapable of shifting when the projectile is discharged from the gun, or by the impact when the projectile strikes armor-plate.

It is about fifty per cent stronger than is ordinary dynamite, and its density is about 1.66, being a little more than once and a half as heavy as water. It is practically incapable of being exploded by any form of shock, and upon ignition it will simply burn like pitch. Experiments have demonstrated that projectiles filled with it can be fired through armor-plate as thick as the projectile itself will stand to pass through, without danger of exploding the maximite from shock, thus allowing the fuze to detonate the high explosive within the vessel itself.

A fuze for high explosives requires a detonator or exploder, usually consisting of fulminate of mercury, or some other fulminating compound. Ordinary dynamite requires only several grains to effect its complete detonation, but the new explosive is so insensitive that from 300 to 350 grains of the most powerful fulminate are required. When thus detonated, the projectile is broken into a very large number of fragments. A twelve-inch projectile weighing half a ton was broken into probably ten thousand fragments in one of the experiments at Sandy Hook. Seven thousand of these fragments were actually recovered and counted.

It has been a difficult task to provide a fuze which will carry a sufficiently large detonator and still be safely discharged from the gun, without danger of going off prematurely and setting off the high explosive, wrecking the gun and killing the gunners.

Lyddite, the high explosive used by the British government during the Boer war, was simply picric acid melted and cast into the projectiles. While cast picric acid is sufficiently insensitive to enable shells filled with it to be fired from guns with safety, it can only be fired through moderately thin plate without exploding from the shock. Nevertheless, in the Boer war a very large percentage of the Lyddite shells did not explode at all, while many more only partially exploded, as evidenced by the green character of the smoke, and the fact that the captured Boers were frequently found to be stained a brilliant canary color. This was owing to the fact that the British government had no fuze by which picric acid could be exploded with any degree of certainty. Many of the shells thrown by the Japanese in the recent bombardment of Port Arthur failed to explode from the same cause.

The difficulty in exploding fused picric acid has led many of the Continental powers to use picric acid in granular form compressed into the projectile, although its density is much less. Still, much less fulminate is required to explode picric acid in powder or granular form than when it is cast solid, and an efficient fuze is not so difficult to provide. But while it is impossible to penetrate armor-plate of any considerable thickness, even with cast picric acid, picric acid in granular form will stand even less shock, and cannot be considered an efficient explosive for armor-piercing projectiles.

Furthermore, it is obvious that when a high-explosive projectile penetrates a warship and explodes inside, if the projectile contains a larger quantity of the same explosive, a higher shattering and wrecking effect will be produced upon the surrounding structure of the vessel, owing to the larger volume of gases produced. Consequently, it is even for this reason alone desirable to penetrate a war vessel with the maximum weight of explosive in the projectile, other things being equal.

The Austrian government has recently adopted a mixture of powdered aluminium and nitrate of ammonia as a bursting charge for projectiles. This explosive is termed ammonal. It is said to be exceedingly powerful, and to have produced most satisfactory results, as far as explosive energy is concerned. It is also claimed that it is quite insensitive to shock, and can be safely fired from guns. But it is not clear that it can be fired through armor-plate with much success.

To explode ammonal, it seems to be only necessary to ignite it, as in the case of black powder. The very fact that ammonal can be exploded by mere ignition renders it dangerous as a bursting charge for projectiles, for the reason that the least flaw in the projectile or fuze would allow the chamber gases of the gun to enter the chamber of the projectile and cause an explosion, blowing up the gun and killing the gunners. The same is true with powdered picric acid, only to a slightly less extent than with ammonal. It is furthermore obvious that the detonator or igniting means of a high explosive should not be located within the high explosive while in the gun. In other words, the fuze should be so constructed that the detonator should not be within a detonative distance or firing distance of the high explosive until after the projectile has left the gun and has struck the target.

For the detonation of our own and other insensitive high explosives used in projectiles, Mr. Maxim has recently developed a fuze which experiments have shown to be capable of carrying any desired quantity of fulminate compound, in such a way that it is impossible for the high explosive to be either ignited or set off, even should the detonator be exploded prematurely.

The explosive used by our own army is indeed so insensitive, that should a shell from the guns of an enemy enter and explode in a ship's magazine filled with projectiles fully charged with it, all armed with the fuze and ready to fire, no explosion of the shells would be produced. Furthermore, should a projectile contain a flaw, and the fire from the gunpowder charge enter the shell space, no explosion would be produced in the gun, nor would there be any if the projectile should break up in the gun. A small portion of it would be burned by the powder gases, but with no disastrous results.

The fuze above mentioned is also so constructed that when an armor-piercing projectile strikes the plate, there is just delay action enough to allow the shell to pass clear through the plate, when the fuze acts to explode it immediately behind the plate. If, however, a projectile be fired through very thin plate, or even the hull of a torpedo boat, or should the projectile strike a glancing blow, it will always explode within ten feet.

The position which the United States occupies to-day with respect to foreign powers in the art of throwing high-explosive projectiles from guns and in the penetration of heavy armor-plate with the same, is about as follows: This government can penetrate with its high-explosive projectiles any plate as thick as the projectile itself will stand to go through, and it is provided with a fuze to explode the shell exactly where desired. In the bombardment of towns and fortifications, our shells would never fail to explode with the very highest results.

As near as can be learned, the best that has been attained abroad is to fire high explosives through plates about half as thick as are successfully penetrated by us, while no foreign government is provided with a fuze that can be depended upon to detonate a high explosive which can be successfully used in armor-piercing projectiles.

DISPERSION AND WAVE LENGTH OF N-RAYS.

In a paper recently read before the French Academy of Sciences, Prof. Blondlot records his experiments on the dispersion of N-rays, in connection with which the wave lengths of these rays were measured. The method used is quite similar to the one employed in connection with light rays, aluminium prisms being used, as these do not exhibit the property of storing up the rays. The radiations produced by a Nernst lamp, after traversing a window closed with an aluminium foil, would strike on their way a board of pine wood 2 centimeters in thickness, another aluminium foil, and two sheets of black paper, so that any other radiation could be expected to be eliminated. By means of a slit made in moist pasteboard, a well defined bundle of N-rays was eventually separated, striking an aluminium prism, the one face of which was perpendicular to the direction of the rays. Now the author states that from the opposite face of the prism different bundles of N-rays will issue, having undergone a horizontal dispersion; and the presence and deviation of these rays are ascertained by shifting a slit filled with phosphorescent calcium sulphide, according to the well-known Descartes method. The indices of refraction of the rays thus separated are 1.04, 1.19, 1.29, 1.36, 1.40, 1.48, 1.68, 1.85 respectively. These results were checked by measurements made with an aluminium lens.

In order next to determine the wave lengths concerned, the author caused the bundle of rays to strike another screen of moist pasteboard, containing a narrow slit so as to isolate a very narrow portion of the bundle. To the movable alidade of a goniometer, an aluminium sheet was attached so that its plane was perpendicular to the alidade. This metal sheet contained a slit only 1.15 millimeters in width, provided with phosphorescent calcium sulphide. By turning the alidade, the direction of the bundle of rays may be accurately marked. Now, when placing a grating in front of the slit of the second moist pasteboard, and exploring the issuing bundle by turning the alidade to which the phosphorescent sulphide is fixed, the presence of a system of diffraction bands quite similar to those observed with light rays is stated, but these bands are much closer together and have approximately the same reciprocal distance. Hence it may be inferred already that N-rays have much shorter wave lengths than light rays. As the angular distance of the single bands is rather small, the wave length may be determined after the reflection method with a scale and a telescope, a mirror being stuck to the alidade. Furthermore, the author ascertains the distance of two symmetrical bands of a higher order, so as to determine from these elements, according to a well-known formula, the wave length of the ray in issue. The values thus found by Blondlot are:

0.00815 μ for refraction index...........	1.04
0.0099 " " "	1.19
0.0117 " " "	1.4
0.0146 " " "	1.68
0.0176 " " "	1.85

From the above results, which, moreover, were checked by further experiments according to the method of the Newton rings, it is seen that the wave lengths of N-rays are much smaller than those of light rays, in opposition to the original opinion of the author and of other experimenters.

THE HEAVENS IN APRIL.

BY HENRY NORRIS RUSSELL, PH.D.

It is a dull part of the heavens that is presented to our view in the evenings of this month. The Milky Way, near which so many of the brightest stars lie, is in its least conspicuous position, close to the horizon, while the relatively barren regions near the galactic pole are high up near the zenith.

If we turn our faces westward at about 9 o'clock in the evenings of the middle of the month, we shall see Taurus, Orion, and Canis Major just setting. Above them, and in the Milky Way, lie Canis Minor, Gemini, and Auriga, with Perseus to the right, and Cassiopeia farther still, close to the northern horizon, and almost under the pole. Along the meridian the only prominent constellations are Ursa Major, which is right overhead, and Leo, south of the zenith. Both these constellations bear some resemblance to the objects for which they are named—which is more than most of the others do.

It is not hard to make out the Great Bear. The handle of the Dipper forms her tail, its bowl is in her body, and some fainter stars to the westward mark her head, while her paws are represented by three pairs of stars which lie about 15 deg. apart in a straight line midway between the dipper bowl and the "sickle" in Leo. With the aid of some smaller stars, it is easy to make out a very fine likeness.

As for Leo, the curve of the sickle marks the head and mane of a couchant lion, while the three conspicuous stars some distance to the left are in his hindquarters, and the bright Regulus is in its traditional position at the lion's heart.

Below Leo is a very dull region, occupied by the long line of Hydra. On the left is Virgo, with the first-magnitude star Spica, and a curving line of five third-magnitude stars between this and Leo. Below it is the little quadrilateral of Corvus.

In the northeastern sky we come again to a brighter region. Arcturus, which lies northeast of Spica, is much the brightest star in this part of the sky. The fairly bright stars north of him also belong to Boötes. Below them is the small semicircle of Corona Borealis, whose regularity, rather than its brightness, makes it a fairly conspicuous constellation. Below this again, and to the left, is Hercules, beyond which we finally come to Lyra, just rising in the northeast. Draco and Ursa Minor, on the right of the pole, and Cepheus below them, complete the list of the prominent constellations.

THE PLANETS.

Mercury is evening star throughout April, and is very favorably placed during the last half of the month. He reaches his greatest elongation on the 21st, at which time he is in Taurus, a few degrees west of the Pleiades, 20 deg. distant from the sun, and 10 deg. north of him. He does not set till after 8 o'clock, and, as he is very bright, he should be seen without difficulty. He should surpass in brightness all the fixed stars, except perhaps Sirius.

Venus is morning star in Pisces, but is not very conspicuous, since she is south of the sun, and rises not more than an hour before him.

She is 150 million miles from the earth, and only about one-quarter as bright as she is at her best.

Mars is evening star, but is now so near the sun that he is practically invisible. On the 1st he sets about an hour after the sun, but only half an hour after him on the 30th. He is in conjunction with Mercury on the 8th, but both planets are too deeply involved in the twilight to be well seen.

Jupiter is morning star, but is not visible till the latter part of the month, when he gets far enough away from the sun. On the 22d he is in conjunction with Venus. The two planets are only half a degree apart, and they will be well worth looking at.

Saturn is morning star in Capricornus, rising about 4 A. M. Uranus is in Sagittarius, and comes to the meridian at 4 A. M. on the 20th. Neptune is in Gemini, and is visible only in the early evening.

THE MOON.

Last quarter occurs at 1 P. M. on the 7th, new moon at 5 P. M. on the 15th, first quarter at midnight on the 22d, and full moon at 5 P. M. on the 29th. The moon is nearest us on the 26th, and farthest away on the 10th.

She is in conjunction with Uranus on the 6th, Saturn on the 10th, Venus on the 13th, Jupiter on the 14th, Mars on the 16th, Mercury on the 17th, and Neptune on the 20th. None of these conjunctions is close.

It is not often that results of astronomical value can be obtained from the work of a schoolboys' drawing class; but this is a fair description of the outcome of certain "experiments as to the actuality of the 'canals' of Mars," that have recently been made by Messrs. Evans and Maunder at Greenwich.

It is well known that there has long been a controversy on this subject. Some observers see the surface of Mars covered with a network of fine straight dark lines, while others, equally keen-sighted in other cases, can see only diffuse shadings. There is no doubt whatever that the observers of the "canals" have drawn the planet just as they saw it, but there is a good deal of doubt whether, if we could see Mars at, say, the moon's distance, we would find that the actual markings were linear and straight.

It is in the solution of this problem that the Greenwich schoolboys have furnished valuable material. These boys (averaging about thirteen years old), who knew nothing of the telescopic appearance of Mars, were told to draw all that they saw on a circular disk that was placed before them.

These disks (different upon different days) were placed at such a distance from the boys that their apparent size was like that of Mars as seen with an ordinary telescope. The principal markings on them were copied from actual drawings of Mars, and represented the prominent dark areas of its surface. In addition to these, some disks had "canals" drawn on them, while others had black dots inserted in the light areas, and in others still irregular river-like lines and lines of faint dots took the place of the rectilinear markings.

In the majority of cases, the boys drew straight lines in place of the irregular lines and lines of dots, producing drawings which exactly resemble those of the canals of Mars made by telescopic observers. A number of them also had a tendency to draw "canals" connecting two black dots, or one dot and an indentation on the edge of the light region, when no line at all really existed on the drawing.

On the other hand, when the boys had to copy a drawing showing straight "canals," they almost all drew them very much as they existed.

The conclusion to which Messrs. Evans and Maunder have come may be stated as follows:

If we have an irregular or broken line, and look at it from such a distance that we can hardly see it at all, it is much easier to be sure that there is a line there than that the line is crooked or broken. Consequently, a perfectly unprejudiced observer may see and draw such an object as a straight line.

This is just what the schoolboys did, as they were seated at such a distance from their copy that the fainter markings were barely visible. On the other hand, since real straight lines are much easier to see under the same conditions than irregular ones, a figure really consisting of straight lines is likely to be seen and drawn so by all observers.

But this is not the case with the faint markings on Mars. It is therefore probable that they are not really straight lines, but are irregular, consisting of a multitude of fine details much too small to be seen separately, and that they appear straight and continuous only because they are so hard to see at all.

Cambridge Observatory, England.

HIGH-SPEED STEAM RAILWAY SERVICE.

As an indirect consequence of the Marienfelde-Zossen high-speed electrical railway trials, experiments are being made on a number of German railway lines with a view to investigating the working conditions of a steam railway service with increased speeds. On the Cassel-Hanover line, for instance, the trains tested are made up of gigantic high-speed locomotives and solidly connected six-axle cars, warranting a mean speed as high as 130 kilometers (81 miles) per hour. This speed would enable the journey between Berlin and Hamburg to be completed in about two hours, and it is safe to state that one such train in either direction would be quite sufficient for the present traffic. In the case of these experiments giving satisfactory results, it is thought probable that next summer some specially suitable lines will be arranged for a similar increased speed service, the more so as the Berlin-Zossen trials have shown existing permanent ways (provided they be fitted with heavy rails) to be fully suitable for a similar service. Even in the case of the introduction of electric high-speed railways being postponed for economical reasons, a material improvement in the German high-speed railway service may therefore be anticipated, as far as lines with specially dense traffic are concerned.

SCIENCE NOTES.

J. D. Kobus has made some experiments for the purpose of determining whether it is possible to improve sugar-canes by vegetative propagation of selected plants, and whether there is any correlation between the amount of sugar present and the power of resisting the *sereh* disease. The results obtained from experiments extending over a period of several years, and involving very numerous analyses, promise to be very valuable to sugar planters. It is shown that for any given variety of the sugar-cane, when grown under uniform conditions, the heavier the plant the greater is the proportion of sugar formed. Also that by taking cuttings from canes which contain a large amount of sugar, the plants so obtained continue to show this increase. Further, it was found that as the proportion of sugar was increased by selection according to the total weight of the plants, so does the power of resistance to the *sereh* disease also become greater.

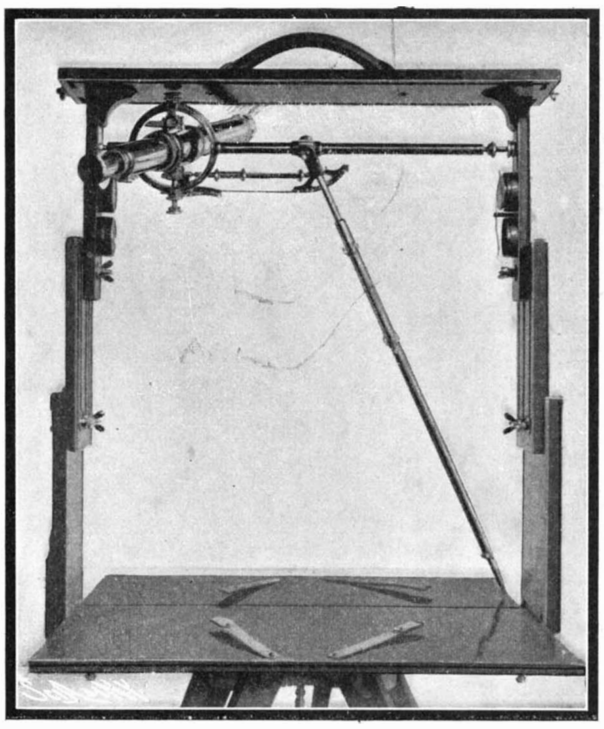
Edouard Meyer finds that the vegetable organism, as well as the animal, gives off N-rays in varying quantities, as may be made evident by the feebly fluorescent screen. The most marked indications are given by the green parts, such as stems and especially leaves, but the emanations are feebly detectable from the flower. Roots, bulbs, and etiolated parts also give off the rays; but the greatest radiant activity appears at the point where the vegetable protoplasm is in its most active state, or is in process of evolution. Thus with two tubes of cress sown on moist wool, one in active germination, the other only recently sown, the evidence of radiant energy was much more marked in the former, and was even obtained from the bottom of the tube, where the radicles had penetrated the wool in the course of their growth. On treating tissues in active growth with the vapor of chloroform so as to slacken their vital functions, the N-ray indications were correspondingly lessened.—Comp. Rend.

Prof. H. du Bois and H. Rubens eleven years ago investigated the polarization of non-diffracted infra-red rays through narrow wire gratings, with a view to obtaining simpler conditions than in the case of visible short-wave rays. In fact, in the infra-red region of the spectrum, there is much less dependency on the molecular own vibrations of the substance, which so influences the behavior of the visible spectrum that a confirmation of the electro-magnetical theory meets with the highest difficulties. Now, in a recent paper read before the German Physical Society, Berlin, the experimenters extend their researches to much higher wave lengths, using the so-called residual rays (Reststrahlen) from fluorspar (mean wave length 25.5 μ) and from rock salt (mean wave length 51.2 μ), the mantle of an Auer burner serving as the illuminant. After being polarized through a reflection on glass or quartz plates under the angle of polarization, the rays were reflected from four fluoride or five rock-salt surfaces, whence a concave mirror concentrated them on a thermic battery. From the results of these experiments, it is inferred that the transmissibility of rays will augment for increasing wave lengths. The increase of the unpolarized rays is particularly remarkable, being fairly well in accord with the theoretical value.

It will be remembered that some little time ago, Messrs. Siedentopf and Zsigmondy showed that by using a very intense source of light it was possible under suitable conditions to recognize in the microscope bodies much below the real limit of visibility. The bodies appear merely as diffraction disks, and it is impossible to examine their actual structure. In a communication to the Société Française de Physique, MM. Cotton and Mouton describe an application of the same principle to the study of liquids. The liquid to be examined rests on a sheet of glass, and is covered by a very thin cover strip of mica. The whole rests on a block of glass, up through which sunlight is directed, the angle of incidence being such that the light undergoes total reflection from the underside of the cover strip. When examined in this way, even the emulsion used by Mr. Lippmann in his system of color photography shows a multitude of shining points. Similarly an emulsion of Chinese ink examined in the same way shows, in addition to the larger particles, a number of similar points, and the same points also appear in colloidal solutions. Further, a culture of the pleuro-pneumonia microbe, which examined in the ordinary way showed only a sort of indistinct granulation, exhibited, when observed as described above, a large number of these shining corpuscles.

THE PERSPECTARTIGRAPH—A NOVEL DRAWING INSTRUMENT.

The instrument illustrated in the accompanying pictures is an exceedingly ingenious one. It was invented with the idea of making it possible to draw in perspective mechanically, with little or no previous instruction. The inventor's idea has been well worked out and brought to a practical conclusion, as experiments with his instrument in the office of the Scientific American have demonstrated. The apparatus is the invention of Mr. Otto Eichenberger, of Geneva, Switzerland, who is at present in this country introducing it. It will be found useful to anyone who wishes to draw accurately in perspective landscapes, buildings, or objects of any sort.

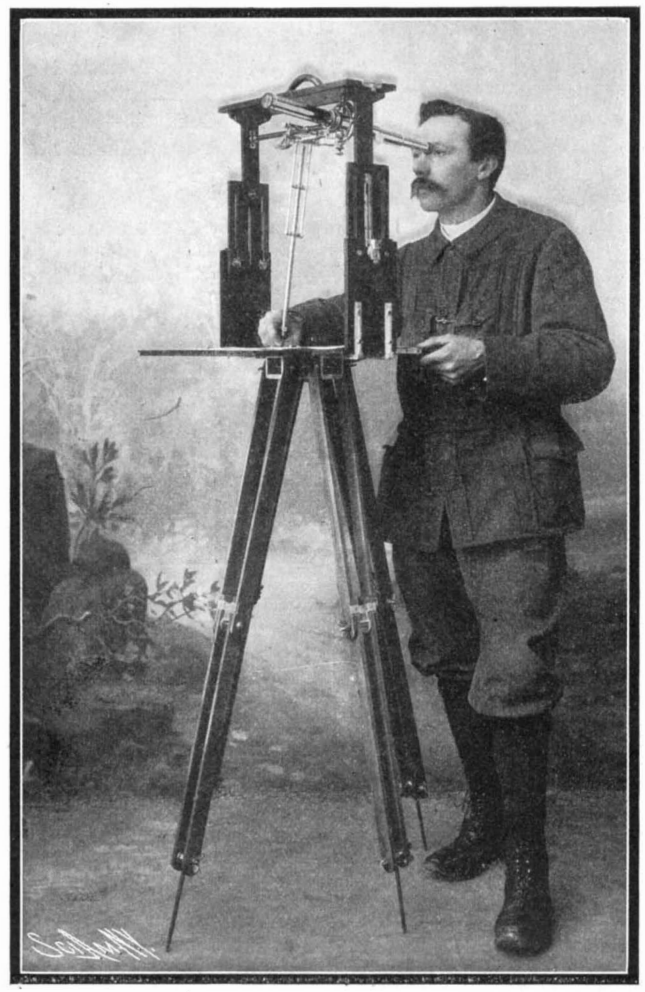


A NEAR VIEW OF THE INSTRUMENT.

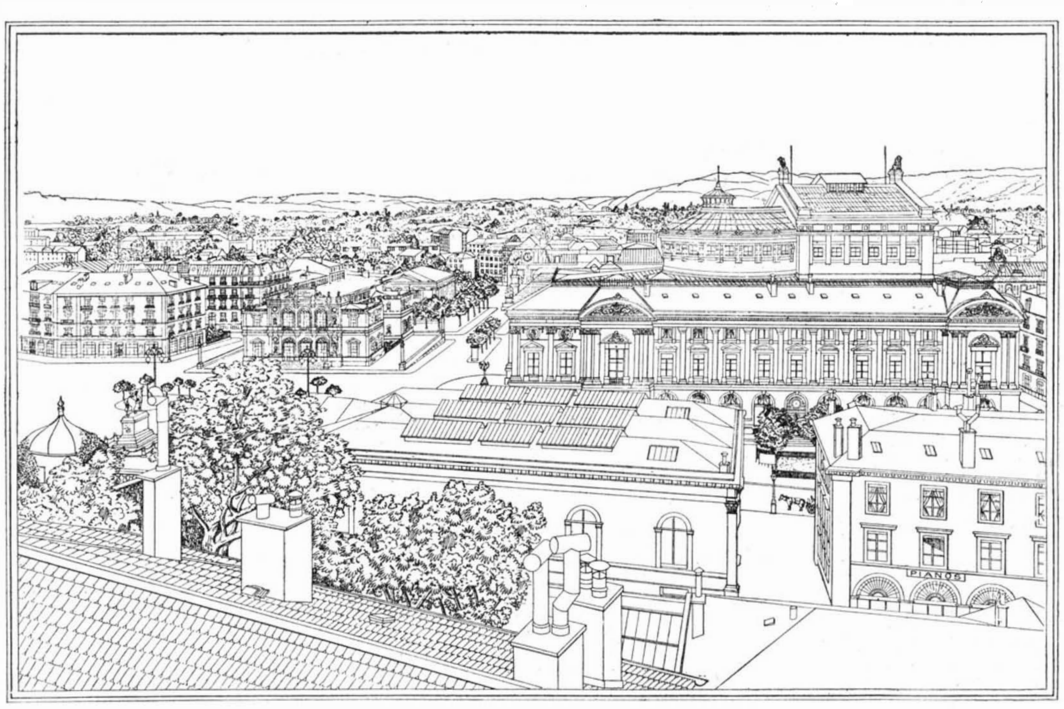
The apparatus consists of a folding box which opens and forms a table for the paper. The two sides of the box are made extensible, and they carry near their upper end a transverse rod mounted so as to turn easily. A telescope provided with an eye-piece at one end and two hairs crossing at right angles at the other, is mounted on two vertical pivots in the center of a ring which forms part of this rod, and is located near one end of it.

The telescope is connected to another frame, which is pivotally suspended from a pin attached to the transverse rod at right angles to the ring that supports the telescope, and this frame carries at its lower end a pencil-holder, the pencil of which is capable of sliding up or down in it, so that the point of the pencil is always in contact with the paper, as the holder assumes different angles while following the movement of the telescope. If the telescope is moved back and forth in a horizontal plane, for example, it will, since it is connected with the pencil-holder through a universally-jointed rod, cause the latter to describe an arc in a vertical plane and its pencil to draw a straight line across the paper below the transverse rod and in the vertical plane with it. A vertical movement of the telescope will cause a line to be drawn at right angles to the one just mentioned. The movement of the telescope in any direction is thus obtained by the combination of its vertical and horizontal movements, and is simultaneously marked on the paper. The line drawn by the pencil is always proportional to the distance moved through by the end of the telescope, as the angle described by the pencil-holder and the telescope is the same. As a result of this, the apparatus makes a true perspective drawing. The telescope is a long-range one, magnifying ten times. It has a short-focus lens and one for long or medium distance work. The size of the drawing depends on the distance of the instrument from the object, as well as on the size of the latter. An object placed 45 centimeters (17.71 inches) away from the axis of suspension of the telescope will be reproduced in its natural size, since this axis is also 45 centimeters above the drawing board. The perspectartigraph instrument illustrated is capable of including within its field an angle of 45 degrees, and of making a drawing 17.71 inches long by 18.89 inches high. A complete circular panorama 141.73 inches long can be made by swinging the instrument on its tripod, and dividing the entire horizon into eight sections.

The operation of the instrument is extremely simple and very readily learned. The draftsman holds the pencil in his hand and moves it over the paper in such a way as to make the intersection of the hair lines in the telescope follow the outline of the object to be copied. With practice, very neat work can be done with the instrument, as the panorama of the Alps and the view of Geneva made with it bear witness. The instrument can be made use of by architects for readily making a perspective view of a house from the plan and elevation drawings of the same; and its inventor believes it will have a wide field of usefulness for teaching children how to draw in perspective, and aiding artists in obtaining true perspective in all their works. He is at present designing a simplified form of his instrument for these purposes.



DRAWING FROM NATURE WITH THE PERSPECTARTIGRAPH.



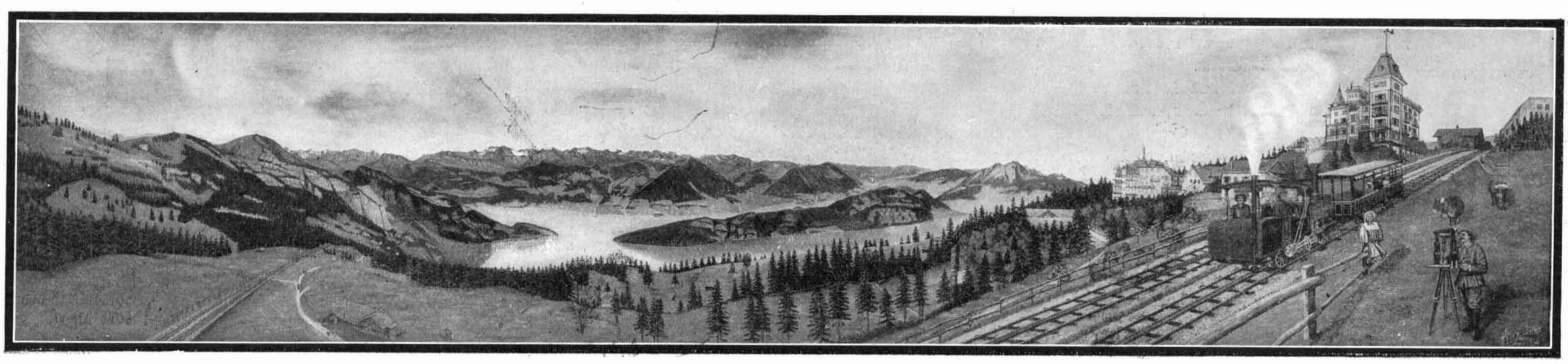
A VIEW OF GENEVA, DRAWN WITH THE PERSPECTARTIGRAPH.

Obtaining Metal Powders by an Electrolytical Method.

Prof. A. Zamboni (Elettricità, No. 4, 1903) has succeeded in obtaining aluminium, sodium, potassium, etc., amalgams, decomposable in water. His method is based on the fact that when electrolyzing a solution of metallic compounds by means of a mercury cathode, the corresponding amalgam is obtained; this process may be applied even to such metals as are commonly regarded as inamalgamable, such as, for instance, platinum and iron. The amalgams thus obtained are spongy substances, filled with mercury particles, and have specific weights between those of mercury and the corresponding metal. If the cathodic vessel has a permeable bottom, the amalgam will rise to the surface, where it may readily be removed; if the bath contains different metals, the density of the current will determine the metal deposited. The amalgam to be obtained by this way may accordingly be electrolytically purified, not only from inamalgamable bodies, but as well from any different metals. By compressing in linen bags the amalgam thus economically obtained, nearly pure mercury will be obtained, the amalgam undergoing a partial decomposition, when a readily pulverized substance will remain, made up of amalgam and metallic powders. If this mass be distilled at a temperature below the melting point of the amalgam, the mercury is found to separate from the metal (especially in the case of iron and related metals), whereas the latter remains in a spongy, friable state, being capable of reduction, when pounded to extremely fine powder. When choosing for this distillation convenient atmospheres, different metallic compounds will be obtained. If, for instance, iron amalgam be distilled in a reducing medium, pyrophoric iron will be obtained, susceptible of being converted into common iron by a convenient treatment. Oxidizing atmospheres will give some so far unknown iron oxides and protoxides.

The above process was found in the course of an investigation of the Edison accumulator; it was originally intended to afford a ready means of preparing ferric oxide.

During the month of February 54,758 packages of exhibits were received at the World's Fair grounds. More than six hundred exhibitors are now on the grounds installing their exhibits.



PANORAMA OF THE ALPS AS SEEN FROM MOUNT RIGHI. DRAWN WITH THE PERSPECTARTIGRAPH LAST SUMMER.

JAPANESE SWORDMAKING.—II.

BY G. H. TILDEN.

In no country of the world, perhaps, has the sword played so great a part in the history of the people or been regarded with such reverence as in Japan. Nowhere also, I venture to say, has the "white arm" reached such a pitch of excellence in quality, shape, and efficiency, as in the Empire of the Sun.

While living in Japan I took lessons in fencing and the study of the Japanese sword was suggested to me by a Japanese friend of mine, Mr. Okakura, director of the school of Fine Arts at Uyeno, Tokyo. I adopted the suggestion, had a forge erected on my place in Tokyo, and engaged the services of Mr. Sakurai Masatsugu, professor of swordmaking at the Fine Art School, as instructor.

The forge was a square, one-roomed edifice about 18 feet on a side. On one side of the room was the bellows, and directly in front of the nozzle of the bellows was scooped a trough in the earth, which served to contain charcoal and constituted the furnace in which the steel was heated. The anvil was a block of iron about 5 x 16 x 20 inches in size let into the earth, and the top of it having been hardened. Upon the wall at this side of the room were hung a kakemono representing Kaneyama-hiko-no-kami, the patron god of swordmakers, and another bearing in Chinese characters the name of Amaterasu-sumara-o-kami, the Goddess of the Sun, the chief goddess of the Shinto cult. Around what corresponded to the cornice in a European room was looped a straw rope from which were suspended at intervals wisps of straw and the zigzag-shaped pieces of white paper peculiar to Shinto and known as *gohei*. These are supposed to act as charms which keep off evil demons and spirits. No woman or female child is ever allowed to set foot within the building constituting the forge, for women are supposed to be attended and followed by troops of demons, whose presence would be detrimental to the quality of the swords manufactured.

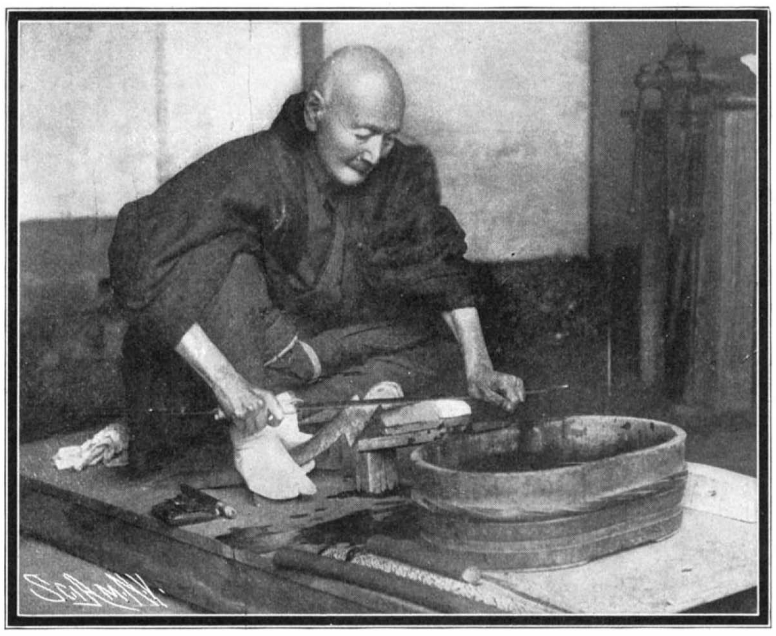
The chief instruments used in making swords are two large sledge hammers weighing 12 pounds each and a smaller one weighing 2 pounds, which is used by the chief swordsmith. Before work at the forge is begun, prayers are offered up to Kaneyama-hiko-no-kami, the patron god of swordsmiths. Prayer finished, the work begins. The metal used in swordmaking is Japanese steel, and I was told that it was made by melting iron ore in a charcoal furnace and dropping it into cold water. The carbon derived from the charcoal causes the formation of steel. It comes in lumps which average about 1½ pounds apiece, and about 15 of them are required to make a sword blade weighing when finished, without sheath or mountings, from 1½ to 2 pounds.

The charcoal used in the furnace of the forge is made of pine wood and is softer than the charcoal used in cooking.

Analysis shows the composition of Japanese steel used for swordmaking to be unusually free from foreign matter, excelling in this respect even the best Swedish steel.

One of the original lumps of steel is heated to a very high degree of temperature and beaten out into a flat slab measuring about 6 x 4 x 1-3 inches. This slab when red-hot is plunged into cold water, which treatment renders it brittle. It is then broken up into twenty or thirty small pieces. Each of these bits of steel is then inspected. If its edge of fracture is dense, granular, and homogeneous in structure and of a dull gray color, the steel is regarded as good. If, on the other hand, the edge of fracture is cracked, glistening and of uneven color, the bit of steel is condemned and rejected. It is this retention of good and elimination of bad steel which is the reason that so much steel is necessary for making a good sword.

After a sufficient number of these small pieces of steel of good quality have been accumulated, another of the original lumps of steel is heated and beaten out into a flat slab. This slab, while red-hot, is creased in two parallel straight lines by pounding the edge of a hatchet into the flat surface of the slab with a hammer. The slab of steel is then rendered brittle and broken along these creases, forming a rectangular slab of steel some 2½ or 3 inches wide. This piece is then taken and upon it are piled up as closely together as possible a number of the small fractured bits of steel. When enough of these have been piled up to make a heap about 2 or 3 inches high, the whole is sprinkled first with straw ashes and then a mixture of earth and water is poured over it. This serves to cake the small bits of steel together and keeps them in position.



Putting an Edge on the Sword.

This is seized with the tongs, heated up to a very high degree of temperature, removed from the furnace, sprinkled with straw ashes and beaten with sledge hammers, until the small bits of steel are united with each other and with the slab upon which they rest, into one mass. The reason for putting on the straw ashes is to prevent the sparks and incandescent particles of steel from flying about too freely while the steel is pounded. The ultimate result of all this pounding is an ingot of steel from four to six inches in length by about one and a half in width and three-fourths of an inch thick.

This is then, while red hot, creased with a hatchet in the middle, at right angles to its long axis, bent over and the two halves then beaten together until they unite and form one solid mass, borax being used as a flux, if necessary. This cutting, doubling over, and pounding is repeated many times, from twenty to thirty perhaps.

Three such ingots are taken and welded together and to a bar of old iron, which serves as a handle. This is then taken in hand by the chief swordsmith, who with his small hammer, and aided by his assistants, gradually beats this mass of steel into the shape of a sword blade. This is a process requiring great manual dexterity acquired only by long practice, and the result is wonderfully accurate, when one considers that nothing is used but hammer and anvil. When the finishing touches are being put upon the blade the work is done entirely by the chief swordsmith, who employs nothing but the small hammer. This hammer is repeatedly dipped into cold water while the fashioning of the sword is going on. The use of water serves to cleanse the surface of the steel of dirt and also causes a thin layer of oxidized or burned steel to scale off, thus insuring a thoroughly clean surface to the sword when beaten into shape.

Offering Prayer to the Sword God Before Beginning to Forge the Sword.

The sword is then completely fashioned by the use of files and an instrument resembling a carpenter's drawing knife. The next process, that of hardening, is peculiar to the Japanese sword and is looked upon as the most important part of its manufacture, while the person who does the hardening is regarded as the maker of the sword, it being his name which is inscribed upon the hilt. His spirit, his character, his individuality, are supposed to enter into the blade which he hardens and the blade is good or bad accordingly.

The blade is covered all over, with the exception of the hilt, to the thickness of about ⅛ inch, with a rather thick paste, made by mixing with water a certain kind of fireclay.

The edge and point of the sword are then scraped clean and recovered with a much thinner layer of clay containing proportionally more water than the clay which has been already put on. All openings into the forge are closed so as to exclude the light, for darkness is necessary in order to determine the proper temperature of the blade to be hardened. Two extra nozzles are fitted on to the bellows in order to insure a wider and more equable distribution of the outcoming blast of air. Prayer having been offered up, the chief smith takes the clay-covered blade, pushes it gently into the furnace and moves it slowly to and fro in the blazing charcoal until the whole blade is uniformly heated from end to end, no one part being hotter than another. The test which determines the proper degree of temperature is when the whole blade attains that degree of redness which is seen when one looks at the bright unclouded sky (not the sun) with the eyelids closed. With a shout of exultation, the red blade is then quickly plunged into the water, of a temperature of 100 deg., and is kept moving to and fro therein, in the direction of its long axis, until all sizzling ceases. The sword now goes into the hands

Forging One of the Ingots From Which the Sword is Made.

JAPANESE SWORDMAKING.

of the professional polisher and sharpener of swords, which is a separate branch of work.

The blade leaves his hands a resplendent, beautiful, and deadly weapon, with an edge of incomparable hardness and keenness and a strength of structure unequaled in other swords. The Japanese sword is not flexible or elastic. The extent to which it may be bent and afterward spring back into its original position is very slight, and if bent beyond this point it stays bent.

I had a Japanese blade about seventy years old, and of not particularly good quality, broken up and analyzed as to its chemical composition and anatomical structure, together with a lump of Japanese steel. The following is the result of the examination:

	Original Lump of Steel.	Hardened Edge of Sword.	Inside of Sword.
Combined carbon (by color)	1.20 p. c.	0.60 p. c.	0.60 p. c.
Manganese	none	none	none
Phosphorus	0.017 p. c.	0.007 p. c.	0.011 p. c.
Sulphur	0.009 "	0.003 "	0.003 "
Silicon	0.03 "	0.12 "	0.12 "

The above results point to a metal of great purity in its unusual freedom from sulphur and phosphorus. Such metal would be neither "red short" nor "cold short" and must of necessity be very tough. "Red shortness" is a tendency to crack or crumble while being forged or rolled while heated to redness. "Cold shortness," on the other hand, is the property of being brittle when cold.

When the sword is finished, the kakemono representing the god chosen is suspended upon the wall and in front of this is placed the sword to be consecrated, together with offerings of *sake*, rice, and sweetmeats. Prayers are offered up to the god and then the neighborhood is invited to the festival. Everyone has a good time and the sword must be left in the presence of the god all night and not removed until the next morning, in order that his influence may enter into the blade and sanctify it.

THE BATTLESHIP "MIKASA" IN ACTION.

We have so recently described the military features (guns, armor, speed, etc.) of the "Mikasa," the largest and most effective battleship in the Japanese navy, that it will be sufficient here merely to reiterate briefly the principal characteristics of the ship, and then pass on to give some idea of what takes place when she is leading the battleship line in a hot fleet engagement.

There are no fanciful ideas or untried novelties about Japan's greatest warship. She is simply an embodiment of the very latest improvements in guns, armor, and ship construction. Her one unique distinction is that she is, just now, the largest battleship in commission in the world. Her leading particulars are: Length over all, 436 feet; beam, 76 feet; draft, 27¼ feet; and displacement on this draft, 15,200 tons. Her battery of twenty-five Belleville water-tube boilers and two sets of triple-expansion engines have driven her for six hours, with an average indicated horse-power of 12,236, at a speed of 17.3 knots, the coal consumption of this speed being only 1.53 pounds of coal per horse-power per hour—an economy which has only been exceeded by a warship in one single instance. When using forced draft she indicated 16,400 horse-power, and maintained a mean speed of 18.6 knots per hour. At the water-line she is protected by a belt of Krupp steel varying from 9 inches amidships to 4 inches in thickness at the ends. Above the main belt amidships a side wall of armor 6 inches in thickness is carried up through the height of two decks to the main deck. Behind this protection are mounted, on the gun deck, ten 6-inch, 40-caliber guns, five on each broadside; on the main deck above, two forward and two aft, are four 6-inch guns in 6-inch armored casemates. Forward and aft are a pair of 12-inch, 40-caliber guns protected by 10-inch hoods or shields and by 14-inch barbettes. There is also a battery of twenty 3-inch guns, six 3-pounders, and six 2½-pounders. Below the water, two near the bow and two toward the stern, in the wake of the 12-inch gun barbettes, are four submerged torpedo tubes. Altogether, the weight of armor worked into this great ship is 4,600 tons. The machinery weighs 1,335 tons; she carries a maximum coal supply of 1,500 tons, and is manned by a complement of 730 officers and men.

The very spirited picture shown on our front page represents the "Mikasa" leading the Japanese fleet of battleships and armored cruisers in column into battle. She has started the forced draft, and is forging ahead at a speed, say, of 17½ knots an hour, in order to secure some advantageous position for herself and her consorts, where the fleet may bring its guns to bear with the best effect upon the enemy. The Russian fleet may be formed also in column, and possibly the same tactics are being pursued by each side, namely, that of concentrating the fire of the fleet as far as possible upon the leading ship of the enemy, with the idea of disabling his ships one by one. Hence the "Mikasa" is the target for a perfect hail of projectiles, great and small.

Now, when stripped for a fight, the modern battleship will present a different appearance from that to which civilians are accustomed in time of peace. Everything that can be removed will be taken down and stowed as far as possible below decks. The hand railings, stanchions, etc., will either be sent ashore, or laid down flush with the deck, leaving the latter to form a glacis over which the great 12-inch guns may sweep and deliver their fire without obstruction. The boats, which would simply afford food for fire, or splinters for the wounding of the crew, will, at the approach of a battle, be lowered, tied together, and temporarily set adrift to be picked up after the fight is over—if possible. "Seamen's dunnage," that is, chests, lockers, and what-not, are cleared away; either stowed below decks or pitched overboard. The furniture of the officers' cabins, which might provide food for a conflagration, is similarly dealt with; and as a gladiator is stripped to the skin, so the ship is stripped, as far as possi'le, to the naked steel. This, by the way, is not so big a task as once it was, for naval constructors have learned to cut out every bit of wood or inflammable material that can possibly be dispensed with, and steel decks, or fireproofed wood, are the order of the day.

At the moment depicted in our drawing Admiral Togo will be standing out in the open on the after bridge, where he can obtain an unobstructed view of the whole field of battle, and with him will be the flag lieutenant, who will transmit by means of signals the instructions of the Admiral to the various vessels. Upon the fore bridge will be the captain of the ship (unless, indeed, he prefers the shelter of the conning tower), who is responsible for the fighting of the "Mikasa," just as the admiral is responsible for the whole fleet. With him are the navigating officer and at times the executive officer. The captain, by means of various telephones, speaking tubes, etc., gives instruction to the officers and chiefs from one end to the other of the great floating war machine. Within the conning tower, or in the pilot house, with his hands on a small, steam steering wheel, is the quarter-master, who keeps the vessel on its course.

A most difficult and complicated task is the control of a battleship in the climax of a great sea fight. To the engine room by means of the telegraph or telephone must be sent the instructions "stand by," "go ahead," "half speed," "reverse," etc., while to every gun station must be sent the correct instructions as to the particular ship which is to be attacked, and as to what part of the enemy's ship, if the range is short, each gunner is to aim at.

They must also be told from time to time what kind of ammunition to use, whether armor-piercing or common shell, etc. Hence it can be understood that at close range, when the storm of projectiles renders the bridge untenable, and the ship must be fought from behind armor protection, there is no more serious blow that can be delivered at a ship than a well-aimed heavy projectile, striking and wrecking the conning tower. It requires a cool head, steady nerves, and some quick thinking to handle a great modern fighting machine like the "Mikasa," especially if the enemy has got her range, and is raining a stream of lighter projectiles and an occasional 12-inch shell upon the ship. Not only is there the incessant din of the discharge of the ship's own guns, but what is infinitely more distracting, there is the clash and jar of the impact of striking projectiles of the enemy, to say nothing of the poisonous fumes from the high-explosive shells. It is this hammering, indeed, that forms the most distracting din in battle, for it is second only in its bewildering and stunning effect, to the death-dealing burst of a shell that has gone through a ship's plating or thick armor.

Far different from the pandemonium going on above decks is the comparative quiet and steady routine of work below the water-line. Thus, in the case of the great 12-inch guns which are shown so conspicuously in our drawing, the men whose duty it is to keep these guns supplied with ammunition do their work from thirty to forty feet below the gun and several feet below the water-line. Immediately under the protective deck, and vertically beneath the center of the turret, is a square chamber known as the handling room, into which open by doorways various compartments, in which are stored separately in racks ranged against the walls of the room bags of powder and the massive projectiles. Suspended overhead are steel tracks with little traveling trolleys and sling chains, by which the powder and shell is picked up from the racks, wheeled out into the center of the handling room, and placed in ammunition cages, that are attached to elevators, by which the ammunition is hoisted to the breech of the big guns. By the time it reaches the guns, the breech plug has been swung open, and a powerful rammer thrusts first the shell and then the powder charge, which is done up in several bags, into the powder chamber. The breech is then swung to and closed; the gun meanwhile is ranged and sighted on the enemy, and instantaneously with the command to fire, an 850-pound shell is hurled at a speed of half a mile a second against the enemy. In the meantime the ammunition cages descend to the handling room, where they are immediately loaded for another journey to the turret. Similarly from other decks lower down in the magazine compartment of the ship, the 6-inch and 3-inch and small rapid-fire gun ammunition is sent up the various ammunition hoists to be distributed to the different gun stations.

Down on the platform of the vessel, 25 feet below the water-line, the stokers feed coal to the furnaces, and go about their routine duties exactly as though the vessel were on her ordinary cruising duties in time of peace, the signs of battle that reach them being the muffled booming of their own guns, or the sharper rattle and crash of the enemy's shell as they pierce and burst from 25 to 60 or 70 feet above; unless, indeed, the rapid-fire guns are playing havoc with the smokestacks, tearing great rents in them, or even blowing parts of them bodily overboard, in which case steam pressures will begin to fall, and the anxieties of the engineer-in-chief will begin to multiply. In the engine room there will be noticed the same steady following out of routine, except that there will be that extra alertness that is visible in any engine room, say, for instance, when the ship is laboring in heavy weather, and special watch is being kept upon the throttle valves and governors. In one particular, however, the engineer will be especially watchful; that is in seeing that his bilge pumps are in perfect order, ready for the call which may come at any moment for driving them to their full capacity, in case the ship is hulled at the water-line, or torpedoed. Men will be found stationed at water-tight doors, or rather such of them as are not already closed, and must, perhaps, be kept open until the last emergency demands that they be shut.

It is popularly supposed that the men below decks run the more serious risk, because of their liability to be engulfed and carried down with the ship in some sudden catastrophe. Such, however, in a vessel of the size of the "Mikasa" is not the case. Even if she were struck by a torpedo, which is the most mortal blow that a warship can suffer, the chances are that not more than one compartment would be flooded. The men who happen to be in this compartment would, of course, be caught in the sudden inrush of water, a liability that is increased by the danger of their being knocked into insensibility, or bewildered by the terrific shock accompanying the blowing in of the side of the ship when the torpedo strikes her. Outside of this, so large is the "Mikasa," that it is questionable whether a single torpedo would suffice to sink her. The great reserve of buoyancy in a 15,000-ton ship, coupled with the large capacity of her pumps, would give her, unless, indeed, one of the bulkheads was involved in the explosion, a good fighting chance to limp home to the nearest port in Japan for drydocking.

It is a curious fact that in spite of the great activity of the Japanese fleet, it being continually under fire, there has been received no authentic account of injuries to the Mikado's ships. This, we take it, is a tribute to the efficiency of Japanese censorship, more than any evidence that her vessels have not received, as well as given, many hard blows; but for such information we shall probably have to await the termination of the war, when there will be a vast amount of valuable technical data to be distributed by the various naval *attachés* and qualified war correspondents.

New Railway up Vesuvius.

Messrs. Thomas Cook & Son have just constructed a new electric railway up Vesuvius from Pugliano, the northern quarter of Resina, to the terminus of the old funicular railway, which was made up the cone to the crater twenty-three years ago. This new line is nearly four and three-quarter miles long. Except for a section in the middle, it is laid with a ruling gradient of one in 12½, and the cars run by adhesion. In the middle portion the gradient rises to one in four, an incline as great as that of the Righi line, and in consequence it has been necessary to use a rack-rail, the Strub system having been selected, as on the Jungfrau railway. On this rack-rail section the cars are pushed up by a four-wheel locomotive provided with two 80-horse-power motors, and fitted with an elaborate system of ordinary and emergency brakes. On the other sections the cars, which seat 24 passengers and can accommodate six more on the platforms, are propelled by their own motors, the current being supplied through overhead trolleys, as is also the case for the rack-line locomotives. The generating station stands at the foot of Monte Cateroni, close to the point where the rack-rail section begins. Pugliano is already connected with Naples by electric tramway, with the exception of a short length which has still to be finished, and the old funicular line up the cone has been reconstructed and equipped for electrical working; hence it will soon be possible to travel by electricity all the way from Naples to within 250 yards of the crater, a good deal more quickly and comfortably than is permitted by the present means of transport.

Correspondence.

The Double-Deck Car.

To the Editor of the Scientific American:

In your issue of this date, in an article on "A Double-Deck Car for Rapid Transit," page 228, you say that such a car "is practically unknown in this country." Double-deck cars have been in use on the electric roads of San Diego, Cal., for a number of years past. I saw them in use there in December, 1902, and am informed by friends that they were in use there some time before that date. They were different from the car described in your article, the upper deck being inclosed only with curtains, the seats running crosswise and being reached by outside stairways.

C. P. Carpenter.

Northfield, Minn., March 19, 1904.

Javanese Casting.

To the Editor of the Scientific American:

In the Scientific American of December 19, 1903, under the title "An Odd Casting," I read the sentence: "No molder who has examined it has been able to solve the riddle of Mr. Galvin's discovery in the line of castings."

Probably you never heard of the methods employed by the Javanese in casting. They make their model of wax, place it in a box, and then fill the box with molding sand. After drying, holes are made in the sand clump, which is then placed on a fire. The wax melts and flows through the holes, leaving a correct copy of the model in the sand. After this explanation, I think, the casting of Mr. Galvin can no longer be considered an unsolved riddle. B. F. Loust.

Souerabaja, Java, February 9, 1904.

Warships Compared.

To the Editor of the Scientific American:

In one of your late editions of the Scientific American I noted with interest your comparison of the British cruiser "Drake," battleship "King Edward VII.," and the American cruiser "Tennessee" and battleship "Connecticut." The fact that you take our very latest designed ships and compare them with ships that the English have greatly improved on, is not doing justice to the British. For instance, the "Drake" (and her sister ships) has been completed a great many months now, and the new armored cruisers of the "Duke of Edinburgh" class are smaller but much more powerful than the "Drake" class. Furthermore, the "Duke of Edinburgh" class will be finished long before our "California" class are ready, to say nothing of the "Tennessee" and "Washington."

The *improved* "King Edward VII." class of British battleships, with their four 12-inch, eight 9.2-inch, and six 6-inch guns, would have been the proper ships to compare with our "Connecticut." They too will be finished long before our ships. English ships are noted for carrying light armaments; but suppose you compare the "Duke of Edinburgh" and "California," the "Connecticut" with the improved "King Edward VII." class, which, by the way, will have been finished a long time when the "Connecticut" is put in commission. I understand that the "Drake" and her sisters have made 24 knots speed, which looks to me as if their 6,000 to 8,000 extra horse-power engines did them some good. F. Saunders.

Treat Avenue, San Francisco, Cal.

The Boll Weevil.

To the Editor of the Scientific American:

Owing to the fact that the boll weevil is becoming a menace to the cotton raisers of the South, it behooves those interested to take active measures to eradicate this pest which bids fair to devastate the cotton fields of the South. Now I have been informed by competent authorities who have used the remedy that the boll weevil, the pest of the cotton plantation, can be positively eradicated by planting cow-peas broadcast over the lands where they existed last year.

It is stated that they cannot live where the peas are grown, and if such is the case, and as the remedy is so cheap, every cotton planter should provide himself at once, because it is worth trying, and in addition there is no better fertilizer in the world than cow-peas. I suggest you publish this in the interest of the cotton planters, as I believe you will be doing them a great service. E. D. Foster.

[Mr. L. O. Howard, Chief of the Division of Entomology of the United States Department of Agriculture, to whom the above letter was referred, writes the Editor that it is true that the cotton-boll weevil will not breed in cow-peas. Therefore, in land planted one year in cotton and the next year in cow-peas, if examined the second year, the boll weevil will not be found. If cotton is grown in an adjoining field, the weevil will be found in its usual numbers. The cow-peas exert no deterrent effect against the cotton. They are probably not as valuable for rotation purposes as other crops.—Ed.]

Electrical Notes.

The London Electrical Engineer says that the system of wireless telegraphy which is the joint invention of Sir Oliver Lodge and Dr. Alexander Muirhead, has been the subject of some exhaustive experiments by the War Office during the past six months. The results obtained are said to have fully satisfied the government experts, who have declared the system to be a reliable method of signaling without lines. The Indian government, who have made independent tests of the system, have, we understand, decided on an installation being made for establishing communication between Port Blair, in Andaman Islands, and the Diamond Island, at the mouth of the Irawaddy, a distance of 300 miles, the apparatus for which will shortly be sent out.

Mr. Hospitalier has published in a recent issue of L'Industrie Electrique an account of a series of tests which he has made with the Edison nickel-iron storage battery, and which were carried out in conjunction with other tests made by the Central Laboratory of Electricity in Paris. In his experiments Mr. Hospitalier made a series of twenty-one charges and discharges partly under so severe conditions that a lead cell would have been put out of service, while the Edison cell was not hurt. From his tests and those of others the author concludes that the Edison battery can be used with charge and discharge rates which would be excessive for the lead cell, while the Edison battery is not hurt, nor does it lose any considerable amount of capacity. From curves, given by the author, it appears that the ampere-hour capacity was about 175, 162, 160, 155 for discharges at 30, 60, 90, 120 amperes respectively. The difference between the mean voltage at the terminals for discharges at 30 and 120 amperes was less than 0.2 volt. The durability of a storage battery is indicated by the total energy given by the battery during its life per kilogramme of its weight. The best lead cell—i.e., the Fulmen cell—tested in the accumulator tests of the French Automobile Club in 1899 gave 1.5 kilowatt-hours per kilogramme. The tests of the Edison battery have shown that it has a capacity at least twice as great. The disadvantages of the Edison cell are its higher price and the fact that its useful voltage is about 1.1, against 1.9 for the lead cell. This means more cells, more connections, etc. The efficiency of the lead cells in the Automobile Club tests, for the low charge and discharge rates used, was between 70 and 75 per cent. The efficiency of the Edison battery, when charged at 60 amperes and discharged at varying rates, was 50 per cent. The author states, however, that this superiority of the lead cell is only apparent, since a fair comparison would require equal rates of charge and discharge. The volume of the Edison cell per normal watt is smaller than that of the lead cell; the volume per watt-hour, however, is greater. The author concludes that the Edison accumulator represents an important and incontestable advance for electric automobile purposes.

There have been introduced within the last year or so two or three systems of single-phase railway working, which have attained a measure of success in the experimental field sufficient to give strong ground for belief that the single-phase method will mark a new era in electric railway operations before very long. Those we call to mind at the moment are known as the Finzi and the Arnold systems respectively, and the latter, we believe, is being installed as an experiment on an extensive scale on one of the American roads. As to its performance under practical operations it is as yet too early to speak, but many eulogistic accounts of the Arnold system have appeared in the pages of the American technical press. Yet another single-phase system, about which excellent reports are at hand, is the invention of Messrs. Winter and Eichberg. This system has been taken up by the Union Electricitäts-Gesellschaft, and has been operated experimentally on the Continent. The principal trials have been made on the line between Johannesthal and Spindlersfeld. It is a part of the Prussian State Railways, 2½ miles long, and a car equipped on the Winter-Eichberg principle has been in regular operation on it since August last. Of the total weight of this car of 52 tons, the electrical equipment accounts for six tons. There are two motors mounted on the same truck, each of 120 horse-power, and the car can be controlled from either end. A small transformer on the car supplies current for driving the braking air-pump, for the controllers, and for lighting. The voltage on the line is 6,000 volts, with a frequency of 25 cycles. The Winter-Eichberg motor, in common with all recent variable-speed alternating-current motors, is of the commutator type. It possesses two windings, the primary and the secondary, the latter being joined to a commutator, and supplied with current at low E.M.F. by means of brushes connected to the low-potential side of a variable-ratio transformer. In practical operation the line voltage of suitable value for transformation is impressed directly upon the primary windings, while a low E.M.F., suitable for commutator operation, is derived by transformation for the secondary circuit. Messrs. Winter and Eichberg have recently taken out a patent for various improvements in details of construction, and we hope that some reliable information will be forthcoming before very long with regard to the practical operation of the system.

Engineering Notes.

To the Pittsburg Steel Company, of Pittsburg, with rod and wire mills at Monessen, Pa., belongs the distinction of having made a record for rolling rods that will probably stand for some time to come. On the day turn on January 14 this plant turned out 716,500 pounds of No. 3 rods, and the night turn following turned out 613,000 pounds, or a total of 1,329,000 pounds for both turns. The best previous record for rod rolling was made at the Rankin Works of the American Steel and Wire Company, and amounted to 605,440 pounds on one turn. When it is known that the rod mill of the Pittsburg Steel Company has been in operation only a little more than a year, having rolled the first rods on December 3, 1902, the above record is all the more remarkable. We may state that the output of rods made on the first day this plant was started was a record breaker, and the mill has been making splendid records right along.

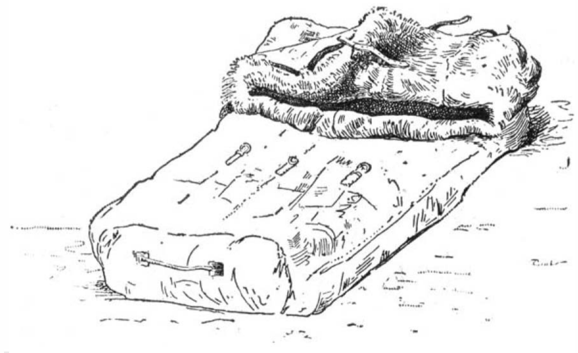
The cost of water power development in France, according to Prof. Janet, varies from $21.40 per horse-power to $150 per horse-power, depending on the head to be dealt with, the lowest expenditure being upon a fall of 140 meters in Haute-Savoie, the horse-power being calculated at the turbine shaft. At Geneva, for the first group of turbines erected, of 840 horse-power, and for the river works then completed, the capital cost amounted to $300 per effective horse-power. The groups of turbines subsequently erected cost but $95 per horse-power, and the completed works would cost but $135 per horse-power. At the chlorate works at Valorbe, the capital expenditure upon the development of 3,000 horse-power amounted to only $19.45 per horse-power. At Niagara, the rates charged to ordinary consumers by the Cataract Power and Conduit Company varied from 2 cents per unit for 1,000 units per month or less to 0.64 cent per unit for 80,000 to 200,000 units per month. The cost of energy for power purposes from water power stations in France and Switzerland varied from 2.1 cents per unit for small powers to 1.24 cents per unit for large powers.

A new process of manufacturing petroleum briquettes has been invented by M. Maestracchi, so Mr. Oliver J. D. Hughes, the United States consul-general at Coburg, reports. The process is a simple one, consisting of mixing petroleum with three other chemicals in the following proportions: Petroleum, 1 liter; soft soap, 150 grains; resin, 150 grains; caustic soda lye wash, 300 grains. This mixture is then heated and well shaken, after which it is allowed to solidify. This operation occupies about 40 minutes. Care has to be observed to prevent the liquid running over, and this is achieved by pouring a small quantity of soda into the vessel and shaking it well until solidification is completed. The mixture is then run into briquette molds of the requisite size, and these are then submitted to heat in a stove for ten or fifteen minutes. The briquettes are then set aside to cool, which occupies an hour or two, and then they are ready for use. If it is desired to make the briquettes more solid, this can be accomplished by the addition of sawdust or sand to the mixture. Experiments have demonstrated that these briquettes yield three times as much heat as ordinary coal; they are lighter in bulk and easier to carry; and what is more important, after consumption, there is no ash or other residue.

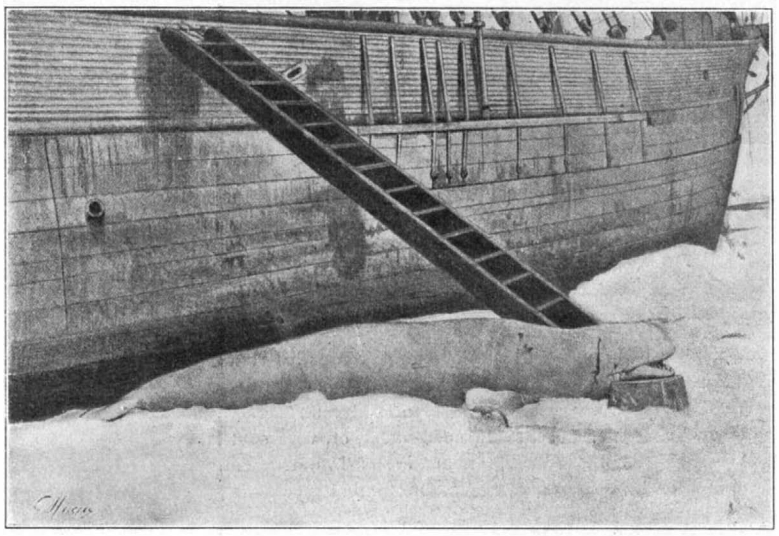
The new turbine-propelled torpedo-boat destroyer "Eden," built for the British navy, recently completed her official trials. The "Eden" is one of the latest 25½-knot type of torpedo-boat destroyers, and is fitted with Parsons turbines instead of reciprocating engines. Her dimensions are: Length, 220 feet; breadth, 22 feet 6 inches; depth, 13 feet 9 inches. On the official four hours' full-speed trial with over 125 tons load on board, the vessel easily attained the speed of 26.099 knots for the first hour and 26.229 for the last three hours, the guaranteed speed being 25½ knots. The result of a previous four hours' full-speed coal-consumption trial was within the amount stipulated in the contract. The main propelling machinery consists of three turbines, one high-pressure and two low-pressure, each driving separate shafts, with two propellers on each shaft. Inside the exhaust casing of each of the low-pressure turbines, a reversing turbine is fitted. In view of the great variation in the horse-power required in modern war vessels, two additional cruising turbines are permanently coupled to the shafts of the main low-pressure turbines. When working at reduced power, the steam from the boilers passes through the cruising turbines in series, and thence to the main turbines. By this means a high ratio of expansion of the steam at all power speeds is obtained, and the loss by throttling of the steam is overcome.

THE ABRUZZI POLAR EXPEDITION.—II.*

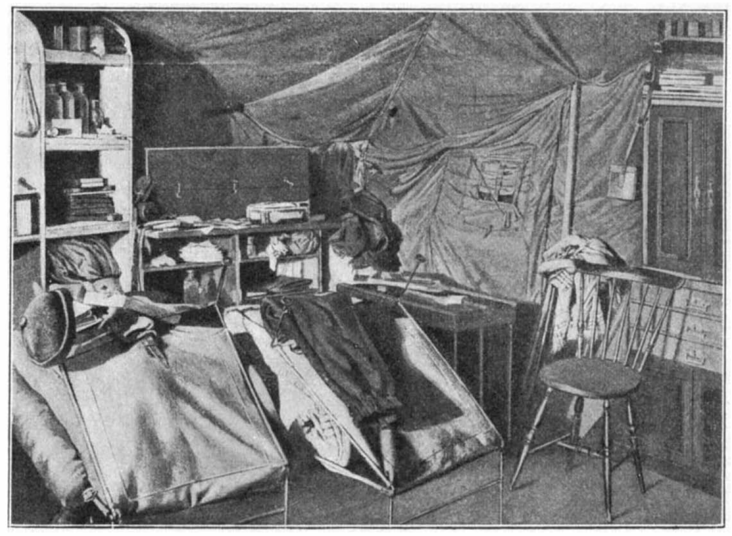
As the "Polar Star," which had been abandoned after it had been seized by the ice, was the only means by which the expedition could return home the following year, every effort was made to save her. Water had first to be pumped out of the ship to enable the leak to be found, and this had to be mended, as well as a leak on the other side. Then it was necessary to keep the ship dry and protect her engines, so that they might remain under water during the winter without being injured. The pump which had been brought to serve in the production of hydrogen gas was put into action. The work of salvage was carried on with great difficulty, and was finally successfully accomplished. When the ship was again floated, she never regained her original shape. In being docked on her return, it was found that the shaft of the propeller had been bent one inch.



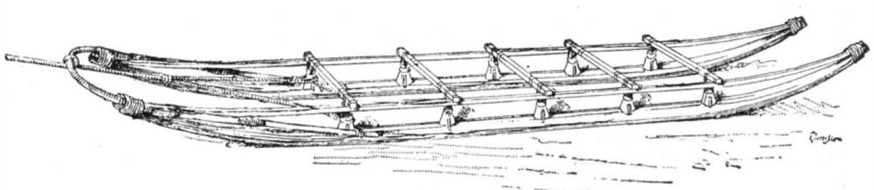
Sleeping Bag Accommodating Three or Four Persons.



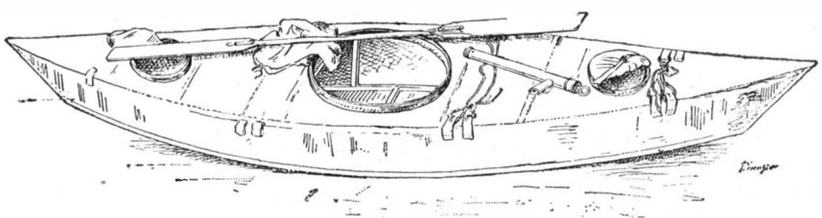
A White Dolphin.



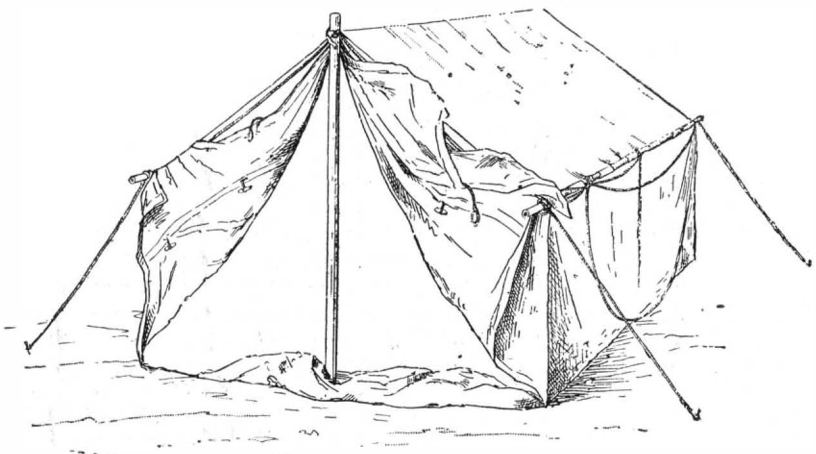
Interior of the Tent.



A Sledge 11 Feet Long.



A "Kayak" 11 Feet 7 Inches Long.



The Silk Tent with Canvas Bottom.

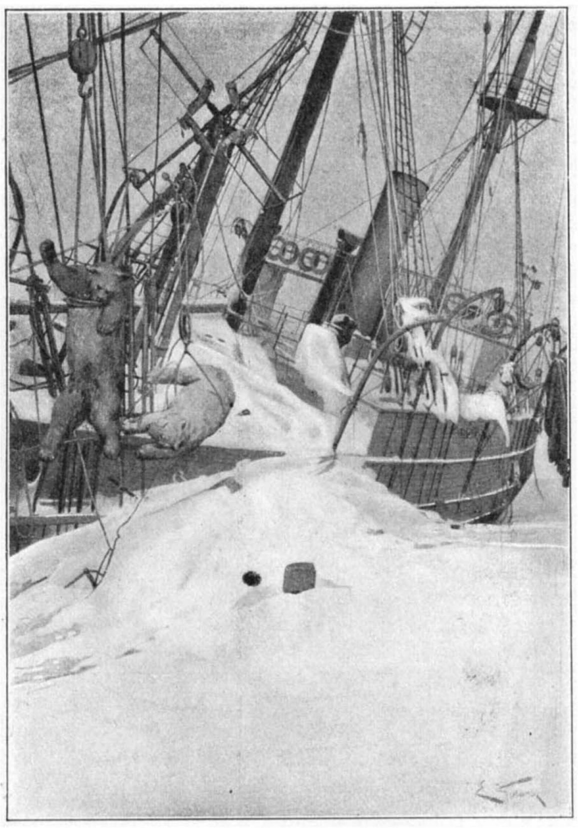
While under canvas the members of the expedition followed the same order of the day as when on shipboard, and life was most monotonous. The tents were subjected to fierce winds. The snow never fell in large flakes, but was granulated by the wind as soon as it fell, so that walking over it left no trace. It was carried by the wind like the desert sand. The chapters of the book devoted to the polar night and the feasts of Christmas and New Year are most interesting reading, as is also that devoted to the preparation for the departure of the expedition toward the pole. Elaborate details are given of the rations, the kayaks, sledges, tents, stoves, etc. As the Duke became an invalid, the expedition was turned over to Capt. Cagni.

The departure toward the pole occurred on the morning of February 21. The first three days which were passed on the ice packs showed certain defects in the preparation, and the expedition returned, to be resumed on the morning of March 10. Then followed a long, dreary wait for those who remained by the ship, and after being separated for 104 days Capt. Cagni returned, having broken the polar record. Excellent advice is given in the book as to the proper equipment of polar expeditions.

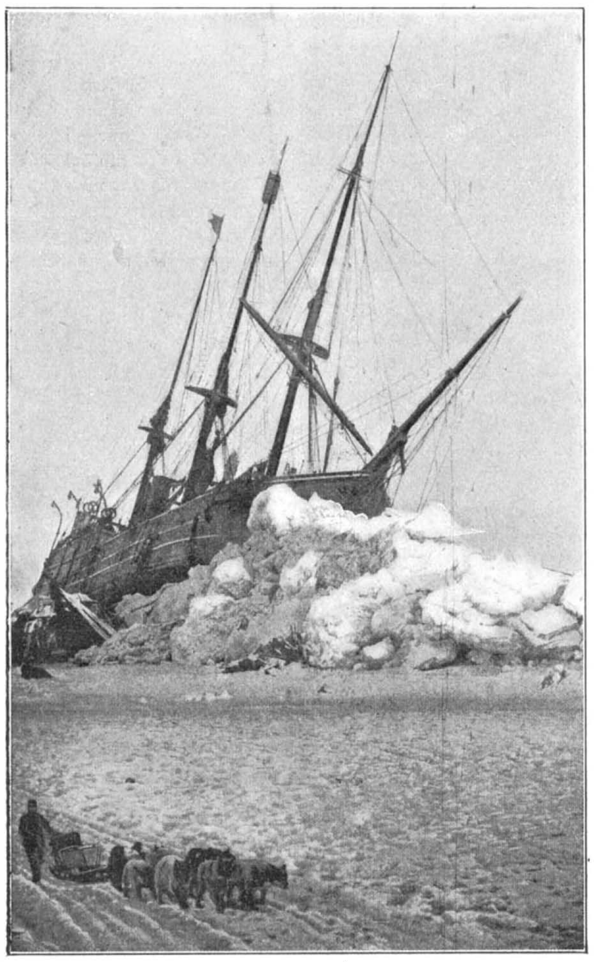
The ship was finally freed with the aid of gun-cotton and gun-powder mines, and on August 16 the "Polar Star" steamed away to Cape Flora, and reached Trömso September 5, and telegrams were sent to His Majesty King of Sweden and Norway and His Majesty King Victor Emmanuel III., announcing that 80 deg. 34 min. North latitude had been reached. So ends one of the most interesting polar expeditions on record.

*A review of "On the 'Polar Star' in the Arctic Sea," by his Royal Highness Luigi Amedeo of Savoy, Duke of the Abruzzi. New York: Dodd, Mead & Co. 1903. Two volumes.

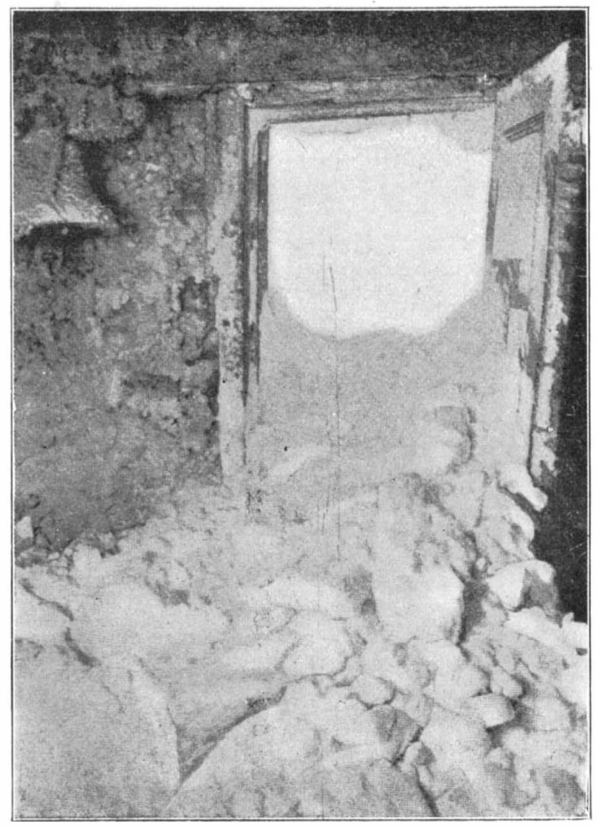
The death was announced in the middle of January of Ferdinand Ritter von Mannlicher, the inventor of the rifle which bears his name. He was fifty-six years of age. His rifle was adopted by the Austrian government in 1886, and subsequently by Holland and Roumania. The weapon is superior for long-distance marksmanship.



The Ship After the Storm.



The "Polar Star" After the Ice Pressure.



The Door of the Tent After a Storm.

THE ABRUZZI POLAR EXPEDITION.—II.

EXCAVATIONS IN THE ROMAN FORUM.

The remains of the northeastern part of the Forum present considerable interest, especially after the recent excavations which Commendatore Boni is making, and much light is being thrown upon the plan of the Forum, thus settling some of the discussions which have arisen upon the subject. Our present engraving shows some of the main points of interest in that part of the Forum which lies to the west of the Arch of Septimius Severus. In the foreground are the remains of the Basilica Fulvia, one of the constructions of the early period, which was modified considerably in after times. In the rear of the Temple of Antoninus and Faustina, one of the landmarks of the Forum. The Sacra Via, the main avenue of the Forum, whose exact position has been so much disputed, has been found according to the recent excavations to lie along the northern side. It passes in front of the two last-named structures and lies underneath the level ground seen on the right of the engraving.

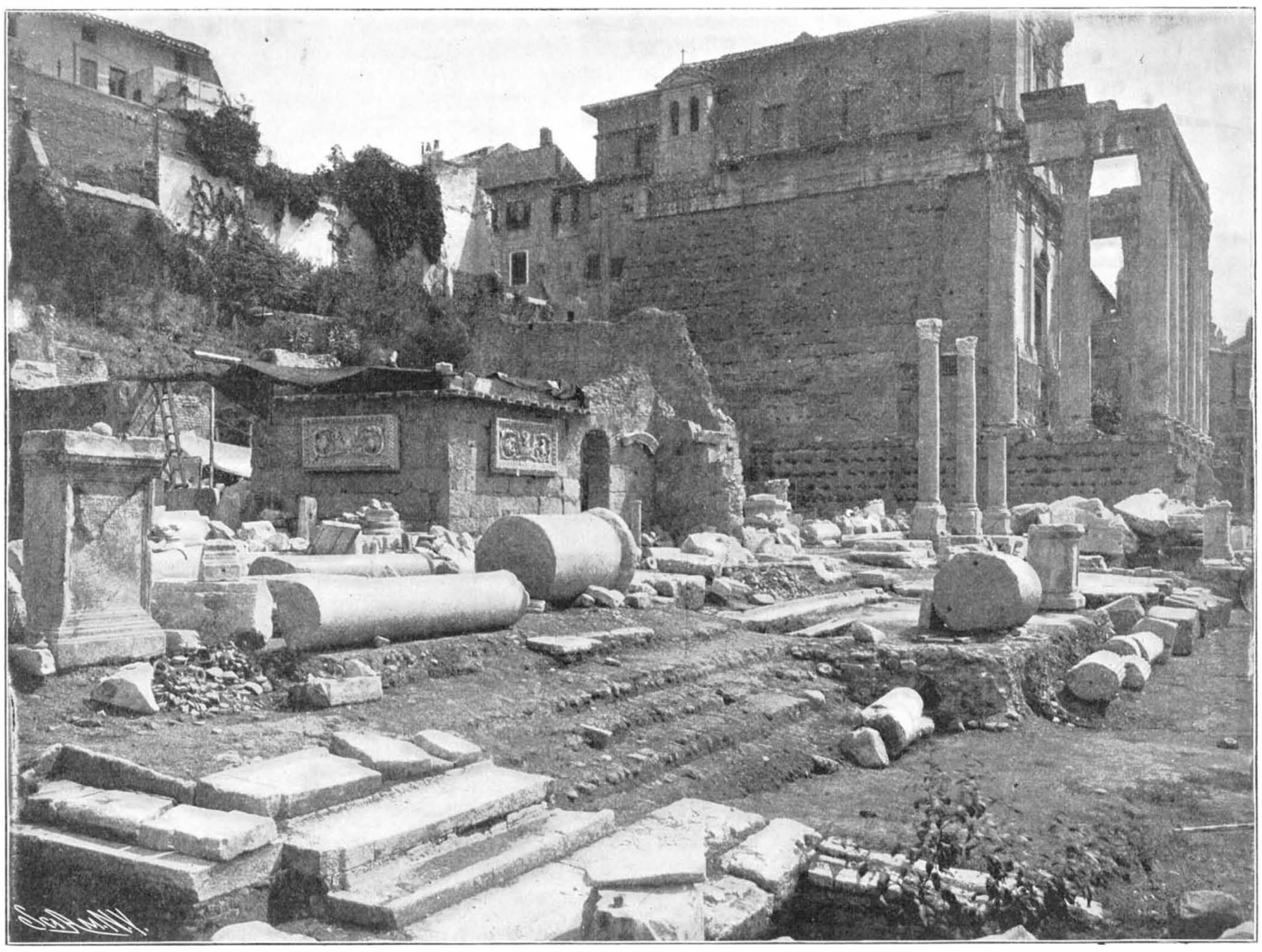
As regards the Basilica Fulvia (of which only the central part built of tufa blocks and part of the portico is now standing) the censor, M. Fulvius Nobilior, founded this edifice in the year 179 B. C. and gave it his own name. Later on, M. Aemilius Lepidus, during his consulate in 78 B. C., restored the building considerably, and ornamented it with bucklers upon which were engraved the portraits of his ancestors. A reproduction of the basilica restored and ornamented in this way now exists upon a medal of the time of Lepidus. It is probable, however, that he did not finish the work upon the building, for only 25 years later we see that Lucius Aemilius Paullus took up the work and received 1,600 talents from Cæsar for this purpose. From this time on, the edifice took the name of Basilica Paulli. It was badly damaged in the fire of the year 740 of Rome, and the work of restoring it was carried out by Augustus and some of the members of the Aemilia family. The splendid Phrygian columns (*pavonazzetto*) which Valentinian and Theodosius gave to the Basilica of St. Paul in 386 A. D. came from the building which Augustus restored.

In the fifth century, the Basilica Aemilia no longer existed. On its site had been constructed a portico, which was probably commenced under Petronius Maximus, prefect of Rome, and completed by Theodoric. To the edifice which they erected belongs the pavement formed of small blocks of marble of different colors, representing geometric forms. The columns of red granite with their pedestals and capitals of white marble (three of which can here be seen) were taken from different edifices and were adapted to the main structure as best might be. The ancient basilica contributed to this building with the old walls constructed of large tufa blocks (some of which still remain, as will be observed), also with a dozen columns adapted to the portico. This colonnade was of considerable length, nearly 200 feet long, and ran along the Sacra Via.

To the ancient structure also belongs the pavement of African marble, and two fragments of an architrave on which traces can still be seen of an inscription showing the reconstruction of the building by Aemilius Paullus, also fragments of a frieze ornamented with bucranes and large pateræ. The place which was occupied by this long portico or colonnade can be easily distinguished on the present site, and also some of the marble slabs which formed the pavement still remain. Some sections of the large marble columns are still left.

At the farther corner of the structure, next the Temple of Antoninus and Faustina, were discovered not long ago the remains of a monumental inscription in honor of Lucius Cæsar, the adopted son of Augustus. The colossal fragments on which the inscription is cut have been left in the place where they were found. They no doubt keep the exact position which they took when the old edifice fell in ruins or was overthrown during the Middle Ages. It is impossible to say to what monument this colossal inscription belonged. Perhaps Augustus, when reconstructing the Basilica Aemilia, added a portico to which he gave the name of his two nephews Lucius and Caius Cæsar.

Until the recent excavations were made, archæologists were not sure as to the exact direction of the Sacra Via, the main avenue passing through the Forum, which was the scene of so many events in the history of the capital. It was formerly supposed that it passed through the middle of the Forum, but the excavations which Commendatore Boni recently made have proved that it ran along the northern side, tracing a line which started from the Arch of Septimius Severus and passed in front of the Basilica Aemilia and the adjoining Temple of Antoninus and Faustina, therefore skirting the colonnade whose remains are visible in the engraving. The actual pavement of the ancient avenue lies, however, far below the level of the present ground. At the corner of the Basilica of Constantine (lying farther back of the Temple) a considerable portion of the old pavement has been discovered. It is formed of large polygonal slabs of basaltic lava. The pavement which has been uncovered so far lies about 8 feet below the ground level and is in a good state of preservation, with the blocks well joined together.



THE NORTHEASTERN CORNER OF THE ROMAN FORUM.

Chemical Studies.

The Agricultural Department's experiments with food preservatives involve the examination of 5,500 samples. A study of the changes in the composition of apples under its methods of cold storage has been continued in collaboration with the Pomologist. A study of olive oil and its adulterations has been completed. About 1,500 analyses were made in the insecticide and agricultural water laboratory. These included toxicological examinations to determine whether bees were killed by poisons used in spraying. In the laboratory work on sugar done for the Treasury Department the number of analyses reported was 1,744. In the Bureau Laboratory over 1,000 analyses were made, 807 of which were reported to the Dairy Division of the Bureau of Animal Industry. The difficulty of distinguishing between butter produced by feeding cotton seed or cotton-seed meal and that to which foreign fats have been added will be the occasion of special study during the coming year.

At the forthcoming St. Louis Exhibition the United States Steel Company will make an exhibit that will cover two acres of floor space. It will be the first exhibit of so wide a scope ever attempted, and will cover every branch of the industry.

A Balloon School for Military Students.

Great Britain is trying hard, after the terrible lessons of the South African war, to set her house in order—at any rate, as regards her army. The country is, however, greatly handicapped in being so small and so thickly populated, rendering it a matter of immense difficulty to get suitable grounds for military maneuvers on a large scale. Aldershot has become altogether too small, owing to the extended range of the modern small-bore rifle; and even Salisbury Plain abuts on many large towns. At Aldershot is established one of the most extensive military balloon factories and schools, among the fighting forces of Europe. It is presided over by a lieutenant-colonel, under whose supervision the balloons are constructed and filled. He also has in charge a kind of military balloon "academy," in which young officers are taught to take important observations from great heights, as well as the making of maps and taking of photographs from both free and captive balloons.

A visit to the Aldershot military balloon factory is most interesting. One commences with the workrooms, in which the girls are sewing together sections of gold-beaters' skin, or great sheets of the finest Chinese silk. The skin is best, however, as being impervious and less likely to let the gas escape. Next come the rope and cordage rooms; the making of the cars or baskets; the chemical department, in which the hydrogen gas is prepared; and lastly the great pit in which the filled balloons are kept on field-days.

Each military balloon carries from two to five officers, each of them a trained observer, map-maker, or photographer. The balloons are frequently taken out either collapsed altogether, or only half filled, and wagons go with them containing stacks of cylinders of gas. When the battle-ground is reached, the tubes are laid on and each balloon fully inflated, and the telephone fixed which is to connect the officers in the car with the tent of the General Staff below. Then all is ready for the ascent. From the foregoing it will be seen that the most common form of military balloon is the one held captive by means of steel wires; and the whole concern, at a height of from 1,000 to 3,000 feet, can be towed along by horses, all the while being kept in close communication with the Headquarters Staff, who are kept constantly advised as to the movements of the enemy and his general dispositions.

A course of military ballooning is now quite the thing in European armies; and it is an interesting fact that a large number of Japanese staff officers have been instructed by Col. Templer's disciples, who volunteered to go out and teach them years ago. In fact, there is no branch of modern military science (or naval science either for that matter) in which the Japanese do not excel.

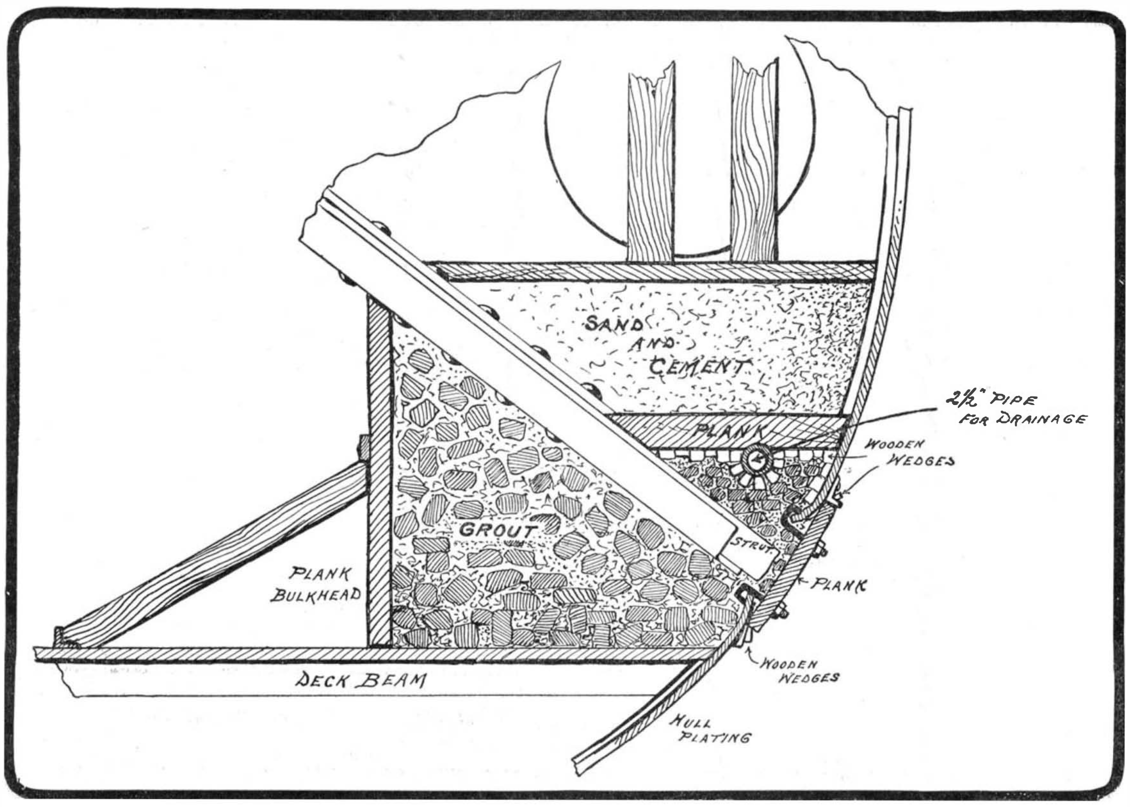
The Current Supplement.

The Boro Budur temple of Java is the subject of the opening article of the current Supplement, No. 1474. Mr. Charles H. Stevenson discusses the subject of seal and walrus oils. An elaborate article on the Hudson River tunnel, with illustrations clearly explaining the nature of the work and the difficulties to be overcome, forms not the least interesting feature of the issue. "The Construction of Steel Cars" is the subject of a paper recently read before the Institution of Civil Engineers in London. The paper is abstracted in the Supplement. Of astronomical interest is an excellent article on giant and miniature suns. The paper on Korean head-dresses in the National Museum begun in the last number is concluded.

ACCIDENT TO THE BATTLESHIP "ILLINOIS."

The battleship "Illinois" is now at the navy yard, Brooklyn, repairing the damages sustained during a collision in which, but for the presence of mind of her captain, Royal B. Bradford, she might have shared the fate of the British battleship "Victoria," which now lies at the bottom of the Mediterranean Sea. The "Illinois" is one of three identical ships, the other two being the "Alabama" and "Wisconsin." She is a first-class battleship, built at Newport News, commenced in 1897, launched in 1898, and commissioned September, 1901. On a displacement of 11,565 tons, when indicating her full horse-power, she has a speed of 17.4 knots. Her armament consists of four 13-inch guns in the main battery, fourteen 6-inch rapid-fire guns in the intermediate battery, and a secondary battery of sixteen 6-pounders, six 1-pounders, four Colts, and two 3-inch field guns. She also has four above-water torpedo tubes. Her belt armor, of Harvey steel, varies at the water-line from 13¾ inches amidships to about 4 inches at the bow. She is protected with 14 inches of Harvey steel on the turrets and 15 inches on the barbettes.

At the time of the accident, the North Atlantic fleet was engaged in maneuvers off the south coast of Cuba. The fleet of battleships consisting of the "Kearsarge," "Maine," "Massachusetts," "Alabama," "Missouri," and "Illinois," was moving in line abreast heading east by north. They were ranged from port to starboard in the order named. The "Missouri," experiencing some trouble with her steering gear, had dropped somewhat back of the line, and was coming up in the endeavor to regain her position abreast of the other ships. About this time the signal was flown to change the course through four points to northeast by north, and the maneuver was being executed when the steering gear of the "Missouri" again was disabled, and she began to sheer over to starboard, converging on the "Illinois," which, with the rest of the line, was steaming at a cruising speed of about 10 knots an hour. The "Illinois," in accordance with the signals, had ported her helm; but the speed at which the "Missouri" was traveling made it evident that a collision was impending, and it looked for a moment as though she would ram the "Illinois" fair in the broadside. Accordingly, Capt. Bradford threw his helm hard over to starboard, in the endeavor to swing his stern away to starboard, clear of the oncoming bow of the "Missouri." The maneuver undoubtedly saved the ship, although it was too late by a fraction of a second to carry the ships quite clear of each other. The "Missouri" struck a quartering blow, neither of the ships having much way on at the time. The ram evidently entered between two blades of the propeller and rode up on the upper cast-steel strut of the port propeller shaft, which, of course, snapped under the strain. It broke in two places: near the boss, and also at the point where it enters the hull. The strut extends through the hull and within the interior of the ship until it meets the underside of the protective deck. Unfortunately, the break was a diagonal one, and when the broken section of the strut fell out, a considerable hole was left into the tiller room compartment, through which the water immediately began to enter. There is a water-tight door to this compartment; but the man whose duty it is to attend the same evidently lost his nerve, and fled above decks without closing the door. The door of the next compartment forward was immediately closed, however, and when it was discovered that the compartment was filling but slowly, this second door was opened, and by wading waist-high in water, the crew were able to reach and close the inner door. The water was then pumped out of the forward compartment, leaving only the tiller room compartment to become flooded, the effect being to settle the stern of the "Illinois" about two feet deeper in the water.



SECTIONAL VIEW SHOWING THE METHOD OF CLOSING THE HOLE IN TILLER COMPARTMENT OF BATTLESHIP "ILLINOIS."

The collision took place about 20 miles from Guantanamo, Cuba, for which point the vessel was immediately headed. Here temporary repairs were executed by some very clever work on the part of one of the ship's divers, who placed felt-covered planking over the hole, and by means of bolt-hooks which caught on the inner edge of the ship's plating, the diver was able to screw the planking up to a fairly snug fit. The hole was so irregular, however, that wooden wedges had to be driven in by the diver, and a patent shot-hole plug inserted, before the hole could be even roughly closed. It was still considered necessary, before the ship could take the long journey to New York, to make further provision against leakage; and at the ingenious suggestion of the ship's carpenter's mate, use was made of some firebrick which happened to be on board and some cement and sand, to make a close sealing up of the rent. The accompanying sketch will show very clearly the way in which this was accomplished. The diagonal riveted member, shown in the illustration, is the inboard portion of the broken strut, and around this was built up a bulkhead of stout wooden planking, completely inclosing the fracture. The brick was then built up around the hole, as shown, and cement forced in for the purpose of filling the interstices and, as far as possible, sealing up the hole. Above the horizontal bulkhead a further layer of material was laid, and the whole of this masonry work (for such it really was) was held in place by means of timber shores abutting against the protective deck above and against a longitudinal angle iron on the floor of the compartment. These repairs completed, the pumps were set going, and with her disabled propeller and shaft slung in heavy chains, as shown in our photographs, and under her starboard engine, the "Illinois" made the long trip of 1,300 miles from Guantanamo to New York without any mishap.

BATTLESHIP "ILLINOIS" IN DRYDOCK; SHOWING BROKEN STRUT, BENT PROPELLER BLADES, AND THE HOLE (TEMPORARILY PLUGGED) THROUGH SIDE OF SHIP.

Action of Radium on Bacteria.

Continuing the experiments of one of us on the action of radium bromide on plants, we have experimented on various bacteria. We find that, in the case of *Bacillus pyocyaneus*, *B. typhosus*, *B. prodigiosus*, and *B. anthracis* in agar culture medium the β radiations from radium bromide exercise a marked inhibitory action on growth. Exposure for four days at a distance of 4.5 mm. to 5 mgr. of radium bromide does not appear sufficient to kill the bacteria, but is adequate to arrest their growth, and to maintain a patch on an agar plate, inoculated with any of these organisms, sterile. A broth tube, however, inoculated from this patch has in most cases developed the organisms, showing that while the growth is inhibited in the patch, all the organisms there are not killed.—Henry H. Dixon and J. T. Wigham in Nature.

According to the Agricultural Department's inventory of farm animals for January 1, 1903, the value of horses was over a billion dollars, and of mules, nearly 200 million dollars. The value of cattle of all kinds considerably exceeded 1,300 million, of sheep, 168 million, and of hogs, 365 million dollars.

RAISING OSTRICHES IN THE UNITED STATES.

BY DAY ALLEN WILLEY.

The Dark Continent has always had a monopoly of the ostrich business, but the United States threatens to become a rival in this industry, and may take away the laurels from Cape Colony, which has been one of the great centers for breeding these birds. The story of their introduction into this country by Mr. Edwin Cawston, of California, is familiar to the readers of the Scientific American.

The success of Mr. Cawston's work has resulted in two other ostrich farms being established—one near Jacksonville, Fla., and another in Arizona. In connection with the Florida farm is a racetrack, where several ostriches have been broken to harness and have paced a mile in 2:30. Mr. H. J. Campbell, the superintendent, has from 200 to 250 adult birds under his care. As each weighs from 200 to 450 pounds, and their heads are from six to eight feet above the ground when the neck is fully stretched, an idea of the size of the flock can be gained. They average much larger than the birds shown with menageries, as they have plenty of space to run about in and stretch their legs, so to speak. Their bill of fare is not expensive. When but two or three days old, the chicks display their appetite for such delicacies as gravel and bits of bone, which is really the first "nourishment" they take. Two or three days later they will eat bran, grass, cabbage leaves, etc., upon which they grow rapidly. In fact, a healthy ostrich will increase its size at the rate of a foot a month for the first few months, and be large enough to kick a man over by the time it is a year old. Many accounts have been written of the fierceness of the African ostrich, but most of the statements are exaggerated. During the laying season the males become quite ferocious, and one must be very careful in approaching a nest, as he may get a kick which will not only knock him senseless, but possibly wound him badly, as each bird has upon its feet claws which will cut like a knife. A curious fact is that if a person stoops over when attacked by one of the large birds, he may save himself from the kick, as it cannot exert any force below a height of three feet, owing to the peculiar manner in which the legs are jointed. The keepers at the Jacksonville farm take with them small dogs, which will drive the largest ostriches anywhere about the pen. The birds realize that they cannot harm the dogs with their feet, and fear them more than a man.

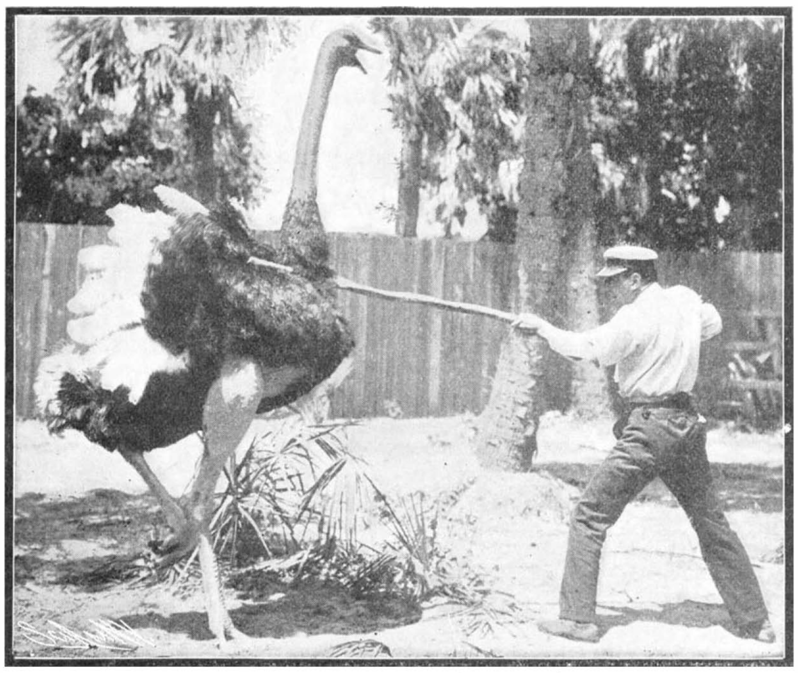
Ostriches are very much like other birds in hatching and rearing their young. Shortly after pairing off, the two birds will begin to build a nest, or rather to dig one out of the ground. The male bird rests his breastbone on the ground, and kicks the sand out behind him. When one side is sufficiently deep, he turns around and operates in a like manner, until a round hole about four feet in diameter and one foot deep is the result of his exertions. Occasionally he intimates to the female that help is required, and they take turns. The hen forthwith begins to lay an egg every other day, until twelve or fifteen are located side by side in this hole in the ground; then they scatter a little sand over the tops of the eggs, to protect them from the fierce rays of the sun. This habit has doubtless led to the supposition given as a fact in many natural histories, that the eggs of the ostrich are hatched by the sun, unaided by the bird.

As soon as the full number of eggs are laid, the couple share the labor of hatching, the male bird sitting on the eggs from about four o'clock in the afternoon until nine o'clock the following morning. It may be understood with what skill this is performed when it is remembered that 250 to 400 pounds of ostrich are bearing down upon fourteen eggs. At about nine o'clock in the morning the hen takes his place. The male ostrich, however, with remarkable intelligence, relieves the female for an hour in the middle of the day, while she goes in search of necessary nourishment. A pair will follow this schedule with regularity for forty days, when the chicks can be heard in the shells.

A fair-sized egg weighs about four pounds, or as much as two dozen hen's eggs. The size of the chick as it emerges from the shell is wonderful. It does not seem as if it could be half as large as it really is. This is due to the fact that the down and feathers, which cover it before it sees daylight, spread out when it leaves the shell, and nearly double it in size.

When a year old, the plumage of the ostrich is usually large enough and fine enough to begin plucking, which is one of the most difficult and dangerous operations of ostriculture. A few of them are driven into a small corral, when one by one they are pushed into a small angular inclosure, and a long, narrow bag is placed over the head, with a hole in the end to breathe through. Then one man holds the bird, while the operator skillfully clips and pulls at the feathers that are ripe. Blinded the bird becomes very tame, but care is exercised by the men to avoid the kicks that necessarily are included by the creature in this performance. When a feather root is hurt, injury is done that can never be remedied, for when a "socket" is pulled out, a feather can never grow again. The short feathers are pulled out without any apparent pain to the creature, as they are ripe and would fall off in the course of nature if not extricated by the skilled operator. The heavy wing feathers are cut off with heavy scissors, the stumps being left in the skin. These stumps are ripe for extraction about three months after a plucking takes place.

Strange to say, the feathers secured from the California and Florida birds are of a better quality than those imported from South Africa, and actually command a higher price. Before coming into the hands of the milliner and dressmaker, however, the glossy covering of the bird must be subjected to several processes. The plumes are tied on strings about four feet long, singly or in bunches of two or three, according to their size. Then they are scoured, cleaned in soapsuds, and rinsed frequently, when they are ready for the dyer. After dyeing comes more rinsing in clean water containing starch. Then the feathers are beaten on a smooth board until they are free from all particles of starch. After this they go to the workroom, where skilled operators "finish" them, and here again they are graded. This grading is even more important than the first, and years of practice and observation are required to render the operator thoroughly competent. They then go to the sewing department. Each "feather" used in the trade consists of several sewn skillfully together, three, four, or five feathers, end to end, according to the value and thickness desired. After being sewn, the feathers are steamed, in order to allow the fibers to assume their natural position, and are sent to the curler, who gives them that graceful shape, both in fibers and stem, so much desired. From the curler they pass to the buncher, who combs them and gives them whatever style is demanded at the time for sale in the open market.



Holding a Brooding Ostrich from the Nest with a Forked Stick While the Eggs are Being Examined.

Copyright 1898 by Graham.

Ostrich Chicks.

Plucking Ostrich Feathers.

OSTRICULTURE IN THE UNITED STATES.

Comparison of Costs for Steam and Electric Traction.

Dr. Reichel, whose very graphic account of the famous run from Berlin to Zossen of 130.4 miles per hour the readers of this journal will doubtless remember, has given some rather interesting cost comparisons between steam and electricity from the German standpoint.

A steam train consisting of a locomotive and five cars weighs 330,000 kilogrammes, contains 168 seats and uses 1,400 horsepower at full speed; the electric train consisting of one motor car and four trailers weighs 260,000 kilogrammes, has 180 seats and uses 1,000 horsepower. The initial cost of both trains is practically the same, being about 400,000 marks ($100,000). The operating cost for simply moving the train is 51 pfennigs (12½ cents) for 100 seat-kilometers, operating with steam, and 49½ pfennigs (11½ cents) using electricity. Applying a calculation to the 150-kilometer, or 94-mile line, between Berlin and Leipzig, we get the following conclusions: On this line an 18-hour service is furnished and 36 trains a day run every hour in both directions, so that if 40 per cent of the seats are occupied (the trailers are put on when necessary) about 2,500 passengers are accommodated. Figuring the fare per kilometer as 6 pfennigs (1½ cents), which is the present second-class fare, this would give a daily income of 22,500 marks ($5,650). The operating expenses, considering transportation only, are about 5,000 marks daily ($1,250). Adding to this the other operating expenses, particularly for employes, maintenance of way, stations, management, etc., 7,600 marks daily, this would make the daily operating expense 12,600 marks. This leaves 9,900 marks for interest on the original capital, which in one year would be 3,600,000 marks, which would give 4 per cent interest on 90,000,000 marks. The cost per kilometer would, in this case, be about 600,000 marks.

What is said to be the largest loom in the world has been built in Germany for weaving artists' painting cloth. It is capable of weaving feltings 48 feet wide.

Legal Notes.

The Art of Cross-Examination.*—If the practising lawyer expects to find Mr. Wellman's book a manual of the cross-examiner's art, he is likely to be disappointed. If the man unversed in law expects to find in this book some account of the methods that trial lawyers adopt in worming out of resistant witnesses the truth which they have sworn to tell, and very often refuse to tell, he will be more than gratified. In a word, whatever may have been Mr. Wellman's intention in preparing this book, it will be read with most interest by men who are not lawyers.

Mr. Wellman's long experience as a resourceful cross-examiner has singularly fitted him for the task of presenting a clear analysis of the methods which every good trial lawyer consciously or unconsciously adopts. Contrary to many cross-questioners, Mr. Wellman does not believe, as a general rule of procedure, in bullying every witness into telling the truth. Sometimes it is necessary; and even then it may not attain the desired end. Mr. Wellman states that the late Benjamin F. Butler was one of the few men who employed the method of roaring at a witness successfully. One example of what is politely termed his "vigorous" method of cross-questioning was afforded when, on one occasion, he began savagely to examine a distinguished Harvard professor. The presiding judge, struck by the indignities to which the witness was being subjected, reminded Butler that the man in the box was a Harvard professor. "I know it, your Honor," replied Butler; "we hanged one of them the other day." In striking contrast to Butler was Rufus Choate, of whom it was said that "he never aroused opposition on the part of the witness by attacking him, but disarmed him by the quiet and courteous manner in which he pursued his examination." In Mr. Wellman's opinion the good advocate should be a good actor. The play of the facial muscles, a look in the eyes, perhaps a smile, may often do more to convince a jury than actual words. Perfect self-possession is one secret of a skillful advocate's success in court. Damaging admissions by his own witness should never disconcert him. An excellent example of the effect of manner rather than of words upon a jury is quoted by Mr. Wellman from O'Brien's "Life of Lord Russell." Once when cross-examining a witness of the name of Sampson, who was sued for libel as editor of the Referee, Russell asked the witness a question which he did not answer. "Did you hear my question?" said Russell in a low voice. "I did," said Sampson. "Did you understand it?" asked Russell in a still lower voice. "I did," answered Sampson. "Then," said Russell, raising his voice to its highest pitch, and looking as if he would spring from his place and grip the witness by the throat, "why have you not answered it? Tell the jury why you have not answered it." A thrill of excitement ran through the courtroom. Sampson was overwhelmed; and he never pulled himself together again.

As to the matter of cross-examination, which forms the topic of an entire chapter, all that can be said is summed up in David Graham's jesting remark: "A lawyer should never ask the witness on cross-examination a question unless in the first place he knows what the answer would be, or in the second place, he doesn't care."

The task of exposing a witness who is not telling the truth, by the wiles of cross-examination, to make him convict himself out of his own mouth, requires more than ordinary adroitness. The difficulty lies in the fact that it is so hard to sift the true from the untrue. Even the habitual liar sometimes tells the truth. It is in his exposition of the method of detecting perjury that Mr. Wellman has given us one of the most valuable discussions of his book. The man who is able to repeat his story over and over again, using almost the identical words in each narration, says Mr. Wellman, is always open to suspicion. If he is suddenly stopped in the middle of his story, and made to start again at the very beginning, he is almost sure to betray the fact that he is reciting a carefully-prepared tale. Having no facts to associate with the wording of the story, he can recall it to mind only as a whole, and not in detachments. By distracting his thoughts to incidents not forming a part of his narrative, and then by returning to those considerations about which he has been first questioned, he is sure to be trapped. He cannot invent answers as fast as a lawyer can invent questions. It is the "instinct for the weak point" that here assists the questioner. Sometimes the lawyer confines himself to one or two salient points, on which he feels confident that he can make the witness contradict himself. An excellent example of this method may be found in the oft-repeated story of Abraham Lincoln's convincing a jury that the witness could not have seen his client commit the murder for which he was charged, by the light of the moon, for the reason that there was no moon at the time the murder was said to have been committed.

The sharpest battle of wits in the courtroom is to be found when the cross-questioner meets the expert. It has become a matter of common observation that not only can honest opinions of different experts be obtained upon opposite sides of the same question, but also that dishonest opinions may be obtained upon different sides of the same question. It is dangerous for a cross-examiner to attempt to cope with a specialist in his own field of inquiry. And yet it is often done with some success. During the famous Carlyle Harris case, in which Mr. Wellman himself played no small part, the prosecution won its case largely upon the information which it had gathered in a thorough examination of six thousand reported cases of morphine poisoning. The distinguishing symptom of the case was symmetrical contraction of the pupils of the eyes. There was no doubt that Mrs. Harris, for whose murder Carlyle Harris was on trial, had taken capsules containing harmless doses of quinine and morphia. The theory of the prosecution was that Harris, who had reasons for wishing his wife out of the way, had emptied one of the capsules and filled it with morphine, thus causing her death. On the trial an expert testified that symmetrical contraction of the pupils was not a certain symptom of morphine poisoning, and that his belief was grounded on a case recorded by a Prof. Taylor. When this point was reached, the cross-examining counsel asked: "Well, sir, did you investigate that case far enough to discover that Prof. Taylor's patient had one glass eye?"

By far the most interesting chapter in Mr. Wellman's book is that which he entitles "Some Famous Cross-Examiners and Their Methods." It is filled with many a striking example of the methods of Russell, Choate, Butler, and Mason. Undoubtedly the most dramatic piece of cross-examination that Mr. Wellman has recorded is that of Piggott by Sir Charles Russell before the Parnell Commission. So overwhelming was it, that two days later Piggott fled to Paris. He later admitted that he had perjured himself, and committed suicide.

Mr. Wellman's book as a whole may be considered a most excellent presentation of both the merits and abuses of cross-examination as it is conducted in criminal trials. Without having written in any sense of the word a textbook, he has given us an admirable work on a subject with which only the trial lawyer is intimately familiar, and yet which is of interest to every man.

* The Art of Cross-Examination. By Francis L. Wellman, of the New York Bar. With the cross-examination of important witnesses in some celebrated cases. New York. The Macmillan Company. 1903. Small 8vo. Pp. 283.

Historical Sketch of Patent Practice.—Mr. F. T. Wentworth contributes an instructive article to the American Machinist in which he gives an historical outline of our law of patents. The granting of letters patent was not altogether the prerogative of the King, for the first legislation in England on this subject, in about the year 1623, was for the purpose of defining the right of royalty in the granting of monopolies and confining letters patent to inventions, thus settling a disputed point as to the King's right to grant such, and preventing the continuance of that flagrant abuse of the executive power which had led to the granting of business monopolies covering all forms of trade during the reign of Elizabeth. These grants were extremely obnoxious to those engaged in all branches of industry, inasmuch as they were generally to court favorites who had no facilities for utilizing the same except by trading in the franchises so acquired.

When the United States gained their independence, the mantle of sovereignty did not fall upon the President, but upon each of the several States, where in the major part it remains to the present day.

The several States were, therefore, each vested with the right under the law existing at the time of the adoption of the Constitution to grant patents for inventions, and there are several known instances where a State actually did grant patent rights. Whatever power the United States government has in patent, as in all other matters, is traceable directly to some Constitutional provision and was not the result of any precedent set by sovereignty abroad, but of patent laws passed by Congress in accordance with powers vested in it by the Constitution.

The first United States patent law was passed in 1790 and provided that the secretary of state, the secretary of war and the attorney-general, or any two of them, might grant letters patent for an invention if they deemed it sufficiently useful and important. The application papers were addressed to the three officials named above, but it was expressly provided that the letters patent themselves should be attested by the President, examined by the attorney-general, recorded by the secretary of state, and sealed with the seal of the United States.

This practice was changed by the patent act of 1793 by vesting in the secretary of state alone the power of passing upon applications for patents, the practice in other respects remaining unchanged.

Under both these laws the granting of the patent was not compulsory, the said laws merely vesting in the secretary of state the power to grant letters patent if he considered the subject matter of an application sufficiently useful and important. There was, probably, no examination made as to novelty under either of these laws, but as the filing of a model or specimen was compulsory, it is apparent that an examination as to utility or operativeness was always had. The examination of the attorney-general was, as in most countries to-day, merely as to the form of the papers. It was under this law of 1793 that the "old patent" of the article was granted, and, to be valid, that patent must have contained the attestation of the President and have been countersigned by the secretary of state and also by the attorney-general to evidence that it had been duly recorded and was in proper legal form.

The granting of patents was a function attached to the department of state and so continued until 1870, when by the statute of that year the patent office was attached to the department of the interior, which had been founded in the interim, to wit, in 1849. There has been at different times agitation tending toward the formation of a separate governmental department for carrying on this work, but it is probable that the patent office will continue to be under the supervision of some one of the other departments.

The practice of granting patents without compulsory examination as to novelty continued until 1836, which year saw not only the destruction of the patent office building and its entire contents by fire, but the destruction by legislation of the old practice and the entire reorganization of the patent office upon the existing lines. This patent act of 1836 was really the beginning of the present patent system. But 10,000 patents had been granted in the half century preceding its adoption, and since, the number has been nearly 750,000.

This act of 1836 not only provided for the examination of all applications in relation to the known art, but created the office of commissioner of patents. We find the patent office report of 1835 signed "Henry L. Ellsworth, Superintendent," and that of 1836, "Henry L. Ellsworth, Commissioner of Patents," the first report so signed. Patents from July 4, 1836, to July 8, 1870, were not signed by the President, but by the secretary of state and countersigned by the commissioner of patents. Thereafter and until within the past few months, each patent was signed by the secretary of the interior and countersigned by the commissioner of patents. At present, however, a patent is signed by the commissioner of patents only.

The first patent issued after the law of 1836 took effect was to John Ruggles, of Thomaston, Maine, on July 13, 1836, a patent which does not seem to have attained any prominence in patent lore beyond having been so issued. It is probable that this patent was granted under the old system, as patent No. 1 (the present numbering of patents dates from 1836 only) was granted to the same party under date of July 28, 1836. The invention of this patent was a "locomotive steam engine for inclines and declines," and seems to have been of no greater prominence in the history of patents than the earlier patent referred to.

The date of the advent of the patent attorney is not positively ascertainable. It is more than likely, however, that he was always present, if only in an advisory capacity. It is worthy of comment that it is generally recognized, both within and without the patent office, that the patent attorney of to-day who does his work conscientiously is the factor which enables the immense volume of business transacted in the patent office each year to be carried on expeditiously, and that the value of many patents is attributable largely to his knowledge of the requirements of patent office practice and of the manner of treating each application to meet such requirements, a knowledge attained only by experience and which embraces every stage of a patent application from its preparation to its final allowance. Although he acquires a considerable fund of theoretical knowledge pertaining to the arts, his business is more particularly to see that the application is filed and sent to issue couched in terms which clearly distinguish the invention for which the patent is sought.

The patent office each year receives from 35,000 to 40,000 patent applications and issues from 25,000 to 30,000 patents. Of the applications on which patents are not granted, some are found upon examination to be for well-known structures, others are duplicates of applications by other inventors, still others are abandoned and the remainder fail to issue because the device is not of sufficient merit over the known art to be patentable. The number of applications seems to increase each year, and the delay in disposing of them in the patent office is due to the failure to develop the capacity of the office in proportion to the increased volume of business.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC STOP-MOTION FOR WARPING-MACHINES.—J. COCKER and C. DENN, Philadelphia, Pa. The object of this invention is to provide an improved electric stop-motion for warping-machines arranged to form a permanent fixture of warping-machine and adapted to stop the motion in case a yarn or thread breaks and prevent the manufacture of imperfect goods.

ELECTRIC-RAILWAY PLOW. — J. H. AKERS, Washington, D. C. This plow can be inserted into or withdrawn from the slot of the underground conduit at any point along the slot, for examination and repairs without having to wait until the car is run over a pit. It provides for the movement of the car forward or backward and is adapted to pass over breaks in the conductor-rails at crossings without damage to the plow and the plow may be conveniently and safely lifted into or taken out of the slot at the same time preserving its freedom of movement for turning curves.

Heating.

AIR-HEATER.—J. WATERHOUSE, New York, N. Y. The invention relates to improvements in machines for heating or reheating compressed air to be used in drying material in machines, as shown in two prior patents granted Mr. Waterhouse—although the invention is not confined to the devices shown in the patents, the object being to provide a heater of simple construction, in which heat may be easily regulated to the desired temperature for the material under treatment.

Machines and Mechanical Devices.

TRIMMING-MACHINE.—N. M. SCHUSTER, Kirksville, Mo. The aim of this inventor is to provide a machine more especially designed for trimming wall-paper and the like and arranged to insure an accurate trimming of the roll at a high velocity and to allow of adjusting the roll according to the width of the margin and while the machine is in operation.

SPEAKING FIGURE.—G. W. SPENCER and A. LYNDE, Atlantic City, N. J. In this patent the invention has reference to acoustics; and its object is to provide a new and improved speaking figure arranged to emit articulate speech, songs, and the like and move the eyes and lips to closely imitate a human being. The record-cylinders are provided with subject matter for speeches, songs, and the like.

FELT-SPREADER.—J. H. OSTRANDER, Ticonderoga, N. Y. Mr. Ostrander's invention relates to improvements in devices for spreading any web of wool, cotton, or paper, and is especially adapted for paper-pulp and paper-machine felts, an object being to provide a spreader that may be readily attached to a machine and which will spread the paper-carrying felt. A further object is to make the device adjustable, whereby it is possible to prevent the felt or paper sheet from creasing or wrinkling while traveling over the spreader.

APPARATUS FOR TREATING YARN.—H. LINDENBERG, West Hoboken, N. J. In carrying out this invention the object in view is the provision of a machine upon which the yarn to be treated is placed and held under tension while it is rotating and while subjected to a bath of suitable chemical and subsequently to a cleansing-bath. A vat or tank is provided designed to contain solutions in which the yarn is to be immersed, such tank being rotatably movable and vertically adjustable relative to the yarn-carrying devices.

HOISTING DEVICE FOR LIVE STOCK.—L. W. JOHNSON, Jerome Junction, Arizona Ter. Mr. Johnson's invention relates to hoisting devices or mechanism. The improvements are intended more especially for use in loading cars with live stock. A movable gangway of special construction is employed for enabling the stock to pass thereonto which may rest on the ground or other surface of the pen from which stock may be taken, and in connection with said gangway hoisting devices are employed for elevating the gangway, together with a load of stock, to a convenient height to enable the latter to pass into the car.

MACHINE FOR TRIMMING AND APPLYING SHADE GOODS.—E. O. ENGBERG, Salt Lake City, Utah. This invention relates to a machine by which the fabric used for window-shades may be slit at its edges to produce the proper width and severed into the necessary lengths, the machine simultaneously creasing the stock, so as to facilitate the application to the lower edge thereof of the usual slat, and the machine, further, having means for carrying the shade-roller and for rotating the same during the operation of the machine, whereby automatically to wind the shade on the roller.

Of Interest to Farmers.

COTTON-CHOPPER.—T. J. LOWRY, Mountairy, N. C. The invention relates to improvements in cotton choppers and cultivating devices. In the present instance Mr. Lowry contemplates the provision of a machine or a device of the class described in which the chopping mechanism may be raised and lowered to put the same into and out of operation at the will of the operator. The mechanism may be held or retained by the operator in any desired position of adjustment.

COMBINED HEADER AND STACKER.—J. H. KINDSVATER, Manhattan, Kan. The improvement is directed to a machine for heading and stacking the grain. The machine is equipped with means for adjusting the cutter apparatus and for throwing it into and out of gear, with power devices for bodily elevating the receiver or barge by the movement of the portable apparatus, with means for tilting the raised barge, for guiding during tilting, and for braking the descent of the barge unloaded and with a horizontal conveyer, which is shiftable relatively to the barge, so that it may be moved out of the way previous to elevation of the barge.

HOISTING MECHANISM FOR STACKERS.—J. H. KINDSVATER, Ellis, Kan. The subject-matter of this application constitutes in part a division of a prior application filed by Mr. Kindsvater. The present improvements are directed to a means for slidably guiding the up-and-down movement of the barge and permitting the same when raised to have a tilting movement to discharge the load, to means for hoisting the loaded barge by the movement of the machine, and to devices whereby the hoisting mechanism and barge may be controlled by a single operation.

TOPPER AND STRIPPER FOR CANE-HARVESTERS.—G. D. LUCE, New Orleans, La. The present invention refers to improvements in topping and stripping mechanism designed to be used in connection with a sugar-cane harvester, an object being to provide a mechanism of this character by means of which the cane may be quickly topped and stripped of leaves and the stalk conveyed to a cart or wagon.

Pertaining to Vehicles.

DEVICE FOR PREVENTING SHAFT-MOTION IN VEHICLES.—W. N. CLEVELAND, Dover, Ky. In the present case the invention relates more particularly to devices used on vehicles for preventing shaft motion due to the vertical movement of the horse. Further, it relates to means whereby the seat of the vehicle may be inclined at slightly different angles, relatively to the vehicle-body, for the purpose of compensating grades over which the vehicle travels, thereby maintaining the seat substantially level.

Railways and Their Accessories.

RAILWAY-SWITCH.—T. E. GUMMERSON, Crestone, Col. The usual construction of frog is done away with in this instance and in its stead a swinging rail is used. The object of the improvement is to do away with the usual frog and to produce a simple switch, one that can readily be installed, removed, or repaired and that is sure in its operation and not affected by sleet, snow, mud, or dust. The device is a safety appliance, as there will be no danger of a person getting a foot caught, as is quite common with the ordinary switch-frogs.

Steam Engineering.

HEATING AND CONDENSING FEED-PUMP.—W. TATE, Greensboro, N. C. The invention resides in a peculiar attachment to pumps, providing steam-condensing and water-heating means, the pumps being adapted for drawing the water from a supply thereof and forcing it, after passage through the heating means, into a steam-boiler or a storage-tank, from which it may be conveyed and used according to conditions and the purpose of its use. The invention is specially adapted for use with double-acting pumps, though it may be modified, adapting it to be used with single-acting pumps.

EXHAUST-NOZZLE.—W. S. CLARKSON, Livingston, Mont. The prime object of Mr. Clarkson's invention is to keep the exhaust from each side of the engine independent, so that the exhaust from one engine will not tend to create back pressure on the other engine and to cause the exhaust-steam to be equally distributed through the smoke-stack, thus bringing about an even and uniform draft within.

ENGINE.—C. F. CHANDLER, Orange, N. J. In this patent the invention has reference to engines in which the motive agent acts simultaneously on two pistons to cause the same to advance toward and to recede from each other. The object of the improvement is the provision of an engine arranged to utilize the motive agent to the fullest advantage.

ROD-PACKING.—N. H. ALBRECHT, Columbus, Ga. The inventor provides packing-blocks in pairs, fitted slidably together, and a cage having radial mortises in which the blocks operate, the cage being fitted within a retaining band and the latter, with the cage in place, being then fitted within a casing having means for retaining the packing devices at one side and means for holding them at the other side, the latter means being provided with openings for passage of steam between a retaining-band and the casing, the band having openings opposite radial mortises in a carrier, so steam may force the packing-blocks against the rod.

Of General Interest.

BARREL-TAP.—H. FESENFELD, Hoquiam, Wash. In this patent the improvement relates to beer apparatus having gas or air pressure in the barrel for forcing the liquid from the barrel through the supply-pipe to a dispensing-faucet at a bar or other place. The object is to provide a tap arranged to permit convenient driving of the tap into the bung-hole without injury to the tap or supply-pipe and without waste of the liquid.

WEATHER-STRIP.—H. EAGON, New Comerstown, Ohio. This weather-strip is of that type known as "hinge-acting;" and the invention consists of the construction and arrangement of parts automatically operating upon closure of the door to provide effective packing whereby rain, wind, dust, and cold air are prevented entrance through such opening as may be between the door and carpet-strip or door-sill.

FASTENING DEVICE FOR DRILL-BITS OR THE LIKE.—C. P. BRINTZINGHOFFER, Howard, Kan. The improvements in this case are intended more especially for use in securing drill-bits to the stems or stocks therefor, it being known that in operations of boring oil and similar wells difficulty and loss of time are occasioned by the loosening of the drills on their stems or else by disconnection and loss of the same within the well. One of the principal objects of this invention is to overcome these difficulties.

VENTILATOR.—F. J. PROCHASKA, Park River, N. D. The purpose in the present case is to provide a ventilator adapted for use in connection with buildings; and which when opened will afford a direct draft and which when closed will be wind, snow, rain, and dust proof, and further to so construct the ventilator that the body or ventilating tube will be unobstructed and so that the ingress of flies or other insects to the tube will be prevented.

LINE-CHALKING DEVICE.—F. M. THOMPSON, East Liverpool, Ohio. Mr. Thompson provides a simple device by which to chalk the line, including the casing having a body for the reeling mechanism, a chamber for the chalk, means of controlling communication between the said chamber and reel-chamber, and means for controlling the outlet for the line from the chalking-chamber, as well as means for preventing clogging of the chalk within the chamber. It may be carried in the pocket and used immediately.

GARMENT-SUPPORTER.—L. E. SCHOCH, Chicago, Ill. The object of the improvement is to provide a supporter, more especially designed as a suspender or as a hose-supporter which is arranged to insure ready self-adjustment of the parts on the wearer bending the body, to give the utmost comfort to the wearer, and to reduce the strain on the webbing and other parts to a minimum.

BOLTING-SIEVE CLEANER. — C. A. SHULTZ, Portland, Ore. In this patent the invention has for its object the provision of a novel simple traveler-block of peculiar form adapted to be moved freely in all directions over the surface of bolting cloth by the ordinary jar of the working machine, and thus prevent the reticulations of the fabric from becoming clogged and rendered defective in service.

COMBINATION BRIDGE AND TAIL-PIECE.—E. REACH, Jersey City, N. J. This application is a division of a former application filed by Mr. Reach. The invention relates to mandolins, guitars, zithers, violins, and other like stringed instruments, and its object is to provide a bridge and tailpiece arranged for attachment to the belly of the instrument and to allow the interchange of bridges of a high or low character, according to the requirements of the instrument.

BIRD-CAGE.—J. A. QUELCH, New York, N. Y. The purpose in this instance is to provide in connection with a cage a paper-roll holder, whereby the paper-covering for the cage-bottom may be conveniently and quickly changed or renewed, and another purpose is to provide a novel means for distributing gravel on the paper as it is drawn through the cage.

BUCKLE.—A. ADDINGTON, Cedarville, Cal. The invention refers to buckles especially for use in connection with saddles, particularly of the Mexican type, to effect adjustable connection between the latigo and cinch and also between the reata-strap and latigo; and the purpose is to construct a simple buckle and one of great strength, and which can be operated to effect the adjustment of the main strap—a latigo, for example—and which when the strap is adjusted therein will also hold the strap firmly in adjusted position.

TOOL FOR PYROGRAPHIC WORK.—Z. N. TYSSOWSKA, Chicago, Ill. In a previous patent the inventor described a combination tool adapted to be used as a burner and a scorcher at the same time, the scorcher portion serving, in addition to its own function, as a chimney for the burner portion, and the burner portion, in addition to its own function, serving as a heater for the jet of gases delivered by the scorcher portion. The present application shows a nozzle device as a separate article of manufacture applicable to any ordinary pyrographic point or tool and by which many advantages may be easily obtained.

PUZZLE.—L. VAN PUTTEN, Holland, Mich. The object in this case is to provide a puzzle relating to games and toys which is simple, cheap to manufacture, and provided with revoluble picture-blocks to be brought in such relative position to each other by the operator that the pictures will form complete sets of pictures.

SLOPE-STAKE ATTACHMENT FOR ENGINEERS' TRANSITS.—W. G. RUSSELL, Russels, Kan. The device is attached to the axis of the transit-telescope, having a level underneath and provided with a graduated vertical arc or circle and clamp and tangent screws applied in the usual way. The objects are to effect the setting of slope-stakes of embankment, and cuts in railroad or other work without the use of the Wye level and without any calculations and with much greater speed than can be made by ordinary methods.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Inquiry No. 5315.—For makers of model feet, medium size, light weight, papier maché, wax, plaster of Paris, etc., in large quantities.

Inquiry No. 5316.—For makers of coil heaters for hot water heating in houses.

Inquiry No. 5317.—For makers of small registers or counters for voting machines.

Inquiry No. 5318.—For makers of articles of indurated fiber made from wood pulp.

Inquiry No. 5319.—For dealers in electric blue printing machines.

Inquiry No. 5320.—For dealers in rubber stamp-making outfits.

Inquiry No. 5321.—For manufacturers of spring motor fans.

Inquiry No. 5322.—For manufacturers of hand cigarette makers.

Inquiry No. 5323.—For machines for making briquettes of shavings or sawdust.

Inquiry No. 5324.—For hand power machinery for making soap.

Inquiry No. 5325.—For makers of iron moulds for casting battery zincs.

Inquiry No. 5326.—For the manufacturers of the "Woodruff" rubber stamp ink pad.

Inquiry No. 5327.—For a machine for making fertilizer bags.

Inquiry No. 5328.—For dealers in mineral lubricating oils.

Inquiry No. 5329.—For makers of advertising novelties.

Inquiry No. 5330.—For machinery for the manufacture of fishing nets.

Inquiry No. 5331.—For parties engaged in molding or vulcanizing rubber into different designs, so that when finished it is flexible.

Inquiry No. 5332.—For makers of highway truss bridges.

Inquiry No. 5333.—For dealers in magical goods.

Inquiry No. 5334.—For machines used in decorticating Ramie fiber.

Inquiry No. 5335.—For gasoline engine for pumping capacity of village water works.

Inquiry No. 5336.—For makers of salt crushers or mills to crush and grind rock salt very finely.

Inquiry No. 5337.—For a machine for packing cigarettes in packages (not boxes).

Inquiry No. 5338.—For a machine for turning pins for cross-arms of telegraph poles.

Inquiry No. 5339.—For machinery for renovating, breaking and picking feathers; also for mattress machinery.

Inquiry No. 5340.—For makers of all sorts of novelties, of different materials, wood, paper, leather, etc.

Inquiry No. 5341.—For metal novelties suitable for the stationery trade.

Inquiry No. 5342.—For a machine for cleaning books in a library, in the nature of a dust pump.

Inquiry No. 5343.—For makers of incubator supplies, also of wooden pumps.

Inquiry No. 5344.—For makers of machines for bundling wood.

Inquiry No. 5345.—For a machine which will fill from 4 to 20 cans of polish, paste, powder, etc., at one time.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9335) H. B. says: We are a constant reader of your valuable paper, and we would like to know some process for tinning small cast-iron and malleable-iron castings. We have used the following without success: We used for a bath muriatic acid cut down with zinc and added one-third water, but it did not seem to take. After we melted the tin on the furnace, we placed the castings in, without the desired effect. A. You will obtain better results by first cleaning the castings thoroughly in a bath of muriatic acid 2 parts, water 1 part (hot) and scrub free from adhering dirt in hot water. Then dip for a few minutes in the saturated solution of chloride of zinc and water as you describe, with sal ammoniac dissolved in the solution to saturation. Sprinkle a little sal ammoniac on the melted tin, and clear the surface before dipping the castings.

(9336) A. B. writes: One pound of dry wood requires about six pounds of air for combustion. Now if one pound of wood is placed a few inches into the ground and left for decay, a slow combustion takes place, and the same amount of oxygen is required. How is the oxygen supplied? By the air through the pores of the ground, or by other sources, and in what proportion? Of course the wood is getting wet and dry alternately, and is exposed to the chemical action of the surrounding soil. A. Air penetrates the ground to the depth of the subwater surface, and thus aerates our well water. It flows into and out of the surface of the ground with every change of the barometric pressure, and thus supports animal and vegetable life beneath the surface of the earth. By contact with the moisture in the earth, air is absorbed by the water and its constituents separated, and by contact the oxygen unites with the carbon and other constituents of wood and other vegetable matter by slow combustion, while the nitrogen is absorbed by the living vegetation in developing growth. It was long since found by Bunsen that a decomposition of both air and water took place in a small degree in aerated water; the air of which, when freed from water by heat, was found to have oxygen in excess, while the water contained ammonia from the union of the nitrogen of the air and the hydrogen of the water. Thus the constituents of both air and water in the form of moisture, by chemical change of their elements, contribute to the decay of other forms of matter by slow combustion, and to sustain vegetable life by adding the constituents necessary to its growth.

(9337) C. W. W. writes: 1. Owing to long-continued cold weather, many water pipes have frozen. These are iron pipes 1¼ to 2 inches in diameter and buried four feet or over. Could you give me the name of some inexpensive chemical or other means of thawing these pipes? A. The most approved method of thawing water pipes under-ground now is by the electric current. See Scientific American No. 12, Vol. 90, March 19, 1904, on "Thawing Out Water Pipes" (10 cents mailed). Otherwise a small pipe inserted into the house end of the service pipe with steam pressure has done good work where the service pipe has been straight. There are no chemicals that will do the work. 2. What per cent of the energy in fuel (soft and hard coal, crude oil or gas) is utilized in the most approved steam engines? A. About 20 per cent of the energy of the fuel is now utilized for power in the steam engine. 3. Can you give a formula for a cement suitable to mend rubber boots, coats, or gloves by attaching a piece of the same material over the break or tear? A. Use rubber cement for mending rubber goods. It can be obtained through the rubber trade.

(9338) P. J. T. says: In a certain electric lighting and heating plant three ordinary tubular boilers with outside firing are used. The grates cannot be shaken, neither is a poker ever used to stir up the fire. When it must be cleaned, the live portion is pushed to the rear end, and the remaining ashes pulled out. The live fire is spread evenly over the grates, and covered with a thin layer of nut coal. This soon makes a nice clean fire—to look at—for a short time; but when necessary other thin layers are thrown on, no poking or shaking being done, until a layer of ashes 3 inches or 4 inches thick has formed on the grates. This is the continual practice. I hold the opinion that in this way 10 or 15 per cent of the value of the coal is wasted, in unconsumed gas going up the chimney, more than would be with intelligent and efficient hand firing, where the light in the ashpit would show a clear, bright fire nearly all the time. A. If all the coal is burned by the method described, and the cleaning of the fire is done at the noon hour, we can see no objection to the method of firing, and the actual loss must be found in the good coal in the ashheap, if any. The slicing of the fire at stated times during the day is also a good practice when properly done, so as to pass the ashes through a close grate without wasting coal. Much depends upon the strength of the chimney draft as to which method of firing is practised. There should be no more waste of unconsumed gases by the chimney in either method of firing with nut or buckwheat anthracite coal. With bituminous coal both methods above described are defective.

(9339) W. A. B. asks: 1. Does the *swing* of a lathe mean the *diameter* or the *radius* of the largest piece of work which can be turned in that lathe? A. The swing of a lathe is the diameter of the largest piece that can be turned. 2. In using an ordinary three-fall tackle, is there anything gained by having the double block on the moving load, or is the direct pull on the free end equalized by the falls? A. In a three-fall tackle, composed of a two and a three sheave block, the two-sheave block should be on the moving load, with the end of the rope in the eye of the block, when with the downward pull the power will be one to five. By reversing the blocks and pulling in the direction of the moving load, using all the sheaves, the power will be one to six; but in hoisting a load with the three-sheave block next to the load, one of the sheaves cannot be used with a down pull, and the power will be one to four. 3. What causes the flash of light when a metal scoop is thrust into ordinary granulated sugar which has become hard from dampness? A. The flash is probably electric, caused by the sudden separation of the crystals of sugar. 4. Will the following gears run, or will there be a deadlock? Shaft No. 1 has a 6-inch gear meshing into a 3-inch gear on shaft No. 2, and also a 3-inch gear meshing into a 6-inch gear on shaft No. 2. A. There will be a deadlock unless one of the gears runs loose on its shaft.

(9340) R. H. G. asks: Am I asking too great a favor in asking you to give me, through the Notes and Queries column, a list of the elements and compounds occurring in sea water, and their percentages? A. Ocean water is not of definite composition. Tarr's Physical Geography places the percentage of pure water in the ocean at between 96 and 97, the remainder being divided between several salts. Common salt is most abundant of these. There is an appreciable amount of magnesium chloride, carbonate of lime, several sulphates, and minute quantities of other substances. Probably some compound of every known element is to be found in ocean water. There are also atmospheric gases dissolved in the water. The range of solid constituents in various oceans is from 3.3 to 3.7 per cent. If more definite numbers were given, they would simply be the analysis of some particular specimen.

(9341) L. M. H. says: Will you kindly explain the following described phenomenon through the Scientific American for the benefit of several persons interested? There is a large slough about eighteen miles south of Los Angeles, Cal., and about thirty miles from the nearest mountains, and eight miles from San Pedro Bay. Its bottom is perhaps thirty feet above high tide and ten feet below the surface of the surrounding country. In the summer it goes entirely dry, and deep cracks open in the bottom; but in the autumn just before the rains commence, the water begins to rise, and at first may be seen far down in the cracks, and continues to rise until it is several inches deep all over the bottom of the slough. The water does not begin to rise at any exact time in the season, but may vary a month or two in different years. Yet it always puts in its appearance a week or two before the rains commence in either the valley or surrounding mountains, and is regarded by the people of that vicinity as a never-failing sign of rain. A. We cannot venture a positive opinion as to the cause of the action of the water in the slough you describe. It would seem as if the heat of summer were enough to account for the drying up of the bottom, and perhaps the cooling of the autumn in advance of the rains would account for the appearance of the water in the bottom earlier than the rains. Evaporation in summer is more rapid than the inflow of water at the bottom of the slough. As the evaporation decreases in autumn the water begins to accumulate, since the evaporation is less than influx.

(9342) C. M. K. asks: Will you please give directions under Notes and Queries for producing cold artificially in a small way for the purpose of testing a thermometer? A. To test the freezing point of a thermometer, pack it in pounded ice, keeping the tube as far as the freezing mark in the ice. For temperatures lower than this you may make a mixture of 8 parts sodium phosphate and 5 parts hydrochloric acid. A temperature of about zero Fahrenheit can be produced with this mixture.

(9343) A. S. asks: Is decarbonized steel capable of being highly magnetized? Can you give formula for calculating velocity of steam at different pressures? Also what should be the piston-pressure (as compared with boiler pressure) for best results? Will steam at 100 pounds pressure and working at 50 pounds piston-pressure flow as fast with 50 pounds pressure, doing no work? A. Decarbonized steel is capable of being magnetized in the same way as wrought iron. The formula for the blow of steam into the atmosphere is $3.6\sqrt{h}$ = velocity in feet per second; h is the height in feet of a column of steam of uniform density at any given pressure due to the evaporation of one cubic foot of water. For 100 pounds absolute pressure the proportion is as follows: 62.5 :100 : :270 :432 and $432 \times 144 = 62208$ feet. Then $3.6\sqrt{62208} = 898$ feet per second, the velocity of steam through an orifice at 100 pounds absolute pressure. Steam doing work behind a piston or otherwise cannot flow as fast as when flowing into the atmosphere.

(9344) A. F. G.: Queries to receive attention must be accompanied by the names and addresses of correspondents. You will find formulas for household ammonia in our Supplements 1108, 1208, 1411, and 1430. Price, 10 cents each.

(9345) J. F. W. asks: Will you please answer the following through queries column? What causes the buzzing in a telephone receiver from an electric light dynamo? Would a ground circuit line be affected more than a metallic circuit? How can it be prevented? A. The buzzing in a receiver of a telephone whose line passes near the wire from an electric light dynamo is due to the waves of the electric current from the dynamo. These produce a current in the telephone, and make the same tone which the dynamo current makes. The dynamo is probably an alternating current machine. The remedy is a metallic circuit, with the two wires twisted around each other at frequent intervals. A line with a ground return cannot be cured of the difficulty.

(9346) J. W. N. asks: What is the highest degree of temperature that water may be made? What is the boiling point of grease or fat? A. Water cannot be heated above 212 deg. Fahr. at the sea level when the barometer registers 30 inches. At that temperature it boils and becomes steam. Above the level of the sea the boiling point is lower, and when the barometer falls, the water boils at a lower temperature. We should not suppose grease had any boiling point, since it only boils at all because of contained water. Pure grease would simply rise in temperature till it turns black by overheating. It has then decomposed into carbon and other constituents.

(9347) R. C. says: I write to ask you a few questions with regard to an X-ray inductor that I have made, or rather been trying to make. Put 250 feet No. 18 on primary. About 5 pounds of No. 32 on secondary. Secondary wire is double silk wrapped. Used an iron core solid. Result, ½-inch spark; could not get a bit more. Used four cells Edison primary battery, 150 ampere hours each. What is the trouble? I think the thing should give 4-inch spark anyhow. A. The first error in winding your coil is the use of too much wire in the primary. Two layers of wire are enough. You have nearly 2 ohms in the coil when a small fraction of an ohm is better. A No. 12 wire wound in two layers is the rule for a coil of this size. The iron core should be made of soft iron wire; No. 18 at the largest. The secondary should be of No. 36 wire. You should get Norrie's "Induction Coils," and study it. We sell it for $1. You do not mention a condenser at all.

(9348) A. P. writes: The Scientific American some time ago decided that an ordinary telephone current is an alternating current. Kindly tell us what a direct current is. By your decision every current in existence is alternating. A. The transmitters now in general use contain carbon, either in granulated form or in older ones as a small ball, and the action of the transmitter depends on the varying conductivity of carbon under pressure. A current of electricity flowing through the transmitter is thus made to vary in intensity by the action of the voice. This current is a fluctuating direct current. Its circuit is completed through the primary of an induction coil. So far as we know, this is never called the telephonic current. The induced current in the secondary of the induction coil flows over the line to the distant receiver. This current is alternating, and is what is ordinarily referred to as the current used in telephoning. It is to this that we referred in the note to which exception is taken. We can quote no higher authority than Miller's "American Telephone Practice," in which he says: "It should be remembered that the current in the primary circuit is an undulating one, and is always in the same direction. The current in the secondary, however, is alternating in character, changing its direction completely with every large fluctuation in the primary current. This latter feature is also productive of better results than would be the case were the current in the line wire of an undulatory character." We do not see how any other view can be taken. An induction coil always gives an alternating current, when the current in the primary is varied in intensity to a considerable degree and the secondary circuit is a closed one. It is true that the old form of telephone used an undulatory current on the line, but these are entirely out of use, unless between houses or rooms in houses where an up-to-date service is not required, or cannot be afforded.

(9349) H. J. L. asks: 1. What amount of moisture does air gather by its being passed or caused to bubble up through water? A. The quantity of moisture that will saturate air when bubbled up through water depends upon the temperature of both air and water. The amount of water required to saturate each cubic foot of air at 62 deg. Fahr. is 6¼ grains. Ordinary dry air, so called, is about 50 per cent of saturation, and contains 3⅛ grains of moisture, and if it leaves the water saturated, it will have absorbed 3⅛ grains per cubic foot of air. This may be increased to four grains at 70 deg. and 5¼ grains at 80 deg. Fahr. 2. Can the dust be removed from air by passing the air through sieves (thin cloth) or water? A. Dust may be removed from air partially by passing slowly through a dry muslin or two thicknesses of cheese cloth, and totally removed if the cloth strainers are wet by sprinkling with water. 3. Will dry cold air, upon mixing with dry warm air, cause any moisture to form? A. So-called dry air in its natural condition is never dry, but contains about 50 per cent of the moisture of saturation, so that it depends entirely upon the relative temperatures and proportions of cold and warm air mixtures required to produce visible vapor. 4. If ordinary outside midwinter air is brought in contact with warm dry air, will any perceptible amount of moisture be formed? A. The same conditions as above stated apply to the admission of cold winter air into warm rooms, as cloud or vapor condensation will entirely depend upon the relative saturation of the air.

(9350) J. N. says: I would esteem it a great favor if you would kindly let me know at your convenience, through the Notes and Query column, how to obtain a green finish on brass goods, resembling verdigris. I think the color is named verde antique. A. For verde antique on brass, wet the articles with dilute acetic acid for a short time, and alternate with a solution of sal ammoniac in water until the desired color is obtained. Or by another method, dip in a solution 1 part permuriate of iron in 2 pints of water until the desired color is obtained. Washing, drying, and brushing or burnishing complete the process.

(9351) H. M. asks: 1. What would the candle power of an incandescent lamp be at 50 volts and 1½ amperes? A. An incandescent lamp will give one candle for from 2½ to 4 watts. Fifty volts and 1½ amperes are 75 watts. The lamp may then give between 20 and 50 candles; perhaps 32 candles would be a good result. 2. Can you tell me the reason why a few cells of batteries that will furnish a spark through 50 feet of wire will not impart the least shock to a person when holding the wires, and a hand power dynamo capable of giving a powerful shock will not make the least spark, and will not give a shock to a person through 3 feet of copper wire. Is it due to the difference in E. M. F. of the batteries and magneto? A. The spark and the shock are due to the self-induction of breaking the circuit of the battery or dynamo. It would require several hundred cells of battery to give a shock directly to one holding the ends of the wires leading from it. If there were cells enough, the voltage of the direct current would send enough current through a man to give a shock. Let the man take the wires in his hands, while connected to the battery; that is, while the current is flowing through them, and pull the circuit open between his hands, and he will get a shock from the self-induction. The same is true of the dynamo. Any voltage up to 110 can give but a feeble shock by touching the poles; but if while holding the wires the circuit is broken between the hands, a shock will be felt. The electromotive force of the current produced on breaking the circuit is much greater than the electromotive force of the current while flowing steadily. 3. Is it known at what voltage an electric current will give a powerful shock to an ordinary man? A. The resistance of the human body is in the neighborhood of 5,000 ohms, as an average. Men differ greatly in this respect. The voltage necessary to force current through a human body therefore differs in the same degree. What will give one man a severe shock will not seriously affect another. Then, too, the shock of the alternating current is worse than that of the direct current. A trolley current has killed persons, we understand. This is 500 volts direct.

(9352) A Reader asks: Please inform me through your paper, if possible, where I can get some light on the subject of the mono-rail system of railroad. The one to which I refer has a name which I remember as the "Mallet" mono-rail. It was discussed in one of the scientific papers, the date of which I do not remember. So far as I recollect, it is a Belgian invention, and patented in that country. Any light that you can throw on this subject will be greatly appreciated by a number of persons interested. A. Queries must always be accompanied by full name and address. The mono-rail system is that with a single rail. It has been illustrated and described in Scientific American Nos. 33, 141, 420, 476, 513, 584, 640, 911, 991, 992, 1014, 1109, 1125, 1422; 10 cents each, mailed.

NEW BOOKS, ETC.

LES MOTEURS À ESSENCE POUR AUTOMOBILES. By L. Marchis, Professor of Physics in the University of Bordeaux. Paris: Published by Vve. Ch. Dunod. 1904. 8vo. Pp. 470, 231 cuts. Price $3.30.

This book is based on lectures given by the author at the University of Bordeaux, before audiences composed chiefly of engineers; but the work is not too technical for the average automobilist, and contains much that is useful to him. An introduction gives the early history of the automobile, and contains tables of speeds made in long-distance racing from the beginning of this sport. The first chapter treats of the various forms of hydro-carbon explosion motors used on automobiles, and of the means employed for studying them and measuring their power. Other chapters are devoted to methods of cooling, mechanically-operated and automatic inlet valves, governing, ignition systems, carbureters, mufflers, and methods of properly balancing motors, with the mechanical principles involved. One of the most important chapters contains rules of construction and operation to be followed in order to avoid fires. This book contains a great deal of valuable information, especially for all interested in the theories met with in automobile construction.

DIE KITTE UND KLEBEMITTEL. Ausfuehrliche Anleitung zur Darstellung aller Arten von Kitten und Klebemitteln fuer Glas, Porzellan, Metalle, Leder, Eisen, Stein, Holz, Wasserleitungs-und Dampfroehren. Von Sigmund Lehner. Sixth revised edition. Vienna and Leipzig: A. Hartleben. 1904. 16mo. Pp. 136. Price $1.00.

We have already reviewed the earlier editions of this work on adhesives, at some length, for which reason it is hardly necessary to enter into a second discussion. It should be observed, however, that some portions of the work have been considerably amplified, notably the chapters on gas and water piping. There is hardly a single industry which does not employ an adhesive of some form in its processes. In this book will be found formulas and methods of applying cements, and the like, for glass, iron, porcelain, stone, wood, leather, and almost every material used in common life.

IRON, STEEL, AND OTHER ALLOYS. By Henry Marion Howe, Professor of Metallurgy in Columbia University in the City of New York. Boston: Sauveur & Whiting, 1903. Pp. xviii, 457. 8vo. Price $5.00.

Alloys are most important in the arts, and we always welcome any addition to the literature of this branch of metallurgy. The present work deals with cooling curves, freezing point curves, the constitution of binary alloys which form no definite chemical compound, variations in electrical conductivity and other properties of series of alloys, the metallography of iron and steel, the heat treatment of steel and cast iron, the phase rule, progress in the manufacture of iron and steel between 1880 and 1900, the blast furnace and metallurgical gas furnaces. The book is a most helpful one to all serious students of metallurgy, and we have no hesitation in recommending it to our readers.

A TEXTBOOK OF ELECTRICAL MACHINERY. Vol. I. Electrical, Magnetic, and Electrostatic Circuits. By Harris J. Ryan, M.E., Henry H. Norris, M.E., and George L. Hoxie, M.M.E., Ph.D. New York: John Wiley & Sons. 1903. 8vo. Pp. 258. Price $2.50.

The form of the material in this volume is the result of several years of experience in its use as a text for the instruction of classes in Cornell University. The book has been designed as a distinctly engineering text, not as a work on physics or applied mathematics. It is a book which will be found of great value to those who have mastered a fair amount of mathematics. It is illustrated by 134 figures, and is admirably printed.

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Saw-guide, H. P. Schofield............... 755,318
Saw-sharpening device, H. P. Schofield..... 755,319
Screen, T. L. & T. J. Sturtevant.......... 755,073
Seal, bottle, A. R. Robertson............. 755,047
Seal, bottle, F. A. Hoons................. 755,573
Seed-drill attachment, B. Mylor.......... 755,523
Self-filling heater or cooler, T. L. Valerius. 755,192
Sewer-system ventilating-pipe, F. Struhs... 755,254
Sewing-machine cabinet, W. C. Free....... 755,292
Sewing-machine hemmer-guide, H. Blaskopf 755,348
Shade cabinet, window, A. E. Kretschmer. 755,017
Shaft-coupling, C. N. Scott............... 755,053
Shaking-screen, T. L. & T. J. Sturtevant.. 755,330
Sharpener, knife, Smith & Sasseman........ 755,599
Shearing and clipping device, J. K. Priest. 755,169
Sheet-delivery mechanism, W. Spalckhaver. 755,068
Sheet-folding machine, C. W. Bennett...... 755,435
Shock-squeezing device, W. I. Brown....... 755,106
Shoe-fastener, C. D. Brent............... 755,270
Shoe-former, F. A. Heath................. 755,488

Shoe-holder, C. B. Kosters.................. 755,015
Shoe-nailing machine, W. Heaton.......... 755,489
Show-case, S. E. Parrish.................. 755,580
Show-case construction, O. Durr........... 755,593
Shuttle, hand-threading, D. Brown......... 755,561
Sifting machine or screen, W. L. Burner... 755,445
Sign, changeable, G. E. Burnham.......... 755,272
Skeining or winding cylinder, J. H. Young.. 755,096
Sled, motor, T. Halldorson................. 754,996
Smoke-consuming apparatus, G. A. Doebbel. 755,220
Smoke-consuming furnace, J. B. Harris.... 754,999
Soap-lock, G. D. Snell..................... 755,553
Soap, etc., machine for stamping, L. L. Conway 755,362
Socket member, P. H. Stein................ 755,407
Socket member, W. S. Richardson.......... 755,582
Sodium sulfid, manufacturing, J. F. White... 755,201
Sound-producing instrument diaphragm, Z. J. Le Fevre 755,506
Speed mechanism, variable, Laur & Robinson 755,504
Speed regulation for motor-driven machinery, system of, G. S. Dunn 754,980
Spinning and doubling apparatus, R. W. Moncrieff 755,153
Spinning and twisting frame doffer, D. E. Carey 755,450
Splicing-tool, A. B. Probasco.............. 755,542
Spring. See Bow-spring.
Spring-head-pinning machine, C. F. Shoemaker 755,005
Spring retaining-clip, E. E. & C. T. Wilt.. 755,266
Stable-beam suspension device, J. Werner.. 755,200
Stacker, hay, J. C. Shafer................. 755,057
Stamp-battery guide, W. S. McDonough.... 755,525
Starch, manufacture of, Goldschmidt & Hasek 755,479
Steam-boiler, D. W. Robb.................. 755,046
Steam-boiler, A. Parfitt................... 755,530
Steam-engine, W. H. Stohlmann........... 755,410
Steam-engine, J. M. Clark................. 755,453
Steam-generators, device for removing steam from the heating-surfaces of, S. M. Cockburn 755,217
Steam-trap, S. Steinmitz.................. 755,251
Steel, etc., converter for making, W. B. Burow 755,215
Still water, F. H. Smith................... 755,179
Stirrup, safety, E. L. Parrish............. 755,531
Stool, folding, Pike & Andrus............. 755,043
Stopper for preventing the refilling of vessels, P. Bonneteau 755,439
Storage apparatus, J. M. Dodge............ 755,566
Storage battery, M. C. Burt............... 754,969
Stove, H. H. Brown.........................755,105
Stove, heating, P. J. Coppens............. 755,277
Strainer, F. G. Brown..................... 755,352
Support, adjustable and collapsible, E. G. Patten 755,039
Suspenders, H. G. Macwilliam............. 755,026
Suspenders, W. O. McCurdy................ 755,524
Suspenders, J. Pusey...................... 755,543
Sweeping-machine, E. L. Keyes............ 755,596
Switch mechanism, electrical, H. Krantz... 755,141
Switch-rod, adjustable, H. Elliot, Jr...... 755,471
Switches, automatic circuit-breaker for electric time or other, A. W. Hutchins..... 755,297
Tank-float holder, G. A. Blake............ 754,965
Telephone, M. C. Burt..................... 754,968
Telephone counting system, J. H. Meyer... 755,515
Telephone-line service-meter, Scribner & McBerty 755,054
Telephone-line service-meter, F. R. McBerty 755,308
Telephone-transmitter, J. A. Williams..... 755,091
Tenoning and boring implement-handles, machine for, G. S. Clow.................. 755,359
Tent, W. Y. Hunter........................ 755,369
Therapeutic purposes, electrical apparatus for, F. C. Fisher..................... 755,121
Thermostat, D. H. Haywood................ 755,487
Thill-coupling, H. C. Ingraham, reissue.... 12,206
Threshing-machine chaffer, W. E. Bradley 755,441
Threshing-machine concave, S. S. Mishler.... 755,152
Till, cash, F. W. Baynes.................. 754,961
Timepiece-holder, illuminated, W. J. Shepherd 755,584
Tins, pots, etc., apparatus for cleaning, W. G. Mortimer 755,521
Tire, cushion, J. H. Toole................. 755,259
Tire protector, pneumatic, L. Niore....... 755,310
Tire, vehicle, P. W. Litchfield............ 755,147
Tobacco-pipe, I. Neuberger................ 755,527
Toilet appliance, J. E. Smith.............. 755,181
Tongs, clinker, C. Clear................... 755,454
Tool, pneumatic, W. H. Soley.............. 755,324
Top, spinning, J. M. Butcher.............. 755,446
Towel or other rack, C. G. Dolbier........ 754,976
Toy, I. D. Worcester....................... 755,339
Trace-holder, C. A. Bertrand.............. 755,099
Track structure, L. Steinberger........... 755,327
Train-signal, J. D. Landers................ 755,143
Transmission of energy, apparatus for wireless, D. M. Moore.................... 755,032
Transom side bearing, M. Dorn............ 754,979
Trap. See Steam-trap.
Trestle-frame, G. H. Smyth................ 755,182
Trucks, pneumatic sander for car, C. A. Pratte 755,539
Tubes, manufacturing, L. O. Bentel....... 755,436
Tubing, implement for truing the ends of, E. D. Webb 755,198
Turbine-engine, rotary, G. Griesche....... 755,481
Turbine, steam, F. D. Shepherd........... 755,062
Turbine, steam, J. B. Evans...............755,474
Turbines, detachable blade for steam, E. E. F. Fagerstrom 754,984
Twisting-machine, belt-driven, J. E. Tynan 755,261
Type-bar bearing, L. Myers................ 755,033
Type-writer indicator, J. N. D. La Touche. 755,502
Type-writing machine, Bettendorf & Bier... 754,964
Type-writing machine, C. H. Shepard..... 755,061
Type-writing machine, Quentell & Judge.... 755,545
Type-writing machine type-arm bearing, J. A. Smith 755,404
Umbrella-carrier, A. J. Igel............... 755,009
Umbrella-rib connection, J. O. Larrabee.... 755,500
Valve, F. F. Tunsberg 755,334
Valve, automatic siphon, A. O'Brien....... 755,036
Valve, compressor, S. A. Reeve........... 755,317
Valve device, C. C. Hedberg.............. 755,000
Valve, end train-pipe, R. M. Dixon........ 755,284
Valve piston and connection, triple, Geltz & Hosack 755,570
Vehicle, dumping, F. I. E. Akers.......... 755,268
Vehicle-gear, T. H. Holman............... 755,491
Vehicle leveling mechanism, J. A. Flyte... 754,985
Vehicle, mechanically-propelled, D. M. Dearing 754,975
Vehicle positioning apparatus, G. A. Ward 755,087
Vehicle running-gear, V. Jeffries.......... 755,228
Vehicle-wheel, Hele-Shaw & Helliwell...... 755,131
Vehicle-wheel, B. B. Weaver.............. 755,421
Ventilating device, C. J. Harrington....... 755,485
Ventilator, F. G. Yawman................. 755,095
Ventilator, W. P. Cosper.................. 755,565
Vessel, sectional molded, W. B. Fenn...... 755,223
Vessels, apparatus for discharging loose cargo from, H. Shoosmith............... 755,064
Vessels in lock-chambers, apparatus for raising or sinking, F. Pokorny......... 755,536
Vibrator, electric, W. MacMillan........... 755,577
Wagon-bolster, J. W. Patterson 755,532
Wagon stake or standard, F. R. A. MacKinnon 755,024
Wagons, device for unloading and distributing earth, manure, etc., from, W. von Chelmicki 755,452
Wall, non-conducting, H. H. Judson........ 755,137
Wash apparatus, C. F. V. Flint............ 755,477
Washing-machine, L. W. Smith............ 755,323
Washing-machine, C. S. Page.............. 755,579
Watch, stop, S. Petrillo................... 755,313
Water-closet, W. Kulow................... 755,498
Water-gage, L. A. Bertram................ 754,963
Water-gages, automatic cut-off for glass-tube, W. Coger...................... 755,456
Water-heater, A. W. Ektrom.............. 755,366
Water-supply, A, Major................... 755,150
Weather-strip, window, J. T. Roberts....... 755,552
Weighing apparatus, automatic, W. Northrop 755,034
Well-drills, crank-movement for, W. R. Vanderwerker 755,083
Well packer, oil, Smith & Wright.......... 755,180
Wheel, T. D. Stagg....................... 755,069
Wheel, J. G. Ranger, Jr.................. 755,316
Wheel construction, W. Kirchman.......... 755,013
Whiffletree-coupling, J. R. Pring.......... 755,541
Whip holder and stretcher, J. A. Weaver.. 755,555
Wind-engine, C. F. Blackketter............ 755,101
Windmill, B. S. Hyatt..................... 755,497
Winder, bobbin, C. Schwartz.............. 755,398
Window-frame, T. F. Ware................ 755,419
Window-frame, metal, H. C. Smith........ 755,585
Window-screen, L. Goetz.................. 755,294

Window, sheet-metal revolving, J. T. Leonard	755,232
Window-weight, J. W. Bryant	755,107
Wire-clamping device, G. L. Hoxie	755,006
Wires, dies for tying intersecting, O. S. Sturtevant	755,185
Wireless transmission, peaked-wave, D. M. Moore	755,305
Wood and vulcanizing same, vulcanized, W. Powell	755,240
Wrench. See Cylinder-tooth wrench.	
Wrench, G. Moore	755,518
Wrench, J. T. Morris	755,520
Wrench and clamp combined, A. L. Nicholson	755,578
Writing-machine, A. Wayne	755,420
Yoke, neck, C. Maples	755,512
Zither, R. Gumz	755,572

DESIGNS.

Clock-case, L. V. Aronson	36,856
Fishbone-tongs, J. Hawkins	36,857
Pin head, hat, W. Turton	36,855

TRADE MARKS.

Boots and shoes, leather, C. E. Green & Co. 42,264,	42,265
Carriage-bolts, Russell, Burdsall & Ward Bolt & Nut Co.	42,281
Clothing, certain named, F. B. Q. Clothing Co.	42,262
Coffee and spice mills, Landers, Frary & Clark	42,284
Dandruff cure and hair-restorer, J. O. Whitener	42,267
Dentifrices, F. G. Plummer	42,269
Hair pins, combs, and ornaments, imitation tortoise-shell, E. & J. Bass	42,259
Ink, Sanford Manufacturing Co.	42,278
Knife-cleaning machines, certain named, Landers, Frary & Clark	42,285
Knitting-machine appliances, certain named, E. Beckert	42,283
Machines for certain named purposes, United Shoe Machinery Co.	42,286
Medicinal tablets for certain named diseases, A. Rogers	42,266
Oil, butter, Kentucky Refining Co. ... 42,271,	42,272
Oil, castor, H. M. Swartley	42,270
Oil, cotton-seed, Kentucky Refining Co. 42,273 to	42,276
Roofing, prepared, S. R. Holland	42,279
Shirts, overalls and coats, workingmen's, Weum-Watt Co.	42,261
Shoes, infants' and children's leather, W. H. Schreier	42,263
Silks, Stewart Silk Co.	42,260
Stone-channelers, Ingersoll-Sergeant Drill Co.	42,287
Stoves and their parts, Shuster & Baer Aktiengesellschaft	42,280
Tooth-paste, tooth-powder, and liquid mouth-wash, J. S. Roberts	42,268
Weaners, calf, Barbee Wire & Iron Works	42,282
Whisky, Scotch, P. Dawson	42,277

LABELS.

"'American Club' Brandy," for cognac, G. Sayer & Co.	10,865
"Coan & Harbin's Koke," for a beverage, Bluff City Bottling Co.	10,863
"Congress Hotel Co. Annex Bourbon," for whisky, Congress Hotel Co.	10,867
"Country Trade," for cigars, Schmidt & Co.	10,873
"Dividend Payer," for cigars, Schmidt & Co.	10,874
"'Eagle Germantown' Lamp Black," for lampblacks and colors, L. Martin Co.	10,846
"Exquisitos Cigarros," for cigars, Central Lithograph Co.	10,880
"'Extra Car Painters' Lamp Black," for lampblacks and colors, L. Martin Co.	10,850
"'Extra Currier's Velvet' Lamp-Black," for lampblacks and colors, L. Martin Co.	10,851
"'Extra Double Refined Superior Coach Painters' Lamp Black," for lampblacks and colors, L. Martin Co.	10,847
"Fino Cigar," for cigars, Central Lithograph Co. 10,882,	10,883
"Flor Fina Cigarros," for cigars, Central Lithograph Co. 10,878,	10,884
"Germantown Black," for lampblacks and colors, L. Martin Co.	10,844
"Gold Share," for cigars, Schmidt & Co.	10,872
"'Golden Star Spirit' Lamp Black," for lampblacks and colors, L. Martin Co.	10,849
"Green Trading Stamp Brand for Groceries," for groceries, Sperry & Hutchinson Co.	10,853
"Habana Cigarros," for cigars, Central Lithograph Co.	10,879
"Home," for condensed milk and evaporated cream, American Condensed Milk Co.	10,862
"Jersey Butters," for biscuits, Ontario Biscuit Company	10,856
"Johnny Mack Mahon's Rattle Snake Oil," for medicine, J. M. Mahon	10,887
"La Fama Cubana De Tabacos," for cigars, Schmidt & Co.	10,869
"Never Slip Rubberized Soles," for shoe-soles, Harrisburg Shoe Mfg. Co.	10,842
"'Old Standard Germantown' Lamp-Black," for lampblacks and colors, L. Martin Co.	10,843
"Ontario Soda Biscuit," for biscuits, Ontario Biscuit Co.	10,857
"P. B. Shoe Superior Quality Style," for shoes, Paul Brothers	10,841
"P M Best 10 Year Old Maryland Rye Whiskey," for Whiskey, P. Malkan	10,866
"Peters' Face Hardener," for a toilet preparation, A. D. Peters	10,885
"Plains Monarch," for cigars, Schmidt & Co.	10,876
"Prairie Blossom," for cigars, Schmidt & Co.	10,868
"Preferred Ham," for ham, Armour Packing Co.	10,854
"Premium Brand," for butter, C. Schallinger 10,858,	10,860
"Puros Fino Cigarros," for cigars, Central Lithograph Co.	10,881
"Race King," for cigars, Schmidt & Co.	10,870
"Red and White," for beer, A. Wilmanns	10,864
"Sail and Rail," for cigars, Schmidt & Co.	10,875
"Scalpia," for dandruff cure, Westchester Drug Co.	10,886
"'Sign Painters' Spirit Lamp Black," for lampblacks and colors, L. Martin Co.	10,848
"Sloat's Distemper Cure," for medicine, G. V. Sloat, Jr.	10,888
"Startwell," for cigars, Schmidt & Co.	10,877
"Torch Black or Commercial Black," for lampblacks and colors, L. Martin Co.	10,845
"Triscuit," for bread, Natural Food Co.	10,855
"Vista Hermosa," for cigars, Schmidt & Co.	10,871
"Weaver 'Quartettes,'" for butter, C. H. Weaver & Co.	10,861
"'XXX' Preservaline," for a preservative and colorant, Preservaline Manufacturing Co.	10,859

PRINTS.

"Artistic Footwear for Women," for footwear, O. McCormick	937
"Egg Chocolates," for candy, C. A. Roach	939
"Ladies' Apparel," for ladies' apparel, Meyer-Both Co.	936
"Men's Apparel," for men's apparel, W. C. Both	934
"Men's Apparel," for men's apparel, Hays, Levi & Co.	935
"Radcliffe Shoe," for shoes, Radcliffe Shoe Co.	938
"The American Girl," for candy, C. A. Roach	940

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