SCIENTIFIC AMERICAN

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Vol. XC.—No. 7.
ESTABLISHED 1845.

NEW YORK, FEBRUARY 13, 1904.

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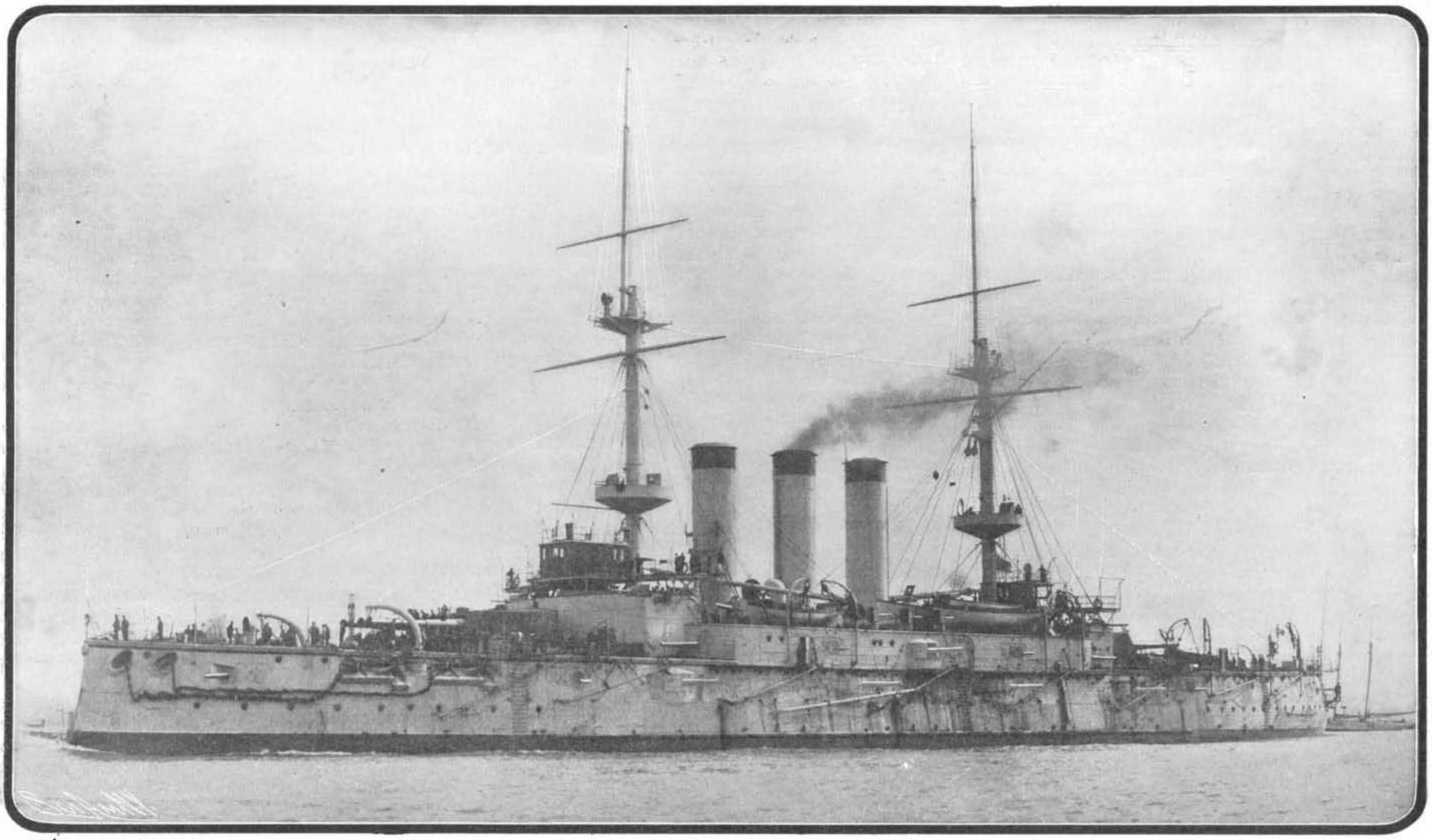

Displacement, 14,850 tons. **Speed,** 18.5 knots. **Bunker capacity,** 1,400 tons. **Armor:** Harvey-nickel. Belt, 9 in. to 4 in.; Side armor, 6 in.; Deck, 4 in.; Bulkheads, 14 in.; Barbettes, 14 in.; Shields, 10 in.; Casemates, 6 in. **Armament:** Four 12-in.; Fourteen 6-in.; Twenty 3-in.; Fourteen smaller guns. **Torpedo tubes:** 4 submerged, 1 above water.

JAPANESE BATTLESHIP "SHIKISHIMA." COMPLETED IN 1899.

Displacement, 9,436 tons. **Speed,** 21 knots. **Bunker capacity,** 1,300 tons. **Armor:** Krupp steel. Belt, 7 in. to 3½ in.; Side armor, 5 in.; Deck, 2½ in.; Gun turrets and bases, 6 in.; Casemates, 6 in. **Armament:** Four 8-in. R. F.; Twelve 6 in. R. F.; Twelve 3-in. R. F.; Twelve small guns. **Torpedo tubes:** 4 submerged, 1 above water.

JAPANESE ARMORED CRUISER "ADZUMA." COMPLETED IN 1901.—[See page 134.]

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ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) .... $3.00 a year
Scientific American Supplement (Established 1876) .... 5.00 "
Scientific American Building Monthly (Established 1885) .... 2.50 "
Scientific American Export Edition (Established 1878) .... 3.00 "

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, FEBRUARY 13, 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.

OUR SYSTEM OF NAVAL COMPARISON.

In the present series of articles on the Japanese and Russian fleets, we follow the system of classification and comparison which the SCIENTIFIC AMERICAN inaugurated at the time of the Spanish-American war. The difficulty of making a really satisfactory comparison is proved by the many different systems that are adopted by naval writers. Some of these, in which the mere number of ships is taken, or the aggregate number of guns and the thickness of the armor, are obviously misleading; for the value of a navy is not to be determined by any one of these features alone, nor, indeed, by any two or three of them. At the same time, a system of comparison that enumerates all the elements of efficiency becomes too elaborate and cumbersome for practical and rapid use. A ship of a given size can only embody a certain amount of the elements of fighting efficiency. She may carry an unusually heavy battery and thick armor, but it will be done at the expense of the speed or the coal endurance, as in the case of the "Indiana" or "Massachusetts." Again, the vessel may be extraordinarily fast and capable of steaming half way round the world without recoaling, like our "Minneapolis" and "Columbia;" but her speed and wide radius of action will be gained at the expense of armor and armament. In other words, it is impossible to get a "quart of efficiency out of a pint of displacement." The science of naval design consists in securing such an apportionment of the total displacement of a ship to the different elements of efficiency, as shall best meet the requirements of the nation in whose service she is to be employed. At the same time there is such a considerable difference in the service required of their ships by the various nations, a difference due to geographical position and general foreign policy, as to render it difficult to institute any hard-and-fast comparison between the navies of the world. The best that can be done is to compare them as to their actual fighting value on a basis of displacement and age.

The leading naval architects of the world are so thoroughly in touch (thanks to that admirable institution the Office of Naval Intelligence, and its like) with each other's work, and with the contemporaneous improvements in war material, that we think it is safe to say that a thousand tons of displacement in a battleship of a certain age is worth about as much as a thousand tons in another battleship of the same age, even though the ships may differ greatly in design. This statement, of course, does not apply to vessels in which glaring defects of design and workmanship are known to exist; but as a general rule a comparison based on displacement and age may be safely followed. In comparing the efficiency of navies, age is the most serious consideration, for the reason that the improvement in designs and in the efficiency of war material is so rapid, that every year added to the age of a warship depreciates its efficiency relatively to the most modern ships of the same class, and, therefore, we think that no vessel over ten years old should be reckoned as a first-class battleship, while those that are ten to twenty years old should fall into the second class, and those older than twenty years be considered as suitable only for coast defense. The armored cruisers being modern vessels are arranged in three classes according as they are above 10,000 tons in displacement, above 7,000 tons and below 7,000 tons; while the protected cruisers are arranged in four classes, the limits of which are 10,000, 7,000, 4,000 and 2,000 tons, all protected or unprotected boats below 2,000 tons being placed under the category of small cruisers and gunboats.

VALUE OF CORRECT PROPELLER DESIGN.

The great importance of providing a steamship with suitable propellers has been illustrated in an experiment, which has been tried recently in the English navy on a large number of cruisers known as the County class. There are fifteen of these vessels, ten of them of 9,800 tons displacement, designed for 23 knots speed, and six of 10,700 tons displacement, designed for a speed of 22¼ knots. When the first of these vessels underwent their steam trials, they failed to come up to their full speed, even when running under full power, the best of them, the "Sussex," making only 22.79 knots, and the "Kent" reaching only 21.7 knots under these conditions. As the designed horse power of 22,000 was reached in these trials, it was considered that the deficiency in speed was probably due to the propellers, which were 16 feet in mean diameter, of 19 feet 6 inches mean pitch, and had a total area on their four blades of 54 square feet. It was decided to increase the surface; which was done by designing new four-bladed propellers, with a diameter of 15 feet 9 inches, a pitch of 20 feet, and a total surface of 80 square feet. On five ships which were tested under the new conditions, there was a most remarkable increase of speed, ranging from a knot to 2¼ knots above the speed of the earlier sister ships. Thus, while the "Kent," with her propellers of small area of surface, made only 21.7 knots under full horse power, the "Berwick" steamed at 23.6 knots, the "Donegal" at 23.56 knots, and the "Lancaster" at 24.01 knots. It was recorded in the SCIENTIFIC AMERICAN some months ago that the 14,000-ton armored cruiser "Drake" had a similar experience, a change of propellers raising her speed from 23 to 24 knots per hour. The fact that a similar gain should have been made in a vessel of 50 per cent more displacement and of different lines, renders it pretty certain that the increase in speed was due entirely to the use of propellers of larger surface and coarser pitch. It is, of course, well understood that the designing of propellers is not an empirical problem, although it is a complicated and difficult one. Account has to be taken of a great many elements, such as the form of the vessel, her speed, the flow of the stream lines as the water closes in and sweeps past the stern, etc.; but even when this is admitted, the experience with these British ships certainly affords much food for thought. There is probably no body of men that has had such a wide and varied experience in this particular problem of the relation of propellers to high speed in large vessels as have the naval designers of Great Britain, where for some years they have been turning out warships of speeds that vary from 21 to 23 knots an hour. It must certainly be admitted that the advantages of big surfaces and coarse pitch receive a strong indorsement in the remarkable results above recorded.

PRECAUTIONS AGAINST POISONING THE QUEEN BEE.

The safeguards provided against the administration of poison to the Empress of China are rudimentary, compared with those which stand between queens of the honey bee and such a risk. Curiously enough, this is a phase of the internal economy of the beehive which appears to have escaped observation.

In the British Isles, no poisonous honey is collected. If it exist, the bees have learned to avoid it. Probably there is none, as the honey from at least one dangerous plant—the deadly nightshade—is harmless. Ivy honey would be the most suspicious of any gathered on a large scale, and it only exerts, so far as observation goes, a slightly laxative effect on the digestive organs. Although, in this country, no poisonous honey is known, it is met with in other places, notably in Asiatic Turkey. It was in this region that Xenophon's soldiers were poisoned, 2,300 years ago, by honey from the *Azelia pontica*, a plant which still flourishes in Armenia. Some centuries later a Roman army suffered similarly, but less severely, there being no deaths.

The precaution of compelling the cook to eat a portion of every dish, which is the usual safeguard of despotic rulers, or the still more primitive plan of giving the first helping to a little dog, can be eluded by having only one-half of a bird or pastry poisoned. In a wasp's nest, each forager on returning proceeds directly to the queen, and offers refreshment, consequently the queen is sometimes destroyed by slowly-acting poison. Farther as regards wasps, it is observed that when any larvæ not recently fed perceive the queen receiving food, they become restless. If nearly grown, they wag their heads in a suggestive way which plainly conveys a demand for a share. Each forager after feeding the queen gives the balance of his load direct to the nurses. In the case of the honey bee, one possible reason why no virulently poisonous honey reaches the hive may be that the insect foolish enough to collect any would probably die, as the so-called honey sack is really a stomach in which a preliminary digestive process proceeds. This is proved by the polariscope, which shows that while the nectar of the flowers is pure cane sugar, or levulose, the substance in the hive cells is sacrometrically half dextrose and half cane sugar. Dextrose is invert sugar, a coarse variety of which is the glucose of commerce. Forager bees returning to the beehive place the half-digested product known as honey in their storeroom with other honey. This mixing would have the effect of attenuating a poisoned load, should such be brought in. Foraging bees never feed the queen or young larvæ, but they give a mouthful or two to drones in passing. Just before sealing for the metamorphosis, workers and drones are fed with honey mixed with pollen. Not so the young queens, who only get a farther supply of the redigested milky substance known as chyle, which is the sustenance of all larvæ indiscriminately during the first three days of their existence. During the chrysalis stage there is no feeding. It is the business of a gang, distinct for the time being, to cater for the queen and young. They bring the food from the stores, submit it to the digestive process referred to, after which it is regurgitated to supply the needs of the queen and young larvæ. The attendants are numerous, and each supplies only a minute quantity. The queen bee is so constituted that her digestive system is capable of assimilating only the prepared food, or chyle. She will die in a few hours on a comb containing honey, although kept at the temperature of the hive.

Thus it would appear that the safeguards are:

1. A bee collecting poisonous honey would probably die before reaching the hive.

2. If one succeeded in depositing poisoned honey, the circumstance that it did so would prove the poison to be not virulent, and its mixture with other honey in the storeroom would still farther attenuate the poison and render it harmless. This is the stage at which the product becomes human food. It has, as stated above, occurred that poisoned honey has passed both these lines of defense.

3. Should the honey be still deleterious, the alimentary attendants of the queen would first suffer, and only those bringing wholesome food would reach her, as a struggle for the privilege of feeding Her Majesty is continually in progress.

4. Should the stores pass the three safeguards before mentioned, there is still another, viz., that each one of the queen's attendants feeds her only for a second at a time, and thus she would never get a sufficient quantity to affect her seriously. The queen is always on the move, and the competition to feed her so great that she is continually bringing fresh bees in front of her, from which position alone food can be administered. No worker bee would think of jostling—everyone gives way to—the queen.

Uneasy monarchs and others may find some suggestions in these arrangements for securing their safety. Probably they will decide to take their chances rather than avoid risk by living on food which has previously been digested by subjects, however loyal.

THE EIFFEL TOWER.

In the SCIENTIFIC AMERICAN of December 26 it was announced that the famous Eiffel Tower was about to be razed to the ground, for the reason that it displayed a marked toppling tendency. M. Eiffel denies the statement that the famous structure is to be torn down, and refers to the report of M. Mascart, president of the Academy of Sciences, in which it is said that "the tower is in a perfect state of preservation, and that no change of position has been noted either in the foundation or in the framework." So far from having sunk to one side, the tower seems to have preserved its position with all the constancy that could be desired. Every competent commission that has ever studied the tower has advocated the preservation of the structure, and vouched for its scientific utility. The first of these recommendations was given to the public on August 11 last, at the Congress of Angers, by the French Association for the Advancement of Science. The views of this society on the safety of the structure were reiterated by the Society of Civil Engineers. Some fifteen days before this second recommendation, a report was handed in by the supervising commission of the tower, whose president is M. Mascart, a quotation from whose report has already been given. After other considerations, among them the scientific service rendered by the tower, it is stated that the preservation of the structure would be to the interest of the public and of science.

The technical committee of the Prefecture of the Seine received at its meeting of the 6th of November the report of M. Pascal, government architect and member of the Institute, which strongly advocates the preservation of the tower. The report of M. Pascal was adopted. Besides this report may be also mentioned the petitions of various municipal councilors presented to the Municipal Council at Paris in the name of the Seventh and Fifteenth Districts for a preservation of the tower.

The administration, on the recommendation of Chérioux, president and author of the report, adopted the recommendations of the Technical Committee. The Municipal Council followed suit.

A brief history of the tower may not be without interest. Begun in 1887, the structure was completed in 1899, and formed one of the noteworthy features of the Paris Exposition of that year. Its cost was in all 7,799,401.31 francs. The total weight from the substructure to the very top is 9,700 tons. The weight of

the metal is 8,564,816 kilogrammes (9,426.7 tons). The vertical pressure, when the wind is calm, varies from 4.1 kilogrammes to 4.5 kilogrammes per square centimeter. The generally accepted hypothesis for the intensity of the wind gives the figures as 300 kilogrammes per square meter exposed, which exposed surface amounts to 8,515 square meters. The corresponding overturning force is 2,554 tons, exerted at a height of 84.9 meters above the level of the substructure. At this level the maximum pressure is received on the girders nearest the center. The pressure is about 723,750 kilogrammes without wind and 1,075,250 kilogrammes with the wind. The total maximum pressure on the soil is received on the north piles under the caisson of the framework. It amounts to about 5.95 kilogrammes per square centimeter.

So far from being unsafe, the tower is pre-eminently secure.

THE FUEL SUPPLY OF THE JAPANESE NAVY.

There are two little seaports on an island off the Asiatic coast which may play a very important part in the Russo-Japanese war, if hostilities are declared. Naval strategists believe that one of the first things Russia will try to do is to cut off the coal supply of the Japanese fleet, if possible, and from the two places referred to comes a very large proportion of the fuel burned on the Mikado's warships. They are both situated on the island of Hokkaido, or Jezo, which adjoins the island of Nippon—the largest of the empire —on the north. Mororan is on the southern coast, on the shore of Volcano Bay, so named from the number of volcanic peaks which overlook it. Otaru, the other port, is on the west coast. These towns are just about large enough to be noted on the map, but are among the largest coal-shipping points in the world, as their harbors are ample to float vessels of deep draft. Jezo is directly east of the Russian possessions in Asia, and a steamship leaving Vladivostok could reach either port easily in two days, as they are not over 500 miles from the mainland.

Naval experts believe that as soon as war is declared, Japan's first act will be to send squadrons to guard these ports, to prevent Russia from landing troops and taking possession of the coal mines, for these are more extensive in proportion by far than any other group in the empire, and the coal is of a very high grade, especially suitable for vessel fuel. Although but little was done to secure the coal before 1890, the output increased from about 300,000 tons in 1893 until it is over 1,000,000 tons at present, one company alone during the past year mining 860,000 tons. This is the Hokkaido Tanko Tetsudo Kaisha, one of the wealthiest corporations in the world. It not only owns coal mines, but railroads, steamship lines, most of the harbor front of the Mororan and Otaru, besides warehouses, coal piers, etc. Its capital is no less than 20,000,000 yen, equal to $10,000,000 in American money, and it has been so prosperous that it has paid annual dividends to its shareholders ranging from 20 to 30 per cent, partly through the contracts which it has to supply the imperial government with fuel.

The mines on the island of Hokkaido are in several great groups, although but a part of the territory of coal-bearing deposits has been examined by geologists and mineral experts. They have estimated that the groups owned by the company referred to alone contain fully 250,000,000 tons of coal, near enough to the surface to be easily secured. The Sarachi group is the largest at present operated, and comprises an area of 5,500 acres, upon which have been found ten veins ranging from 3 feet to 7 feet in thickness; but the greatest producers are the mines of the Yubari group, representing about 4,800 acres, for here have been found veins no less than 25 feet in thickness. Analyses of the coal show it to be a high-grade bituminous, excellent for not only steaming but gas and coke making, so the company has built a large number of coke ovens in connection with the pits. The third group, known as the Purowai mines, is considerably smaller, comprising only about 727 acres, while the fourth covers about 600 acres.

To operate the various collieries, the company in question employs a force of 8,000 people, of whom about 1,500 are women, but all of the mines are equipped with American apparatus on an extensive scale. For instance, compressed-air cutting machinery is used for working the larger veins; mine locomotives, also operated by compressed air, haul the coal to the bottom of the shaft, and the elevating machinery was also built in the United States purposely for the industry. The galleries and shafts are lighted by electricity, and in fact everything connected with the operations is as up-to-date as at any mine of this country. The railroads connecting the mining district with the seacoast are also largely built and equipped with American material. The company owns 212 miles in all, one line extending from Otaru and the other from Mororan. The government has built a system in the interior with which both of the coal railroads form connection, and of this fact the Russians are probably well aware. Consequently, unless they are well guarded, the island could be easily invaded and the mines seized, as they are but a comparatively short distance from the seacoast. The Yubari group, which is the principal producer, is less than 100 miles from either of the shipping ports, and the Sarachi group, which is the farthest from the coast, is but 117 miles distant.

PROGRESS IN THE STUDY OF RADIUM AND RADIOACTIVITY.

MINERAL WATERS AND RADIUM.

At a meeting of the Bath Town Council recently Mr. T. Sturge Cotterell stated that Prof. Dewar had, at the expense of the Royal Society, and with their concurrence, collected the gases that arose in the largest and perhaps the best known of their hot mineral springs, the King's Bath. The analysis of the gases revealed the fact that the rare element helium existed in the waters. The presence of helium led to the belief that something more of scientific interest might be found in the deposits that collected in the tanks and pipes at the three springs. A few weeks ago a quantity of the deposit from the new Royal spring was obtained and sent to the Hon. R. J. Strutt, son of Lord Rayleigh. "My experiments have," he says, "led to some conclusions which may, I hope, interest the [Baths] committee. I have found that the deposit contains radium in appreciable quantities, though I am sorry to say not enough to pay for extraction. It will be remembered that the gas which bubbles up from the springs contains a small proportion of helium. Sir William Ramsay has recently made the most important discovery that radium slowly evolves helium by a spontaneous change. I think there can be but little doubt that the helium of Bath owes its origin to large quantities of radium at a great depth below the earth's surface. A little of this radium is carried up by the rush of hot water and is found in the deposit. My experiments promise further interesting developments, which I shall have much pleasure in bringing to the notice of the committee in due course." Mr. Cotterell said it would be noticed that Mr. Strutt stated that radium existed in "appreciable quantities," and as this appeared to require further explanation he wrote to him and received a reply. Mr. Strutt said: "When I speak of 'appreciable quantities' of radium, I mean quantities such that its presence may pretty easily be detected. But the percentage of radium in the deposit is very much less than that in the ores which are at present used to obtain it from. The reason why the presence of radium is so easily detected, in spite of the smallness of the proportion present, is that the tests are exceedingly sensitive; indeed, the only reason why so small a proportion of radium could be detected was the unique and extraordinary properties of that substance."

In connection with the experiments on the waters of Bath, Prof. Henry A. Bumstead's work in an allied field is of interest. Prof. Bumstead, and his assistant Prof. Wheeler, have been experimenting with the radium found in the surface water and the ground around New Haven, and have published in the American Journal of Science a detailed account of their work. As a result of his many months' investigations, Prof. Bumstead draws three conclusions of greatest interest to investigators. In regard to the presence of a radio-active gas in the ground and surface water near the city Prof. Bumstead says first:

"The radio-active gas found in the ground and in the surface water near New Haven is apparently identical with the emanation from radium. If any other radio-active constituent is present it can only be in a very small proportion."

The second conclusion deals with the density of the radium emanation and is as follows:

"The density of the radium emanation, as determined by its rate of diffusion, is about four times that of carbon dioxide, which gives it a molecular weight of 180."

In closing his experiments with the gas Prof. Bumstead attempted to determine the properties of the active gas recently obtained by Strutt from metallic mercury, and in regard to this he says:

"We were unable to obtain the radio-active gas from mercury recently described by Strutt, and are therefore inclined to attribute his results to an impurity in the mercury used."

THE X-RAYS AND RADIUM IN THE TREATMENT OF CANCER.

The Annus Medicus of the Lancet refers especially to the therapeutics of cancer, quoting from a paper published in the first volume of the "Archives of the Middlesex Hospital," by C. R. C. Lyster, the medical officer in charge of the electrical department of that institution. In writing of the effect which the X-rays have upon cancerous growths, the author says "that a very large number of cases have been relieved of pain, and that in a certain number the growth has undergone a definite retrogression; of all the new growths the rodent ulcers have been by far the most satisfactory to treat. The cases that have been under treatment have varied from those exhibiting small recent spots to the most extensive and old-standing lesions. They have all shown a great tendency to improve; the more recent ulcers have quickly healed, leaving a healthy scar, and there had been no recurrence up to the time of publishing the report. In cases of rodent ulcer of long standing, and with considerable loss of tissue the tendency to heal has been remarkable, but after a time, recurrence is not unusual, and this seems to be more difficult to deal with than is the original ulcer. Of other growths, experiments so far seem to show that the best results are obtained in cases of mammary carcinoma, especially in the recurrent forms. Sarcomata are not so amenable to treatment as are carcinomata. The cases which are apparently the least benefited are the epitheliomata, and this is more especially the case after secondary infection of the lymphatic glands has occurred. With regard to the use of high-frequency currents in malignant disease, it is believed that the good results claimed for this therapeutic measure are due more to the tonic action of the rays than to any direct action on the growth itself. Cases of rodent ulcer and epithelioma were submitted to the action of radium and also to pitchblende, the application of the latter substance being of particular interest, as it is far more easy to obtain than radium; the results of the treatment have not yet been published."

The Lancet, in reference to radium in the treatment of cancer, says: "Full of theoretical interest as the discovery of radium is, its remarkable property of radio-activity has already met with practical application in the treatment of disease, but its real value in this regard, as in the treatment of cancer and lupus, cannot yet be determined. The radio emanations are undoubtedly powerful to produce chemical change, but it remains to be seen whether they will be effective in checking the advance of a morbid process, or of destroying, or of restoring to a healthy state, diseased tissue."

The Vienna correspondent of the British Medical Journal states that Exner and Hozknecht have used radium in the treatment of carcinoma and sarcoma with satisfactory results. The conclusions reached by these investigators are as follows: "Radium rays irritate the cells of the skin less vehemently than cells of cancer and sarcoma. The last named are brought to necrosis before the other tissues suffer severely from the effects. The radium dermatitis is very similar to the Röntgen rays dermatitis." The experience then of the majority of medical men who have used X-rays in the treatment of cancer is that in some forms of the disease they have proved decidedly beneficial. As to radium, its use has been too limited and the period in which treatment has been effected by its means has been too short to warrant the passing of a definite opinion with regard to its efficacy as a therapeutic agent in cancerous growths.

THE CURRENT SUPPLEMENT

A splendid picture of the great electrical power plant of the city of Berlin will be found on the front page of the current SUPPLEMENT, No. 1467. The article which accompanies the picture describes the mechanical and electrical novelties of the station. Other electrical articles of interest are those entitled "The Electric Furnace in Metallurgy," "Prof. Slaby's Experiments in Wireless Telegraphy," and "Contemporary Electrical Science." Prof. S. P. Langley concludes his scholarly biography of James Smithson, founder of the Smithsonian Institution. The problem of increasing the fertility of the soil is one that is of especial importance. An exceedingly valuable and instructive contribution to the literature on the subject is George T. Moore's paper on "Bacteria and the Nitrogen Problem," published in this week's SUPPLEMENT. The many inquiries received by the Editor for information pertaining to the caoutchouc-yielding Landolphia of the French Congo will find their answer in an exhaustive discussion of the subject by M. Aug. Chevalier.

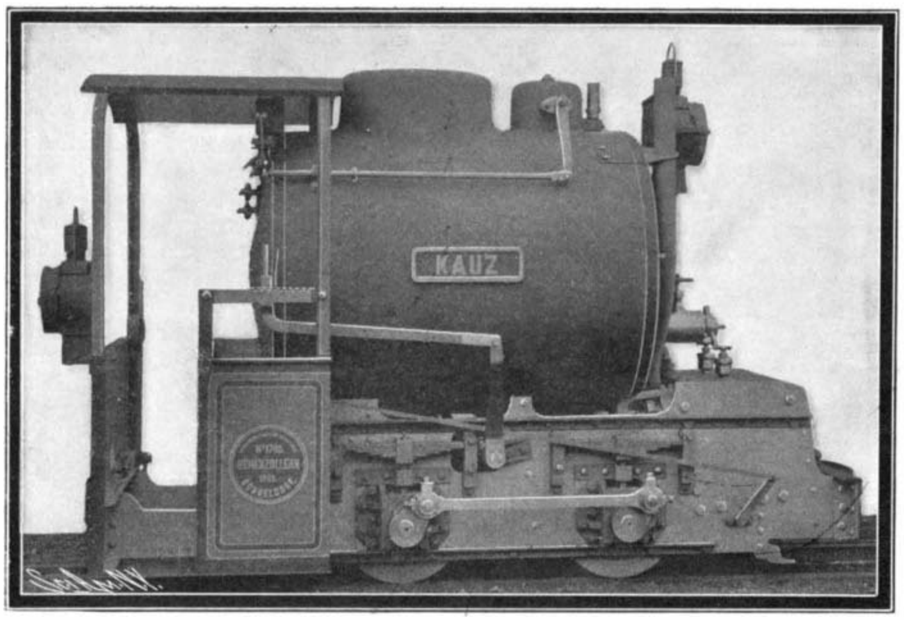
THE HYDROSCOPE AND ITS SUCCESS.

Cavaliere Pino is the inventor of a machine called the hydroscope, to which reference has already been made in these columns. The instrument consists of a long tube carrying an optical instrument at the end. Objects at the bottom of the sea are reflected upward, where they may be readily studied from the deck of a steamer. By means of the hydroscope, Pino succeeded in bringing up objects from the sea that have been concealed for two thousand years. These were found off the Grecian coast, and include some valuable art objects—creations of ancient Greek art.

The flooding of the Kansas River last May resulted in some very curious changes in the river bed. At one of the curves in the river cut-offs were formed, which caused the water to flow for a distance of two miles through the old bed, but in an opposite direction to the old current. A complete description and discussion of the peculiar conditions produced by this flood may be found in the current SUPPLEMENT, No. 1467.

SAFETY LOCOMOTIVE FOR EXPLOSIVES FACTORY.

The accompanying illustration shows a handy little locomotive that has been designed and built at the Hohenzollern Works in Dusseldorf for use in factories that are devoted to the manufacture of gun powder and high explosives. Although it is a steam engine, it has no fire box, nor does it carry fire or flame of any kind whatever. For its motive power it depends entirely upon its boiler or hot-water reservoir which is filled with water, under a pressure of several hundred pounds to the square inch and a corresponding temperature of several hundred degrees. Our readers will recognize in this an adaptation of a system that has been in use for many years, and that has found considerable favor in Germany. The boiler is charged from a stationary plant with water heated to a point far beyond the temperature at which it would boil under atmospheric pressure. When the locomotive commences to move and the steam is drawn off from the boiler, the pressure of course is lowered, and as soon as it falls below the point corresponding to the temperature of the water, the latter begins to boil, giving fresh supplies of steam. Thus, as the engine is operated there is a fall of pressure with a corresponding boiling of the water. Care is, of course, taken to thoroughly lag the boilers, steam pipes and cylinders, and when once the boiler is charged, the engine is capable of independent operation for a considerable period of time. The first warming up of the locomotive requires about thirty minutes, and an unskilled laborer can soon learn to handle it satisfactorily.



SAFETY LOCOMOTIVE FOR EXPLOSIVES FACTORY.

BOILER SCALE DETECTION.

BY GEORGE J. JONES.

The subject of boiler scale is now the most embarrassing matter encountered by engineers in the economical operation of power plants. In these days, every item of cost is carefully watched and results noted, in order to see that full return is received for the expenditure, and every penny which cannot prove its justification is cut out. But in the matter of boiler scale, power plant engineers and operators have been more or less in the dark. It has been known full well that a coating of scale on the tubes of a boiler stood for a vicious extravagance, but as the formation is not in view, and has been heretofore hard to determine without throwing the plant, at least partially, out of service for a considerable time, many a plant has been allowed to run along with its efficiency impaired to a great degree by a coating of the scale on the heating surfaces of the boilers.

Just exactly what this embarrassment represents in figures is a difficult matter to accurately determine; but Thurston, who gave the matter some special attention and wrote a book on the subject, says that half an inch of scale on the tubes of a boiler represents an increase of sixty per cent in the coal bill. On what basis this statement was made is not known; but it has been clearly demonstrated more recently in the case of a large plant at Bayonne, N. J., in a very complete test, that the coal consumption was cut down by 23 per cent after a thorough cleaning of the boilers.

We have said that heretofore there has been no means of determining its presence, but in most of the large plants it is the custom to clean the boilers thoroughly at regular intervals. By a recently patented invention, that of L. Bancroft Mellor, of Philadelphia, it is now possible to quickly and accurately arrive at the amount and location of formation on boiler tubes or other similar surfaces. This instrument is shown in one of the accompanying cuts. It not only shows the extent of scale and other extraneous matter, but also detects blistering and other defects which may increase or diminish the normal diameter of the tube or cylinder. The variation in relative distance between two measuring points of the device is recorded on a revolving disk. The instrument consists of a tube serving as a frame having a traverse wheel mounted thereon, which rotates by contact with the inside of the tube to be measured, as it is passed through for the purpose of exploration. This wheel by suitable gearing rotates a disk on which is mounted a chart or dial. A movable arm opposite the traverse wheel is mounted on the frame, which acts as a lever, causing a reciprocating motion of a rod carrying a pen, which rests on the chart, the motion of the pen corresponding to the reciprocating motion of the arm. Thus the relative distance between the traverse wheel and the arm is recorded, and the varying distance of the tube through which the instrument passes is approximately recorded in a sinuous line. The length of the frame tube can be varied to suit any length of tube by adding sections of frame tube between the traverse wheel section and the revolving disk. Some of these record disks are shown, indicating different boiler conditions.

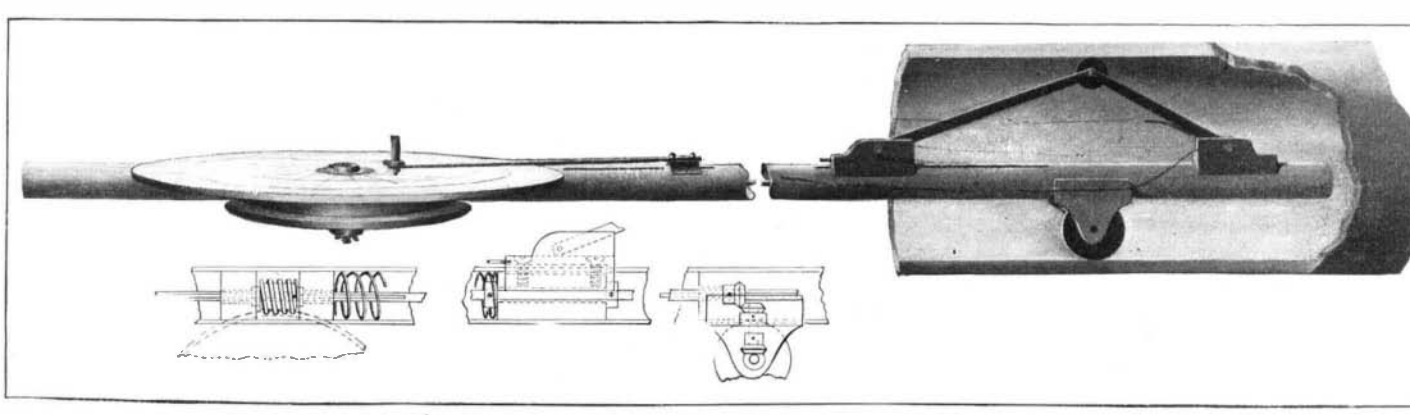
The reason for the presence of scale has never been explained satisfactorily, although a great deal of time has been spent by scientific men in the endeavor to solve, not only the mystery of its origin, but to arrive at some means of preventing the deposit. It takes place with the use of all kinds of water except distilled, and of course this is out of the question for general power plant use.

Because of the inconvenience and expense of determining the presence of the formation, many a plant is in operation to-day, with its boiler tubes choked almost to the point of stoppage of circulation. The engineer is probably making use of some alleged scale-preventing compound or subjecting his feed water to some treatment with the same object in view. In blissful ignorance he is therefore responsible for greatly increased fuel bills, while he is congratulating himself that his boilers are doing their best work.

Boiler scale has many marked characteristics, as shown in the accompanying cuts, which are samples taken from boilers worked under different conditions. In the first of the tube sections shown, the interior was almost sealed, the circulation being maintained through a number of small holes in the center of the crust. The large hole shown in the same photograph was made in the operation of cutting the section out.

SCALE-FILLED TUBES.

The device described above has been adopted by the leading boiler-insurance company of this country, to be used in determining the condition of boilers after explosions. It has also received the indorsement of the Franklin Institute in being awarded the John Scott Legacy medal and premium.



A DETECTOR AND MEASURER OF SCALE FORMATIONS IN BOILERS.

A PRACTICAL PRIMARY BATTERY.*

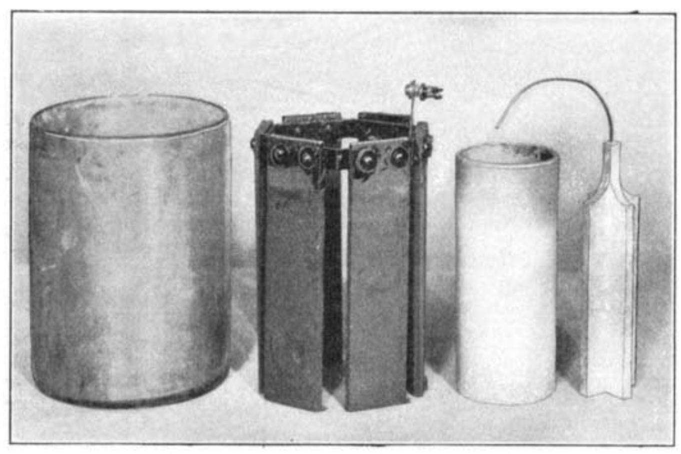
Every amateur who delights in "making things" dabbles more or less with electricity. Most of these are so situated that they have no access to the large sources of supply of the electric current, such as lighting stations can furnish, and if they would do any real work, must make their own generators and apparatus. It is to the assistance of such that the present section is devoted.

The battery represented in our engraving can be made at a minimum cost, and when made will give a maximum of output. The materials to be purchased are glass jars, porous cups, carbons, zincs, burrs, screws, binding posts, and some sheet copper.

All the pieces for the cell come ready for use, except the carbons, which are peculiar to the special form of cell. As the cut shows, there is a ring of carbons to be placed in the glass jar and to fit in the jar as closely as may be without exerting pressure upon the jar. Six plates of carbon are required for each ring. Each plate has two holes of a size to fit the screws. The holes may be made most easily by awls and reamers, such as are to be found in a set of tools in an awl handle. A little patience and experience will enable any one to make the holes neatly. Carbon is very hard and will wear a drill very fast. Hence, it is better not to attempt drilling holes in a carbon plate. Of course the holes should be equally spaced, if the appearance of the finished work is to be considered.

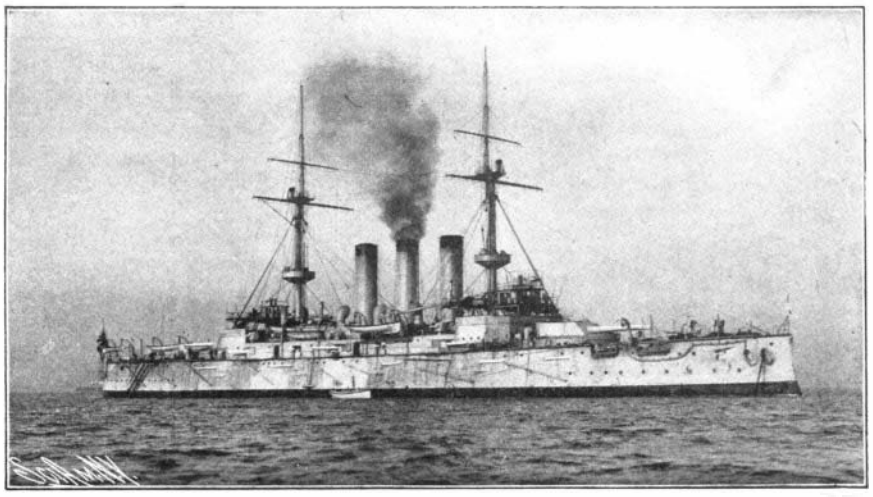
The copper should be about 1-32 inch in thickness and about ⅝ inch wide. It can be bought of this width, or cut by the dealer or by a smith with large shears. A strip must be bent into a six-sided ring of such size that when the carbons are fastened to it the whole will slide snugly into the glass jar. It will be better after one strip has been fitted to its place to straighten it out and use it as a pattern, or template, by which to drill the holes in the rest of the copper strips. They will then be all alike and interchangeable. A template should also be used for making the holes in the carbons, though all holes may be reamed a little on one side or the other to allow the screw to pass through. If the worker has no means of tapping a thread for the screw, he should buy nuts for the screws also. The holes in the copper strips may be punched with a nail punch, if one has no means of drilling them. For punching holes in this way the end of a stick of hard wood should be used as a bed on which to rest the copper which is to be punched. The strip of copper which leads up out to the binding post may be riveted to the ring, or one end of the ring may be left long enough to bend up a couple of inches above the top of the jar. The carbons should be long enough to reach above the jar so that the metal parts shall not touch the glass. In this battery the fluid employed will corrode metals very rapidly.

(*Continued on page 138.*)



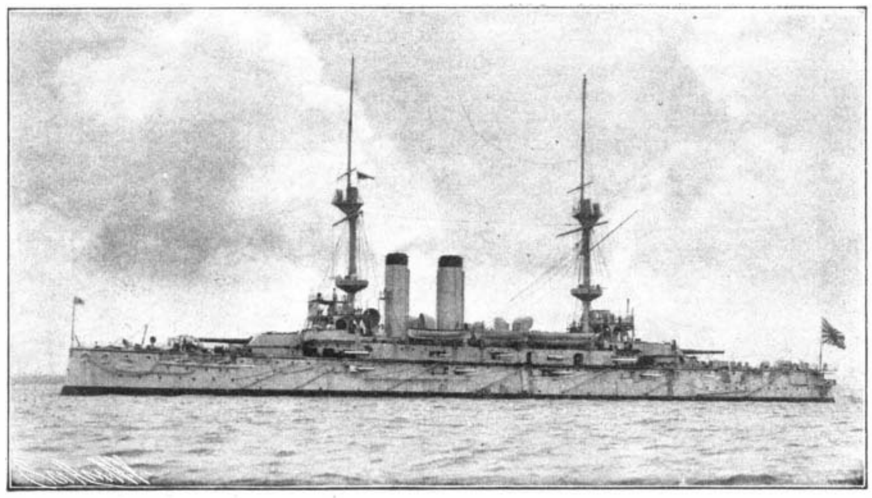
A PRACTICAL PRIMARY BATTERY.

* From "Home Mechanics for Amateurs." By Geo. M. Hopkins. Copyright 1903 by Munn & Co. Publishers.



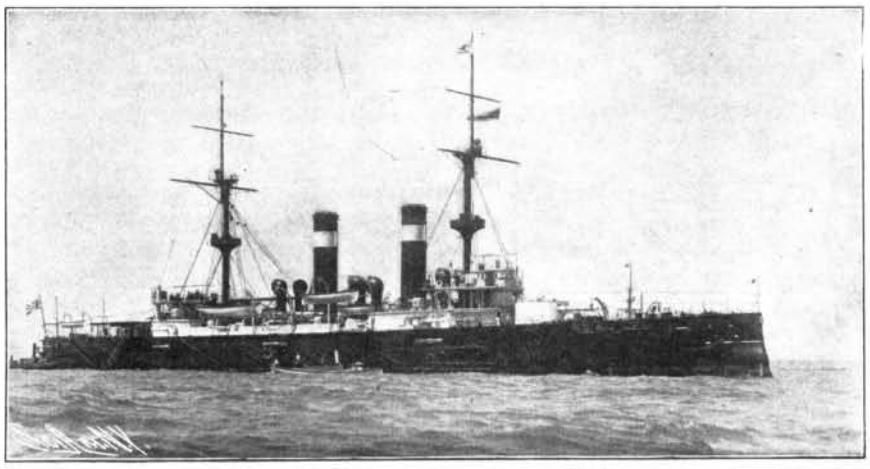
Displacement, 15,000 tons. **Speed,** 19.1 knots. **Bunker Capacity,** 1,500 tons. **Armor** (Harvey-nickel): belt, 9 inches to 4 inches; side, 6 inches; deck, 4 inches; barbettes, 14 inches; shields, 10 inches; casemates, 6 inches. **Armament:** four 12-inch; fourteen 6-inch; twenty 3-inch; 14 small guns. **Torpedo Tubes,** 4 submerged.

Battleship "Hatsuse." Completed in 1900.



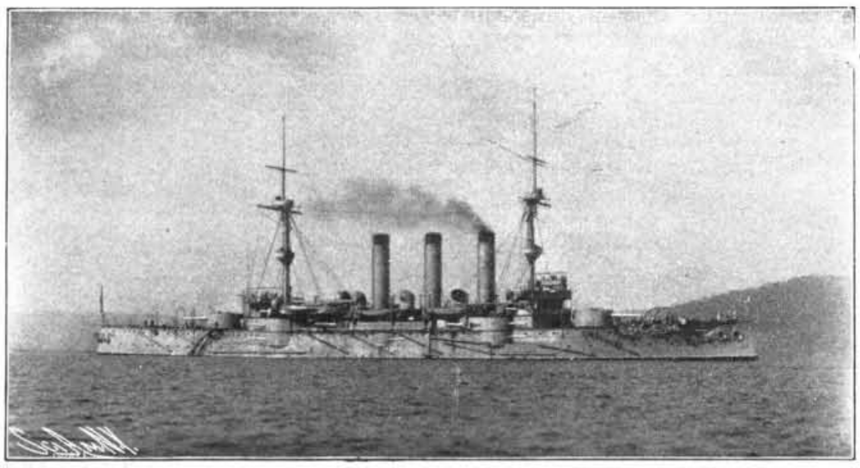
Displacement, 15,200 tons. **Speed,** 18.3 knots. **Bunker Capacity,** 1,400 tons. **Armor** (Harvey-nickel): belt, 9 inches to 4 inches; side, 6 inches; deck, 4 inches; barbettes, 14 inches; shields, 10 inches; casemates, 6 inches. **Armament:** four 12-inch; fourteen 6-inch; twenty 3-inch; 14 small guns. **Torpedo Tubes,** 4 submerged.

Battleship "Asahi." Completed in 1900.



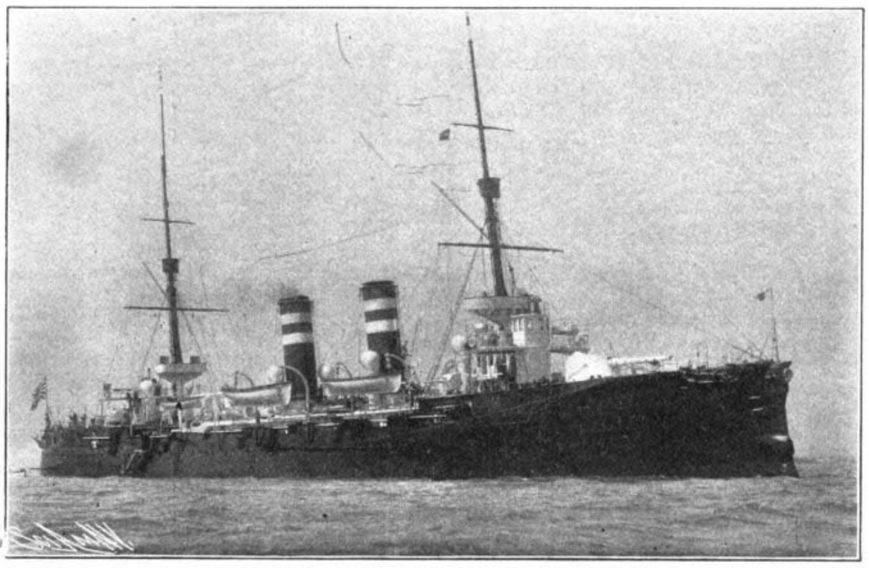
Displacement, 9,750 tons. **Speed,** 22 knots. **Bunker Capacity,** 1,300 tons. **Armor** (Harvey-nickel): belt, 7 inches to 8½ inches; deck, 2½ inches; side, 5 inches; 8-inch gun turrets, 6 inches; casemates, 6 inches. **Armament:** four 8-inch; fourteen 6-inch; twelve 3-inch; seven smaller guns. **Torpedo Tubes,** 4 submerged, 1 above water with 6-inch armor.

Armored Cruiser "Asama." Completed in 1899.



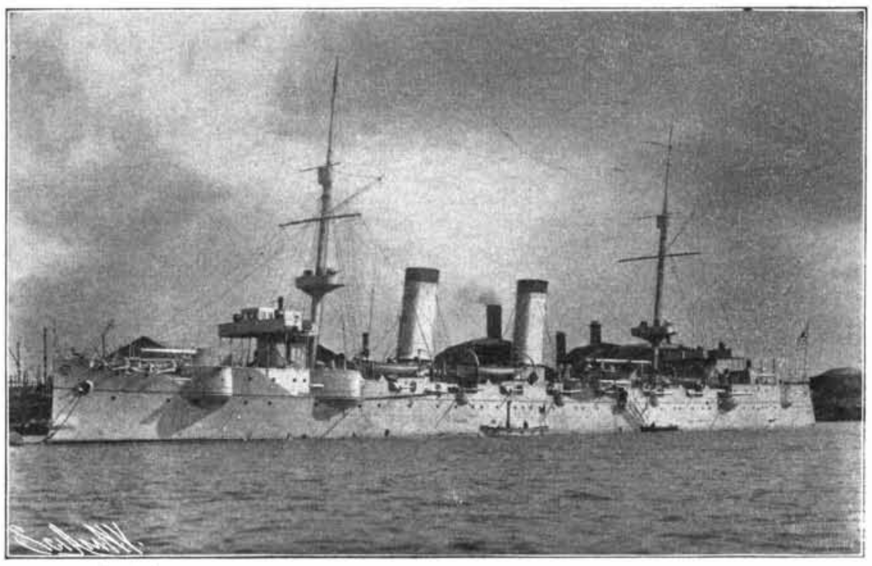
Displacement, 9,800 tons. **Speed,** 21.8 knots. **Bunker Capacity,** 1,300 tons. **Armor** (Krupp): belt, 7 inches to 3½ inches; deck, 2½ inches; side, 5 inches; 8-inch gun turrets, 6 inches; casemates, 6 inches. **Armament:** four 8-inch; fourteen 6-inch; twelve 3-inch; 12 smaller guns. **Torpedo Tubes,** 4 submerged.

Armored Cruiser "Iwate." Completed in 1901.



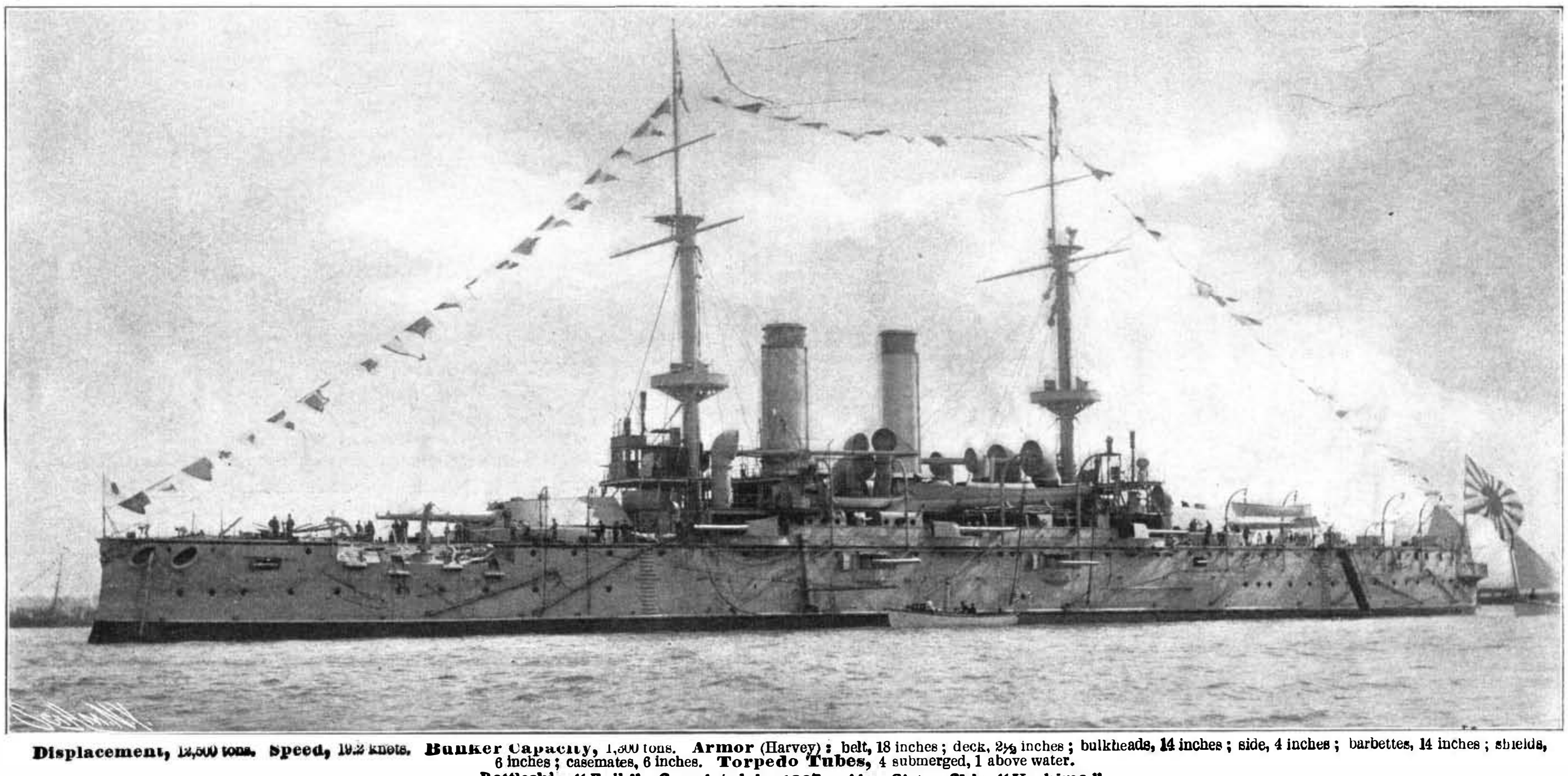
Displacement, 4,300 tons. **Speed,** 24 knots. **Bunker Capacity,** 1,000 tons. **Armor** (Harvey-nickel): deck, 4½ inches; 8-inch gun shields, 4½ inches; 4.7-inch gun shields, 2½ inches. **Armament:** two 8-inch; ten 4.7-inch; 18 smaller guns. **Torpedo Tubes,** 5 above water.

Protected Cruiser "Takasago." Completed in 1898.



Displacement, 4,760 tons. **Speed,** 22.76 knots. **Bunker Capacity,** 1,000 tons. **Armor** (Harvey-nickel): deck, 4½ inches; 8-inch gun shields, 4½ inches; 4.7-inch gun shields, 2½ inches. **Armament:** two 8-inch; ten 4.7-inch; 18 small guns. **Torpedo Tubes,** 4 above water

Protected Cruiser "Kasagi." Completed in 1898.



Displacement, 12,500 tons. **Speed,** 19.2 knots. **Bunker Capacity,** 1,300 tons. **Armor** (Harvey): belt, 18 inches; deck, 2½ inches; bulkheads, 14 inches; side, 4 inches; barbettes, 14 inches; shields, 6 inches; casemates, 6 inches. **Torpedo Tubes,** 4 submerged, 1 above water.

Battleship "Fuji." Completed in 1897. Also Sister Ship "Yashima."

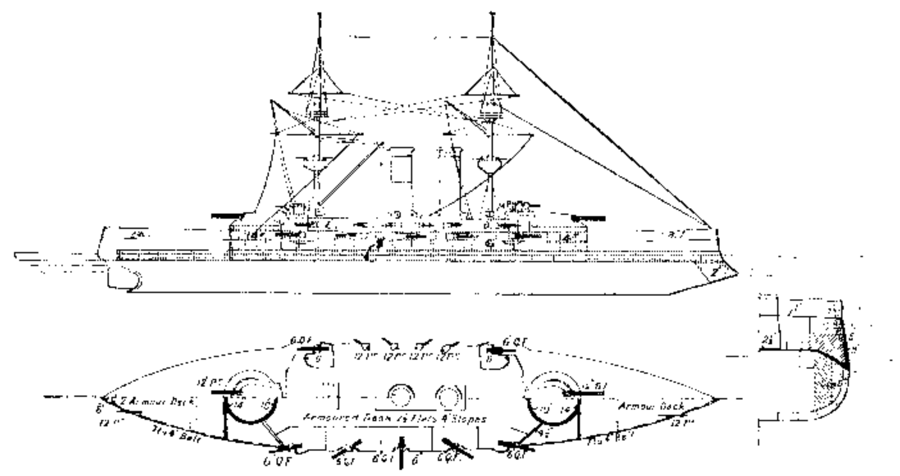
THE JAPANESE NAVY.—[See page 134.]

THE JAPANESE NAVY.

No stronger evidence of the important part played by sea power could be given than is offered by the spectacle of a little nation like Japan standing fully prepared and eager to enter into a life-and-death struggle with the greatest military power upon earth. The confidence of Japan is based upon her possession of a thoroughly modern and highly efficient navy, and upon the fact that the proximity of the seat of war to her harbors and dockyards will probably give her a strong strategic position against a nation whose battle must be fought with half the circumference of the world intervening between a disabled ship and the dockyard for its repair. Command of the high seas would place a Japanese army of invasion within easy touch, at all times, of its base of supplies; while the Russian army would be dependent upon several thousand miles of single-track railroad, whose capacity would at all times be utterly inadequate to the task of bringing to the seat of war the necessary supplies.

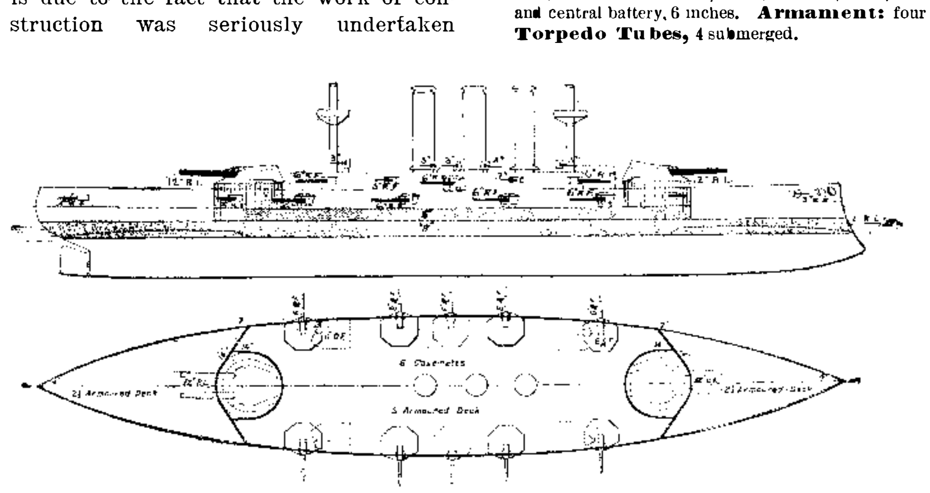
The Japanese navy has the distinction of being the most absolutely modern of all the leading navies of the world. This is due to the fact that the work of construction was seriously undertaken only after the close of the Chinese war, while the ships which she owned at the time of the war were well up-to-date, and are indeed to-day serviceable vessels.

The main strength of the navy lies in the homogeneous fleet of six first-class battleships, all built within the last eight years in English yards, of which the latest, the "Mikasa," built by Vickers in 1900, shares with her sister, the "Asahi," the distinction of being to-day the largest and most powerful battleship in commission. With a length over all of 436 feet, a beam of 76 feet, and a draft of 27¼ feet, this vessel displaces 15,200 tons and carries a complement of 730 men. She conforms in general design to the British battleships of the "Prince of Wales" class; but she is somewhat larger, carries a more numerous intermediate and secondary battery, while the intermediate guns are carried in broadside behind a continuous wall of 6-inch armor, instead of being mounted in casemates. There is a continuous belt of Krupp armor at the waterline, which varies in thickness from 9 inches amidships to 4 inches at the ends. The protective deck is 4 inches in thickness on the slopes. The side armor amidships, from the main belt up to the level of the main deck, is 9 and 6 inches thick. The armament of this as well as that of all the other warships, is of the Armstrong type. It consists of four 12-inch, 40-caliber guns in barbette turrets, protected by 14-inch Krupp steel on the barbettes, 10 inches on the front of the turrets, and 8 inches on the sides. The intermediate battery is made up of fourteen 6-inch, 40-caliber guns, ten of these being carried on the gun deck behind a continuous wall of 6-inch Krupp armor, and four in separate casemates on the main deck, two forward, two aft. The secondary battery of twenty 3-inch guns is widely



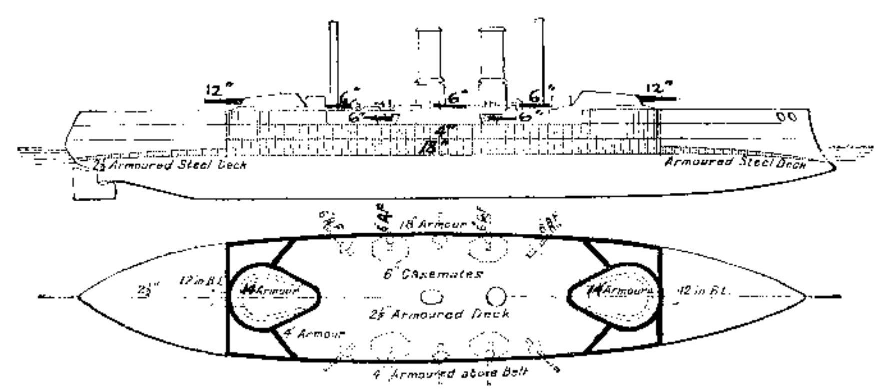
Battleship "Mikasa." (The Largest Battleship in Commission in the World.) Completed in 1902.

Displacement, 15,200 tons. **Speed,** 18.6 knots. **Bunker Capacity,** 1,500 tons. **Armor** (Krupp): Belt, 9 inches to 4 inches; sides, 9 inches; deck, 4 inches; barbettes, 14 inches; shields, 10 inches; casemates and central battery, 6 inches. **Armament:** four 12-inch; fourteen 6-inch; twenty 3-inch; 12 small guns. **Torpedo Tubes,** 4 submerged.



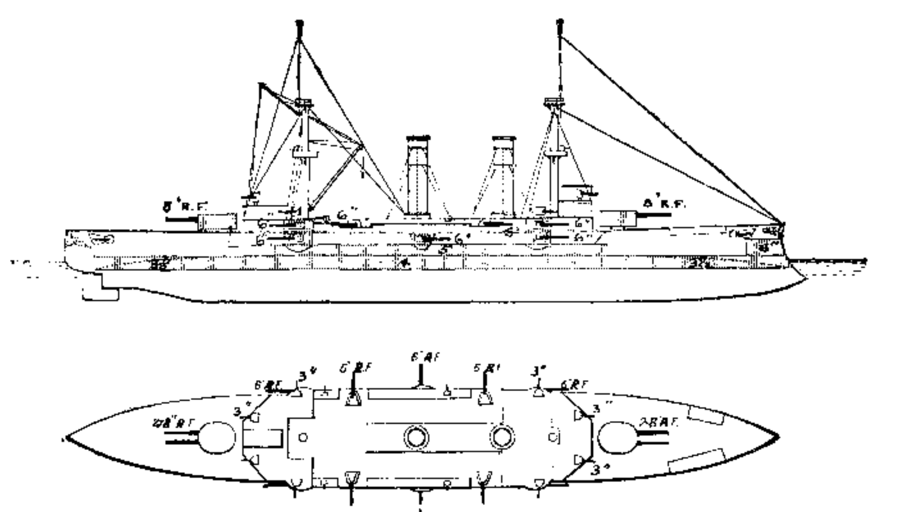
First-class Battleships "Shikishima." Also, with modifications, the "Asahi," of 15,200 tons, and "Hatsuse," of 15,000 tons.

Displacement, 14,850 tons. **Speed,** 18.5 knots. **Armor:** Main belt, 9 inches; upper belt, 6 inches; deck, 4 inches; gun positions, 14 and 6 inches. **Armament:** four 12-inch, fourteen 6-inch rapid-fire, twenty 3-inch, eight 3-pounders, six 2½-pounders. **Torpedo Tubes,** 5. **Date,** 1899.



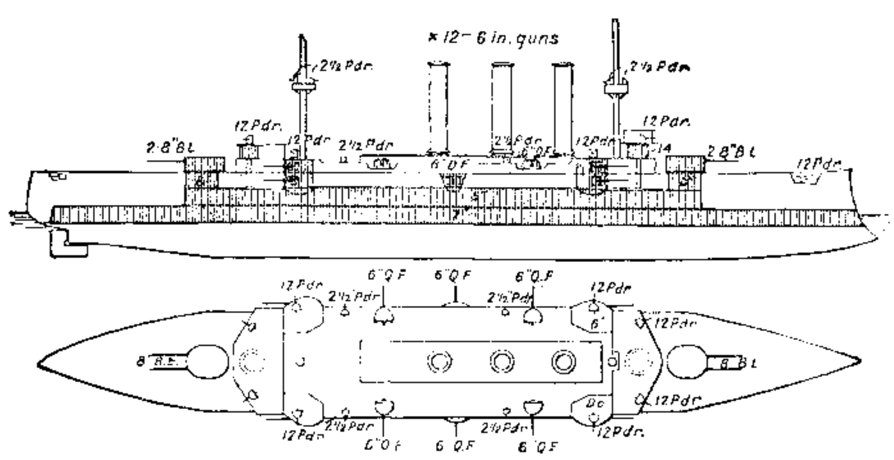
First-class Battleships "Fuji" and "Yashima."

Displacement, 12,500 tons. **Speed,** 18.2 and 19.2 knots.



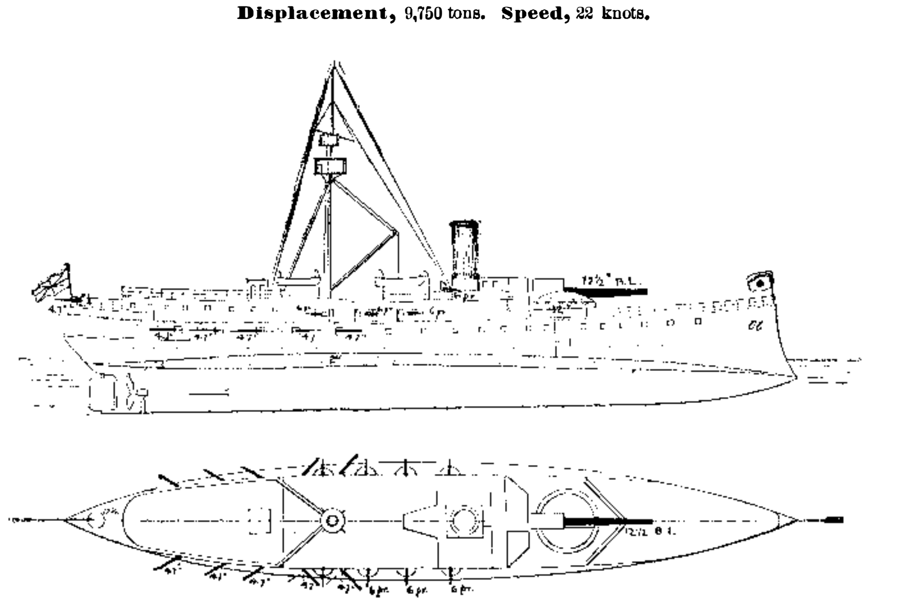
Armored Cruisers "Asama" and "Tokiwa."

Displacement, 9,750 tons. **Speed,** 22 knots.



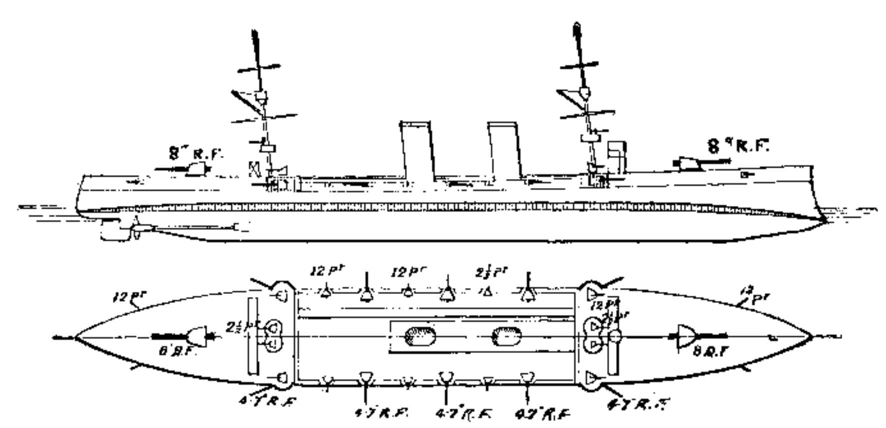
Armored Cruisers "Idzumo" and "Iwate."

Displacement, 9,800 tons. **Speed,** 22.04 and 21.8 knots.



Protected Cruisers "Itsukushima" and "Hashidate." Also, with modifications, "Matsushima."

Displacement, 4,277 tons. **Speed,** 17.5 knots.



Protected Cruiser "Takasago." Class of Four Ships.

The "Takasago": **Displacement,** 4,300 tons. **Speed,** 24 knots. The "Yoshino": **Displacement,** 4,150 tons. **Speed,** 23.1 knots. The "Chitose" and "Kasagi": **Displacement,** 4,760 tons. **Speed,** 23.7 and 22.5 knots.

THE JAPANESE NAVY.

distributed throughout the main and gun decks. There are four 18-inch submerged torpedo tubes, mounted in broadside. The vessel has shown 18.6 knots speed on trial, and carries a normal coal supply of 700 tons, with a maximum bunker capacity of 1,500 tons.

The "Asahi," built on the Clyde in 1899, is of about the same dimensions, displacement, and speed as the "Mikasa," and the armament distribution is practically the same, the chief exception being that the intermediate battery of 6-inch rapid-fire guns is carried in casemates, four of the guns on the gun deck, and six on the main deck. The next ship in size is the "Hatsuse," built at Elswick in 1899. She is of the same dimensions as the preceding vessels, differing from the "Asahi" only in the fact that she is of about 200 tons less displacement. Like the "Mikasa" and "Asahi," she is equipped with Belleville boilers; but she exceeded them in speed, having accomplished 19.1 knots an hour. The fourth vessel in importance is the "Shikishima," of 14,850 tons displacement, built at the Thames Iron Works in London in 1898. She has half a foot less beam than the other three; but her armor and armament are identical with those of the "Asahi" and "Hatsuse," and she made on trial a speed of 18.5 knots. Her normal coal supply is 700 tons, and her maximum 1,400 tons. She carries four submerged torpedo tubes, and one above the water in the bow protected by 6-inch armor. It should be mentioned that the armor of the three last-named ships is of the Harvey-nickel type. The other two battleships, the "Fuji," built at London in 1896, and the "Yashima," built at Elswick in the same year, are sister vessels of 12,500 tons, and carry each a complement of 600 men. The length over all is 412 feet, the beam 73½ feet, and draft 28½ feet. They were designed to be an improvement on the British "Royal Sovereign" class. The guns and armor distribution are as follows: There are four 12-inch, 40-caliber Armstrong guns, protected by 14-inch barbettes and 6-inch barbette shields; ten 6-inch, 40-caliber rapid-fire guns, four carried in casemates on the gun deck behind 6-inch armor and six carried behind shields on the main deck; while there are sixteen 3-inch guns and four 2½-pounders distributed throughout the ship. At the waterline there is a belt of 18-inch Harvey armor extending for two-thirds of the length amidships, with which is associated a 2½-inch armored deck. Above the belt, the side protection consists of 4-inch armor as high as the level of the gun deck. There are four submerged torpedo tubes and one above water in the bow protected by 6-inch armor. The normal coal supply is 700 tons, and the maximum is 1,300 tons. The motive power consists of cylindrical boiler triple-expansion engines, with which the "Fuji" accomplished 18½ knots on trial, and the "Yashima" 19.2 knots.

Next in importance to the battleships, and fully equal to them in excellence, is a fleet of eight armored cruisers, all of high speed and carrying powerful batteries. First there are the "Idzumo" and "Iwate," built by the Armstrongs in 1899-1900, 408 feet over all, 68½ feet beam, 24½ feet draft, and displacing on this draft 9,800 tons. They have continuous belts of Krupp steel varying from 7 inches to 3½ inches; armored decks 2½ inches thick on the slopes, and a side protection of 5 inches of armor extending from the main belt up to the level of the gun deck. They carry four 8-inch rapid-fire guns in two turrets of 6-inch steel, further protected by 6-inch barbettes; fourteen 6-inch rapid-fire guns, of which ten are mounted in casemates and protected by 6-inch armor, four of them being on the main deck and six on the gun deck, and the other four are mounted behind shields between the 6-inch casemates on the main deck. There are also twelve 3-inch rapid-fire guns and twelve smaller guns disposed throughout the vessel. There are four submerged torpedo tubes. The vessels are equipped with Belleville boilers, and on trial the "Idzumo" made 22 knots, and the "Iwate" 21.8 knots.

The "Asama" and "Tokiwa" are armored cruisers, built by the Armstrongs in 1898, that are practically identical with the "Idzumo" and "Iwate." Their dimensions are: Length, 408 feet; beam, 67 feet; draft, 24¼ feet; and displacement, 9,750 tons. The "Asama" made 22 knots on a six hours' forced draft trial, and the "Tokiwa" 22.7 knots. They carry four submerged torpedo tubes and one tube above water in the bow protected by 6 inches of Harvey-nickel armor.,

In addition to the four Armstrong armored cruisers, there are two of about the same displacement which were built in Stettin, Germany, in 1899, and St. Nazaire, France, in 1900. The Stettin ship is known as the "Yakumo." She is 407 feet in length over all, 65½ feet beam, 23¾ feet draft, and displaces 9,850 tons. The armor, which is of Harvey-nickel and Krupp steel, consists of a continuous belt 7 inches thick amidships and decreasing to 3½ inches at the ends, and an armored deck 2½ inches thick on the slopes. Above the belt armor is a side protection of 5-inch armor extending to the level of the gun deck. The armament consists of four 8-inch rapid-fire guns mounted in two turrets fore and aft, protected by 6-inch armor, and

STATISTICS OF JAPANESE NAVY.

	Number of ships.	Average speed in knots.	Average displacement in tons.	Total displacement in tons.
Battleships, 10 years or less........	6	18.75	14,208	85,250
Battleships, 10 to 20 years old.	..	....	.	...
Battleships, old or refitted	..	. .	....	....
Totals........................	6	....	. . .	85,250
Coast Defense Vessels.............	3	12.5	4,356	13,067
Armored Cruisers, 9000 tons or over	6	21.75	9,731	58,386
Armored Cruisers, 7000 to 9000 tons,	2	20.2	7,632	15,264
Armored Cruisers, below 7000 tons.	..	....	....	....
Totals.	8	....	. ..	73,650
Protected Cruisers, 10000 tons up....	..	....	....	....
Protected Cruisers, 7000 to 10000 tons	..	....	....	...
Protected Cruisers, 4000 to 7000 tons	7	20.5	4,400	30,801
Protected Cruisers, 2000 to 4000 tons	8	18.4	2,965	23,720
Totals........................	15	....	....	54,521
Small Cruisers and Gunboats........	11	16.5	1,037	11,411
Grand Totals..................	43	....	...	237,899
Torpedo Boat Destroyers........ ...	20	30.75	332	6,645
Torpedo Boats, 1st Class...........	38	27.5	138	5,203
Torpedo Boats, 2d Class	35	23	66	2,315
Totals..........................	93	....	....	14,163

twelve 6-inch rapid-fire guns mounted as follows: Two on the gun deck in broadside protected by 6-inch casemates, and eight on the main deck, two forward and two aft, in casemates of 6-inch armor, and four mounted in broadside in the open behind shields. There are twelve 3-inch guns and twelve smaller guns. Four submerged torpedo tubes are carried, and one in the bow above water. The "Yakumo" is about one to two knots slower than the Armstrong boats, having made 20.7 knots on trial. The French-built cruiser "Azuma" is a longer and leaner craft, measuring 446 feet in length over all by 59 feet beam, 24¼ feet draft, and her displacement is 9,436 tons. Her armor protection and armament are the same as those of the "Yakumo." On her trial she made 21 knots speed. The other two armored cruisers of the fleet of eight are the "Kasaga" and "Niasin," of which illustrations and some description were given in our issue of January 23. These vessels are of 7,632 tons displacement, and are armed, the "Kasaga" with four 8-inch and the "Niasin" with two 8-inch and one 10-inch guns, and both vessels with fourteen 6-inch, ten 3-inch, and four smaller guns. They carry four above-water torpedo tubes behind 6-inch armor, and the protection consists of a 6-inch belt, and 6-inch side armor in the wake of the batteries carried up to the level of the main deck. The speed of the vessels is a little over 20 knots an hour.

The fourteen armored ships above described form the first line of defense for Japan. Following them we come to a class of vessels, the protected cruisers, of much smaller displacement, but of high speed and powerful batteries. The most important of these are four vessels, the "Chitose," "Kasagi," "Yoshino," and "Takasago." The "Chitose," built at San Francisco in 1898, and the "Kasagi," built at Cramps in 1897, are both of 4,760 tons displacement. The "Chitose" showed a speed on trial of 23.76 knots an hour, and the "Kasagi" 22.76 knots. They are protected by a 4½-inch deck supplemented by cofferdams and bunkers amidships. The battery is mounted behind shields, and consists of two 8-inch rapid-fire guns, one forward and one aft, and ten 4.7-inch guns mounted behind shields on the gun deck. The guns are all of the Armstrong rapid-fire type. Both of these vessels carry four above-water torpedo tubes. The "Yoshino," of 4,150 tons displacement, was built by the Armstrongs in 1892. She mounts four 6-inch, eight 4.7-inch, and twenty-two smaller guns, and carries five torpedo tubes. The steel deck is 4½ inches in thickness. On trial the vessel made 23.1 knots. She carries a maximum coal supply of 1,000 tons. The fourth cruiser is the "Takasago," built at Elswick in 1897. She is of 4,300 tons displacement, and she maintained 24 knots speed on trial. She has a 4½-inch protected deck, and her armament consists of two 8-inch rapid-fire guns behind 4½-inch shields, ten 4.7-inch guns behind 2½-inch shields, and eighteen smaller guns and five torpedo tubes.

We now come to a class of three curious vessels, the "Matsushima," "Itsukushima," and "Hashidate," built at La Seine, France, in 1889, 1890, 1891. They are of 4,277 tons displacement and 16.7 knots speed. They are protected cruisers pure and simple, inasmuch as they simply have an armored deck 1½ inches in thickness with a cellulose belt for protection, and 5 inches of armor protection above the engine-room hatches. The peculiarity of these little ships is in their armament, the main element of which consists of a big 12½-inch Canet gun, which in its time was the most powerful weapon in existence. The gun weighs 66 tons, and fires a 990-pound shell with a velocity over 2,300 feet per second, and a muzzle energy of 35,200 tons. This gun is mounted, in the case of the "Matsushima" (which, by the way, was the flagship of the Japanese admiral at the battle of Yalu) amidships abaft the superstructure, in a barbette protected by 12-inch steel armor, covered with a 4-inch hood, and communicating with the magazines by hoists protected with 12 inches of steel. In addition to this gun an intermediate battery of twelve 4.7-inch rapid-fire guns is carried in broadside. There are also four above-water torpedo tubes. The other two vessels carry the 12.5-inch gun on the forward deck, and the intermediate battery consists of eleven 4.7-inch guns. There are no vessels in the world that compare with these rather nondescript cruisers, and it is difficult to assign them their true fighting value.

The Japanese navy also includes eight smaller protected cruisers of from 2,000 to 4,000 tons displacement, whose average speed is 18.4 knots an hour and average displacement a trifle under 3,000 tons. The "Akitsushima," launched in Japan in 1892, is of 3,150 tons displacement and 19 knots speed, and carries four 6-inch, six 4.7-inch, and ten smaller guns, and four above-water torpedo tubes. The "Suma," launched in Japan in 1895, of 2,700 tons, and 20 knots speed, has a 2-inch deck, and 4½-inch shields to her 6-inch guns. She is armed with two 6-inch, six 4.7-inch, and sixteen smaller guns, and she has two above-water torpedo tubes. The "Akashi" is a sister vessel to the "Suma." The "Chiyoda," 2,450 tons, 19 knots, launched on the Clyde in 1889, is really an armored cruiser, but on account of her age and the partial belt which she carries, she is included among the protected boats. She has a 4½-inch belt, a 1-inch deck, and carries ten 4.7-inch guns, seventeen smaller guns, and three torpedo tubes. The "Naniwa" and "Takachiho," launched by the Armstrongs in 1885, are vessels of 3,700 tons displacement and 18 knots speed, which were refitted in 1900. They have a 3-inch deck, 3-inch engine hatches, and carry two 10.2-inch Krupp guns, six 6-inch rapid-firers of the Elswick pattern, sixteen smaller guns, and four above-water torpedo tubes. The protected cruiser "Idzumi," 18 knots, formerly the Chilean "Esmeralda," built at Elswick in 1884, and overhauled and refitted in 1901, was the first protected cruiser ever built, and was a famous vessel in her time. She has a 1-inch steel deck, and carries two 6-inch, six 4.7-inch, and seven smaller guns. A protected cruiser of small value is the "Sai Yen," of 2,300 tons and 12 knots speed, built at Stettin in 1886, and captured from the Chinese. She carries two 8-inch guns forward in a 10-inch compound armor turret, and one 6-inch gun aft, besides eight smaller guns and four above-water torpedo tubes.

The Japanese navy includes eleven small cruisers and gunboats, some old and some quite modern, which range in displacement from about 600 to 1,600 tons, and from 12 to 21 knots speed. They call for no particular description.

The torpedo boat flotilla consists of twenty destroyers of an average displacement of 332 tons and an average speed of 30.75 knots; thirty-eight first-class torpedo boats, with an average displacement of 137 tons and average speed of 27.5 knots; and thirty-five second-class torpedo boats, with an average displacement of 66 tons and an average speed of 23 knots. The vessels are chiefly of Thornycroft, Yarrow, Schichau, and Normand construction, and the flotilla, which numbers altogether nearly a hundred vessels, is probably as efficient as any in the world.

Exclusive of the torpedo boats, the Japanese fleet is made up of forty-three vessels, of a total displacement of 237,899 tons, of which eighty-five per cent is thoroughly modern, and embodies the latest ideas of the leading naval constructors of the world. The officers are intelligent, resourceful, and brave, and the men well drilled, thoroughly amenable to discipline, and full of patriotism and courage.

Such is the navy of Japan. In the following issue we hope to give an article, similar in scope, on the Russian navy.

An Oxyacetylene Blow-Pipe.

An oxyacetylene blow-pipe is described by M. Fouché in the Bulletin of the French Physical Society. The flame is formed by the combustion of a mixture of one part of acetylene to 1⅛ of oxygen, and in order that the explosion may not travel back into the blow-pipe, a jet velocity is required, due to the pressure of a water column four meters in height. The flame melts most metals readily; it will solder iron and steel. Even silica and lime are melted by it. With a reduction of the proportion of oxygen, the flame becomes luminous, and on falling on lime the free carbon goes to form carbide of lime.

RESULTS OF THE FLORIDA AUTOMOBILE RACE MEET.

Our illustrations show some of the machines that participated in the races run during the last days of January on the Ormond-Daytona beach, located on the east coast of Florida. This beach was described in our Automobile Number a year ago, and the pictures on this page also give a good idea of its great width. It extends for 30 miles or more along the coast in just such a condition as shown in the photographs, and, although this year the longest distance run in one direction was but ten miles, next year it is hoped to run twenty. The course is ideal in more ways than one. Besides being very broad, it is bordered by the ocean on one side and by sand dunes on the other, so that if anything went wrong with the steering gear of a machine while racing, the car could only make a dash into the ocean or into a soft sand bank, and would probably not injure its driver much in either case. An example of this was had in the overturning of Mr. J. Insley Blair's Panhard machine when rounding the 10-mile post in the 20-mile handicap race. Its driver, W. Ehlrich, tried to make too wide a sweep, and, as the machine struck the soft sand far up on the beach, the car was thrown upon its outside wheels, breaking its axles and falling upside down upon its driver. Despite this fact, Mr. Ehlrich was not very badly injured. The sand is so hard on the beach when the tide is out that the heaviest machines do not cut in at all, and, on account of its moisture, the tires do not heat perceptibly, even at the very high speeds that were attained.

On the Way to the Races.

Most of the records made the first three days of the meet were given in our last issue. The best of these was a mile in 39 seconds made in a speed trial by Mr. W. K. Vanderbilt, Jr.; five miles in 3:31 3-5, also made in the five-mile free-for-all race by Mr. Vanderbilt; and a mile in 43 seconds, made by Barney Oldfield on the Winton Bullet No. 2 in the one-mile championship race. The last-named machine had a serious breakdown the third day, which accounts for its non-appearance in the long-distance races. As it was the only high-powered American car that came anywhere near Mr. Vanderbilt's 90-horsepower Mercedes in speed capability, it is to be regretted that it was unable to follow up its initial victory in the longer contests.

In the five-mile handicap race, which was won by S. B. Stevens on his 60-horsepower Mercedes in 4:00 2-5, Tracy on the 70-horsepower Peerless racer, with a handicap of 5 seconds, came in second in 4:28 1-5, and F. A. La Roche on a 40-horsepower Darracq (35 seconds handicap) finished third in 5:05 1-5.

The one-mile invitation race for gentlemen drivers resulted as follows: First heat, won by H. L. Bowden on his 60-horsepower Mercedes in 51 4-5 seconds. W. G. Brokaw, on his 30-horsepower Renault, was beaten by 300 feet, and James C. Breeze, on his 40-horsepower Mercedes, by 500 feet. Second heat, won by W. K. Vanderbilt, Jr., in 47 3-5 seconds, with Stevens second in 50 1-5 seconds. Final heat, won by Vanderbilt in 48 seconds, with Bowden second in 51 seconds.

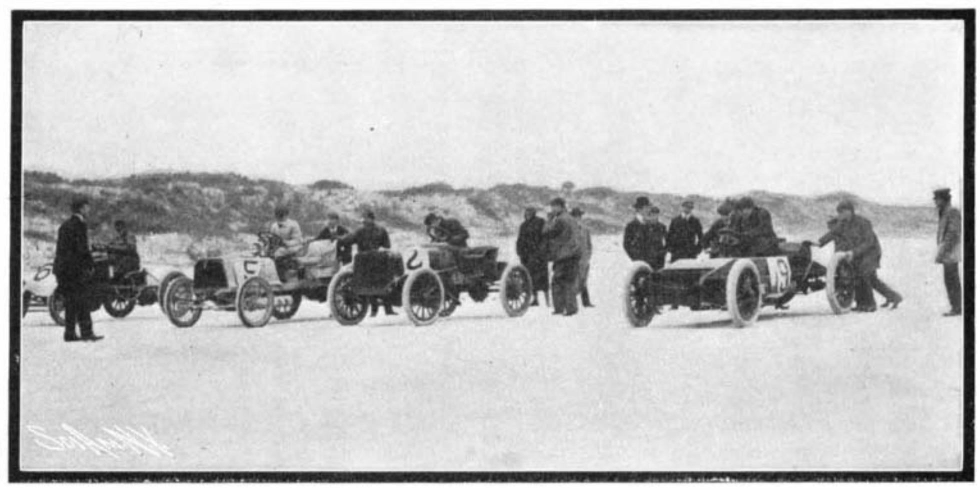
A mile race for machines of the 1:05 class resulted in Bowden's Mercedes taking first place in 52 2-5 seconds, with La Roche's Darracq second in 55 1-5, and Blair's Panhard third in 1:06 3-5.

A mile race for machines of the 56-second class was also won by Bowden who, in the first heat, came in first in 48 seconds, while Stevens on a duplicate Mercedes came in second in 0:48 4-5, and Brokaw finished in 49 seconds. The second heat was won by La Roche in 0:53 2-5, B. M. Shanley's 40-horsepower Decauville coming in second in 0:57, and William Wallace's 30-horsepower De Dietrich taking third place in 1:23. Bowden's time in the final heat was 0:50 4-5. La Roche was second in 0:54, and Brokaw third in 0:56 3-5.

The great event of the last day, January 30, was the 50-mile championship, which was won by W. K. Vanderbilt, Jr., in 40:49 4-5. H. L. Bowden was second in 42:44 2-5, and J. I. Blair's Panhard was third in 57:08 3-5. Mr. Vanderbilt's intervening times were 10 miles, 7:25; 20 miles, 17:02; 30 miles, 24:11; and 40 miles, 33:52 2-5. His average speed was 73½ miles an hour, including four turns at the end of the ten-mile stretch.

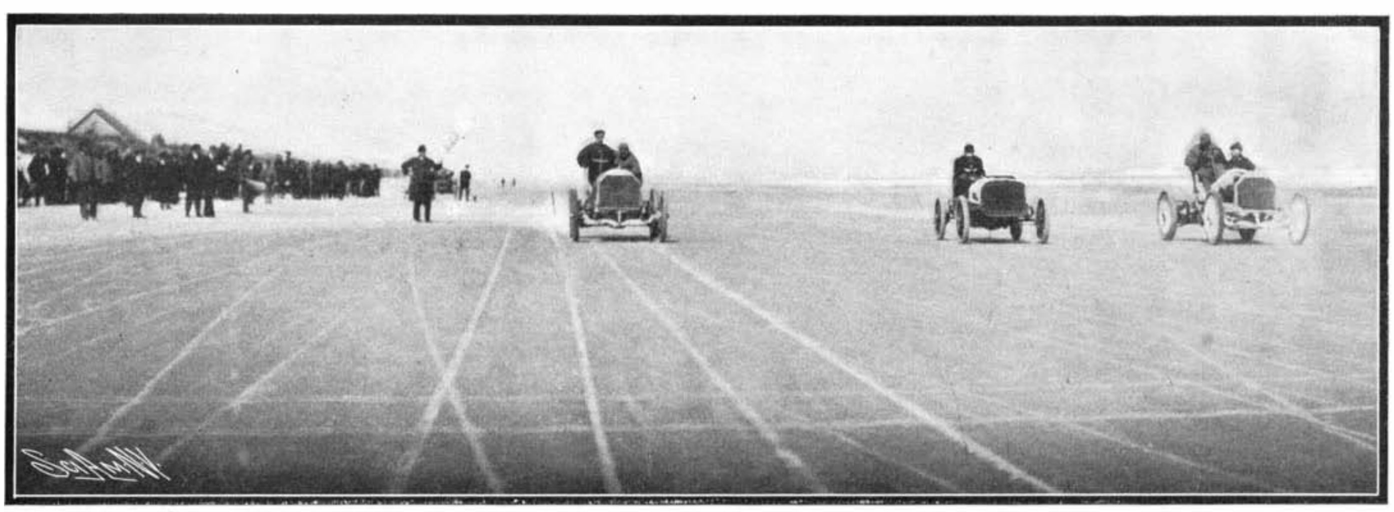
The ten-mile invitation race for gentlemen drivers was also won by Mr. Vanderbilt in 6:50, an average speed of 87.8 miles an hour. S. B. Stevens was second in 7:03 1-5, and H. L. Bowden third in 7:08. James L. Breeze took fourth place in 9:29, and Walter Christie, on his new 30-horsepower car, in which the motor crank shaft forms the front axle and drives the front wheels, came in fifth in 9:35.

The ten-mile championship of America was won by Vanderbilt, with Bowden's Mercedes second, and Shanley's Decauville third. As the timing instruments did not work, no time was taken. The best time for 15 miles was made by H. L. Bowden on his 60-horsepower Mercedes in 10:18. The following table will be found of use for quickly finding speeds in miles-per-hour:



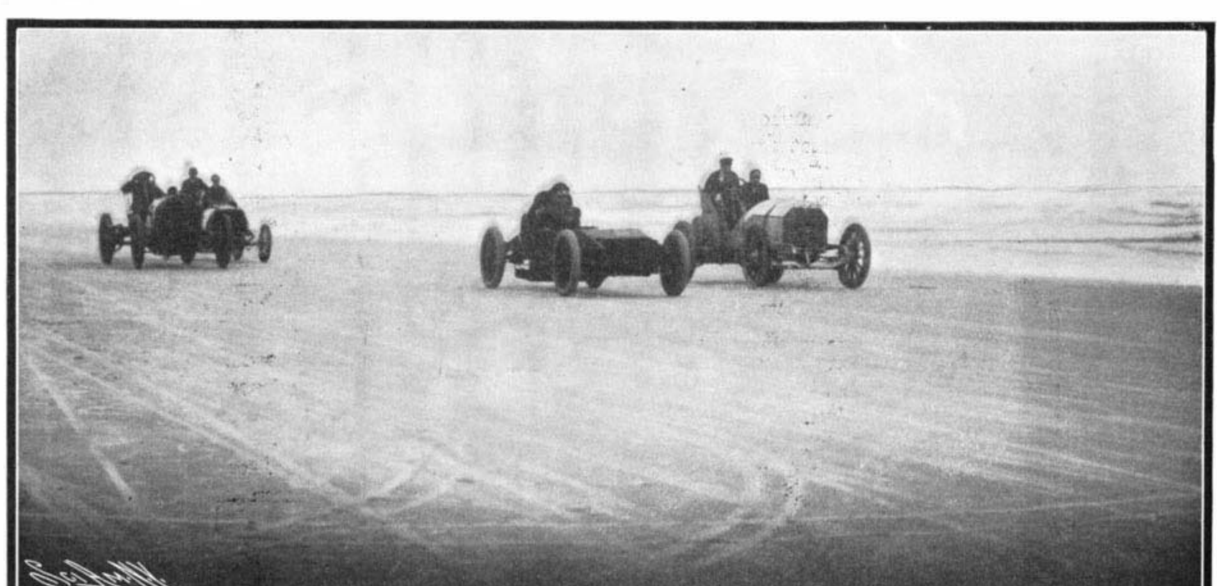
Standing Start of the Free-for-All Race.

Time Going 1 Mile in Seconds.	Miles Per Hour.	Time Going 1 Mile in Seconds.	Miles Per Hour.
59	61.02	44	81.82
58	62.07	43	83.72
57	63.14	42	85.71
56	64.29	41	87.80
55	65 45	40	90.00
54	66 66	39	92.31
53	67.92	38	94 74
52	69.23	37	97.30
51	70.59	36	100 00
50	72.00	35	102.86
49	73.47	34	105 88
48	75.00	33	109 09
47	76.59	32	112.50
46	78.26	31	116.13
45	80 00	30	120.00



Vanderbilt's 90-h. p. Mercedes. Shanley's 40-h. p. Decauville. 60-h. p. Mercedes.

Crossing the Line with a Flying Start.



One-Mile Championship Race.

Barney Oldfield on the Winton Bullet and W. K. Vanderbilt, Jr., on his 90-horsepower Mercedes seen on the right.

THE FLORIDA AUTOMOBILE RACE MEET.

A GREAT ENGINEERING FEAT.

BY G. P. BLACKISTON.

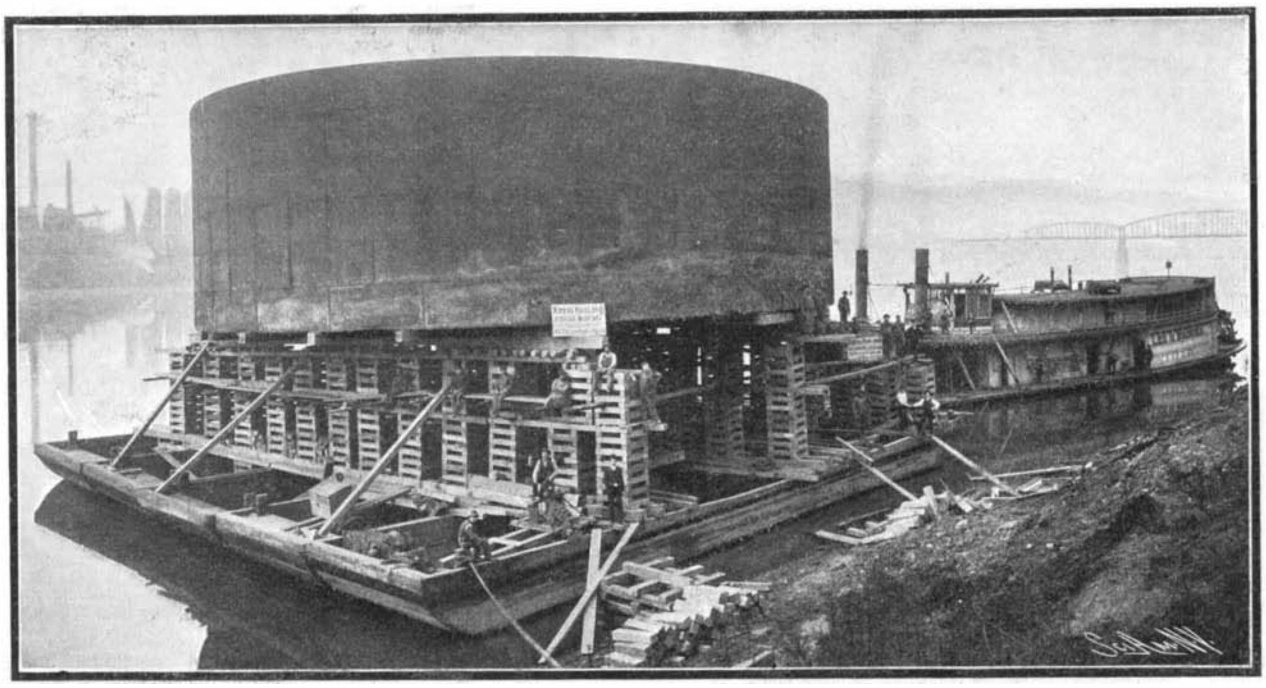
Perhaps one of the greatest engineering feats ever accomplished on the water by any house mover has just been successfully performed in Pittsburg, Pa.

The subject in question is the removal of a 5/8-inch steel oil tank, 80 feet in diameter, 26 feet high, weighing 150 tons, a quarter of a mile down a 30-degree hill to the river, placed upon five sand barges, towed a mile down the river, and moved 200 feet up the steep bank. All the more marvelous is it when we consider that five tracks of the Pennsylvania Railroad had to be crossed within forty minutes, in order not to interfere with traffic, and that the members of the Kress-Hanlon firm, who engineered the work, were but twenty-three years of age.

This monster tank was sunk 7 feet in the ground; and in order to raise it, a trench 4 feet wide and 7 feet deep was dug around it, and 32 holes, 4 feet square, 2 feet deep, and 8 feet apart, were then tunneled under it, and wooden blocks inserted. By the aid of 64 five-ton jacks, two under each block, the tank was raised 4 feet, when it was underpinned with 12-inch timbers; and the necessary running timbers being securely fastened with 7/8-inch chains, the tank was gradually moved under the steady power furnished by two horses and the necessary block and tackles, crabs, and ropes.

When the railroad was reached, it was 38 feet above the ground. After being lowered 32 feet, chalk lines were stretched across the railroad tracks, and the cribbing built on the opposite side of the same. After a battle with the numerous electric light and telephone wires, the tank was rolled over the tracks to within ten feet of the bank of the Allegheny River. Being lowered within 24 feet of the water, it was moved on five sand flats, 16 feet wide and 90 feet long. These were made stationary by ratchets and steel cables ¾ inch thick, which were placed from the first to the fifth flat, thus making the five flats act as one. The boats being thus made fast, the tank was slowly rolled into the position as seen in the picture. It was then carried one mile down the river, and transferred to its new location.

The work was done for the Atlantic Refining Company, and only required twenty-four men six weeks to accomplish the task.



EIGHTY-FOOT STEEL OIL TANK. WEIGHT, 150 TONS; CAPACITY, 23,000 POUNDS. MOVED ACROSS THE PENNSYLVANIA RAILROAD AND DOWN THE ALLEGHENY RIVER.

Silver is well known to be the best metal for reflecting light; by means of high polish, it can be given a brightness which surpasses that of any other metal; it is of an almost faultless white color with a very faint trace of yellow. Although silver counts among the precious metals, it is of little use in close vicinity to electric arc lamps; for silver mirrors, probably owing to the influence of ozone, which is always produced in small quantities by the glowing wire, quickly lose their brightness and become dull. Under similar conditions metal palladium remains unaffected, and furthermore it is of nearly the same whiteness as silver. In an article lately published in a German electro-chemical paper the way to manufacture reflecting mirrors out of this very expensive palladium metal is described, as follows: The outward curved, paraboloidal surface of the glass model of a mirror is first thinly covered with silver, and then a thicker copper covering is put on. By means of heat the metal cover is removed from the glass, and the silver which is on the hollow inner side of the curved metal sheet is first polished, and then by means of an electrolytical process covered with a thin layer of palladium. It is then said to make the best light-reflecting surface in the world.

An Enormous Iron-Ore Deposit.

According to Stahl und Eisen, a survey of the Luossovara iron-ore deposits made under the direction of the Swedish government shows that they contain 235,000,000 tons of ore in the portion lying above sea-level, while drilling-tests indicate that 400,000,000 tons are present within the depth of 100 meters below sea-level. The shipments from the mine in 1902 were 232,000 tons, but they will be increased to 1,200,000 tons annually with the completion of the Ofotin railroad and the harbor improvements at Narvik.

A PRACTICAL PRIMARY BATTERY.

(Continued from page 132.)

To prevent the fluid from creeping up through the pores of the carbon and reaching the copper, the ends of the carbons should be dipped in hot melted paraffine and saturated by it before clamping them to the copper ring.

The binding posts may be of any available form except those with wood screws. A machine screw is necessary because the binding post is to be clamped to the copper strip by it. When these parts are screwed together the battery is ready to be assembled.

Nothing has been said about the sizes of jars and the rest, since the cell may be made of a size to fit any jar into which the porous cup and carbons will go. Round porous cups may be had from 1¼ inches up to 5 inches in outside diameter, and round glass jars may be had from 2½ inches up to 7 inches in inside diameter. There is thus ample range of size for any one to consult both the depth of his pocketbook and the quantity of current which he wishes the battery to give. This is a point not understood by many amateurs. The voltage which a cell gives is determined by the kind of chemicals used in it and not by the quantities of chemicals consumed. The current in amperes, which, the voltage being fixed, the cell will give, and the work it can therefore do, are determined by the quantity of chemicals consumed by the cell in its action. It may be stated as a fair average result that one pound of zinc will give 320 ampere hours in a cell such as this.

Carbon plates can be had in a great variety of sizes and shapes. The best way is for the one contemplating making the battery to write to a dealer in electrical supplies and ask for a catalogue, which he will be glad to furnish. All the parts can then be selected of proper proportions to each other, so that they will go together. Either the Daniell, bottle, or Fuller zinc should be used. The cut shows the Daniell zinc. It is a good form because of the large surface exposed to the action of the fluid.

The best solution for this cell is the chromic acid fluid. It should be made by weight, taking chromic acid 18 parts, water 60 parts, sulphuric acid, concentrated, 9 parts. A pint of water may be taken as a pound, and a pint of the sulphuric acid as 1.8 pounds. The chromic acid is a solid and can be most easily weighed directly. Put the chromic acid into the water. It dissolves readily. Then pour the sulphuric acid into the mixture very slowly, a little at a time, stirring it in thoroughly, else a disagreeable accident may be had from the heat produced. It is considered by many that this solution is improved by adding 1 part of chlorate of potash. When it is cold it is ready for use.

The zinc in all cells of this character must be amalgamated; that is, coated with mercury. This may be done directly by dipping the zinc into the solution for a short time and then rubbing mercury upon it, or better, by putting an ounce of mercury into the bottom of each porous cup. Another way is to add to the solution in each porous cup as much bisulphate of mercury as will lie on a quarter of a dollar. The zincs will then be amalgamated directly from the solution.

The cell may be set up in various ways with only slight differences in the resulting current, durability and constancy of action. We will give four modes of arranging the cells:

First—Fill the glass jar to within an inch of the top and the porous cup to the same level with the solution described above.

Second—Fill the porous cup with a mixture of water 10 parts and sulphuric acid 1 part, and the glass jar with the chromic acid mixture given heretofore.

Third—Fill the glass jar with the chromic acid solution and the porous cup with water to which table salt has been added at the rate of 4 ounces to the pint. Sulphate of zinc may be used in place of salt, 6 ounces to the pint.

Four—Fill the glass jar with chromic acid solution and the porous cup with clear water. This will start slower than any of the other modes of filling, but will work, because enough of the chromic acid solution passes through the pores of the cup to act upon the zinc.

The adaptedness of this cell for many uses is shown by the fact that it can be arranged as a one-fluid cell also. Removing the porous cup, hang the zinc in the center of the glass jar by means of a board cover of the jar through which a hole is made to receive the end of the zinc. The fluid used will be the chromic acid solution. The zinc must be fully amalgamated before putting it into service, and the bisulphate of mercury should be used to maintain the zinc in condition. In this form the cell gives its strongest current, but will only last about half as long.

Whenever this cell is to be out of use the zinc should be removed from the liquid. The porous cup should be taken out and set in a dish of the same solution as it contains. In this way all waste of the chemicals is prevented.

The battery, as described, is one of the strongest and most reliable primary batteries. With its strongest current it readily heats fine iron and platinum wires. With the porous cup it is adapted to drive motors, fans, and excite electromagnets. A large battery will light small incandescent lamps. Eight or ten cells, holding two quarts each, will drive the motor of SCIENTIFIC AMERICAN SUPPLEMENT, No. 641, to full power, and run a sewing machine or turn a small lathe, or do any other equal work. The expense of maintenance is not great. The liquid when it becomes green is exhausted and must be replaced by fresh solution. The zincs can be used till they are entirely dissolved. This battery is not a toy, but a serviceable piece of working apparatus.

A curious experiment has been tried in Germany with calcium carbide for raising and sinking a submarine craft. The boat is provided with an ordinary acetylene generator with a large reservoir, which is connected at its upper part with a water tank. Both the tank and the reservoir have pipes from their bottoms leading into the sea, and vertical tubes from their tops leading into the air. When the tank and reservoir are filled with water the boat sinks; to raise it, a carbide cartridge is inserted into the generator, a large amount of gas is suddenly produced which enters the reservoir, driving the water with which it is filled down through the outlet pipe into the sea, and if the increasing gas be now permitted to enter the water tank, it will likewise force the water out of it, and thus so increase the buoyancy of the craft as to make her rise to the surface, where she will, of course, remain till the gas is permitted to escape.

A very old handkerchief, of English design and manufacture, has been in the possession of the family of Mr. James C. Colman, of Newburyport, Mass., for nearly seventy years, and is evidently much older than that. It measures 19 by 24 inches, and is in excellent preservation. It is pictorial, with the printed legend, "The Effects of the Railroad on the Brute Creation." Steam railways are portrayed with passengers comfortably sitting in coaches; while the horses, looking on, lament their occupations gone, and are the embodiment of wretchedness. They are mere skeletons, whose bones the carrion crows are waiting to pick. Meanwhile the steeds try in unusual ways to gain their living. Three horses are playing violins and a bass viol, and another is passing the hat for contributions. Scrolls from their mouths read, "Please remember old Billy, the Wheeler on the Liverpool Road"; "Remember old Paddy, a leader on the Liverpool road," and similar pathetic appeals for charity. It is interesting as a relic of the earliest days of railroading. H. C. H.

NATURAL MONUMENTS.

BY CHARLES F. HOLDER.

So striking are many of the monuments of nature, those strange effigies of the works of man, chiseled by happy chance, by wind and weather, that one is often impressed by the belief that man originally found his ideas of art and architecture in nature, at least that the suggestion and impulse came in this way, and was developed and fostered by the human mind.

In crossing one of the most arid and forbidding regions in the State of Texas, the writer noticed a singular section of the country, which bore so remarkable an imitation to a gigantic structure built by human hands, that even an examination almost failed to dispel it. The work appeared to be gigantic ramparts formed of titanic blocks piled one upon another, as the pyramids might have been made. In one place they were exposed; in another covered, merged into a hill, reappearing far away; and only the vast nature of the work showed that it was accidental. This singular "work" is near the Pecos River region, which winds down through the State, cutting some striking gorges and abounding in picturesque scenery. Investigation shows that this rock has weathered or broken at regular intervals of six or eight feet, giving the impression of artificial blocks. On a portion of a branch of the Pecos River there is a series of flying buttresses or pillars, which stand out from a lofty cliff, presenting a most remarkable and imposing appearance. The traveler coming upon these stupendous figures in this wilderness, would easily mistake them for the work of man, so perfect are they.

In the Garden of the Gods are found strange monuments, the work of the hands of nature, towering aloft and assuming curious shapes that simulate the work of man; but all these, so remarkable as they are, do not rank with the singular and perfect column, known as the Sheepeater's Monument, which rises in the mountains of Idaho ten miles down Monumental Creek from the town of Rooswilt, in Thunder Mountain. It was discovered a number of years ago by some herders and prospectors, and was reported as a gigantic monolith, made by prehistoric man; and its appearance would justify the assumption. Yet the column is the work of wind and weather. The monument is over seventy feet in height, of commanding proportions, and can be seen against the sky for a long distance. It is nearly eighteen feet in diameter at the base, and rises in almost perfect proportions, being near the summit ten feet in diameter, sixty feet from the ground. The crowning feature of this stupendous column is what appears to be a cube of solid rock poised artistically upon one of its points—a position which would be a masterpiece of engineering to accomplish by the most skilled appliances of man.

This American Pillar of Hercules stands on the edge of a deep cañon filled with pine trees, and is an object lesson to the student of geology as well as to one interested in the fantastic in nature. The story of the pillar is easily told. It stands as a remnant of the mountain, which has been cut away by the constant washing of rains of untold centuries. At first a cloudburst, possibly, formed a channel; this became a cañon, and as the sides of the mountain washed away, a column-shaped mass, which was more resistant and harder than the rest, was left. Accident made the top of the column larger, as chance shaped the lower portion. This monument, due to the disintegrating power of nature, is formed of a rough conglomerate which but adds to its attractiveness, huge blocks and bowlders clinging to its sides, standing out in such relief that it is almost possible to use them as stepping stones and climb to the summit; yet so tall is the pillar, they are not seen at a distance, and do not interfere with the regular outline.

In the accompanying photograph this stupendous piece of nature's carving is seen. On the right side, part way up, are projecting bowlders which weigh several tons, and the strength and nature of the entire structure can be realized by the size of the surmounting cube, which shows from the point of view two level faces, and which it is estimated weighs one hundred tons or more. Marvelous as is this pillar, it is known to fame as "Sheepeater's Monument," the real meaning or significance of which is not definitely known.

Yachtsmen on the coast of Southern California are familiar with some remarkable monuments. One at the north end of Santa Catalina rises to a height of seventy feet directly from the sea—a needle-like rock, which from the base beneath the surface to the summit is believed to be over one hundred feet. On the upper portion is a large sea eagle's nest, composed of sticks, kelp, and refuse of various kinds, the piling up of years. When a storm is on, this rock receives the full force of the sea, which rises high in air to be swept across the intervening space and envelop the narrow head of the island in flying scud; yet the eagles persist in their home. On the north end of San Clemente Island there is a similar rock, known as the Chimney, which might well serve as a lighthouse on these rocky shores.

A NATURAL MONOLITH IN IDAHO.

At a point 60 feet from the ground the diameter is 10 feet.

High-Speed Trials With Electric and Steam Locomotives.

In the course of the Marienfelde-Zossen high-speed trials, the safety of working of the current collectors was particularly remarkable, even for the highest speeds. Special attention was paid to braking and inertia tests. By increasing the braking pressure, the braking distance was more and more reduced. Moreover, a new device was tested, automatically preventing the wheels from being braked at decreasing speeds by drawing air off from the braking cylinder. Trailing experiments were performed on six-axle sleeping cars, connected to the high-speed cars, it being shown that trailers up to speeds of 160 kilometers will run rather smoothly, material oscillations being observed only at speeds as high as 180 kilometers.

These experiments having shown that existing permanent ways, with careful construction and supervision of the track, are capable of standing much higher speeds than those now in vogue, even without any specially-designed cars, the Prussian railway authorities have decided on undertaking on the same Marienfelde-Zossen military railway some further experiments as to the performance and behavior of several types of locomotives. It is intended to reach speeds as high as about 90 miles an hour; and as the locomotives ordered for this purpose are now complete, it is anticipated that these experiments will be started in a very short time.

The Destruction of the Turin Library by Fire.

The famous library of the University of Turin was destroyed by fire on January 26. It is said that about 3,700 manuscripts, including almost all those of Oriental origin, were destroyed.

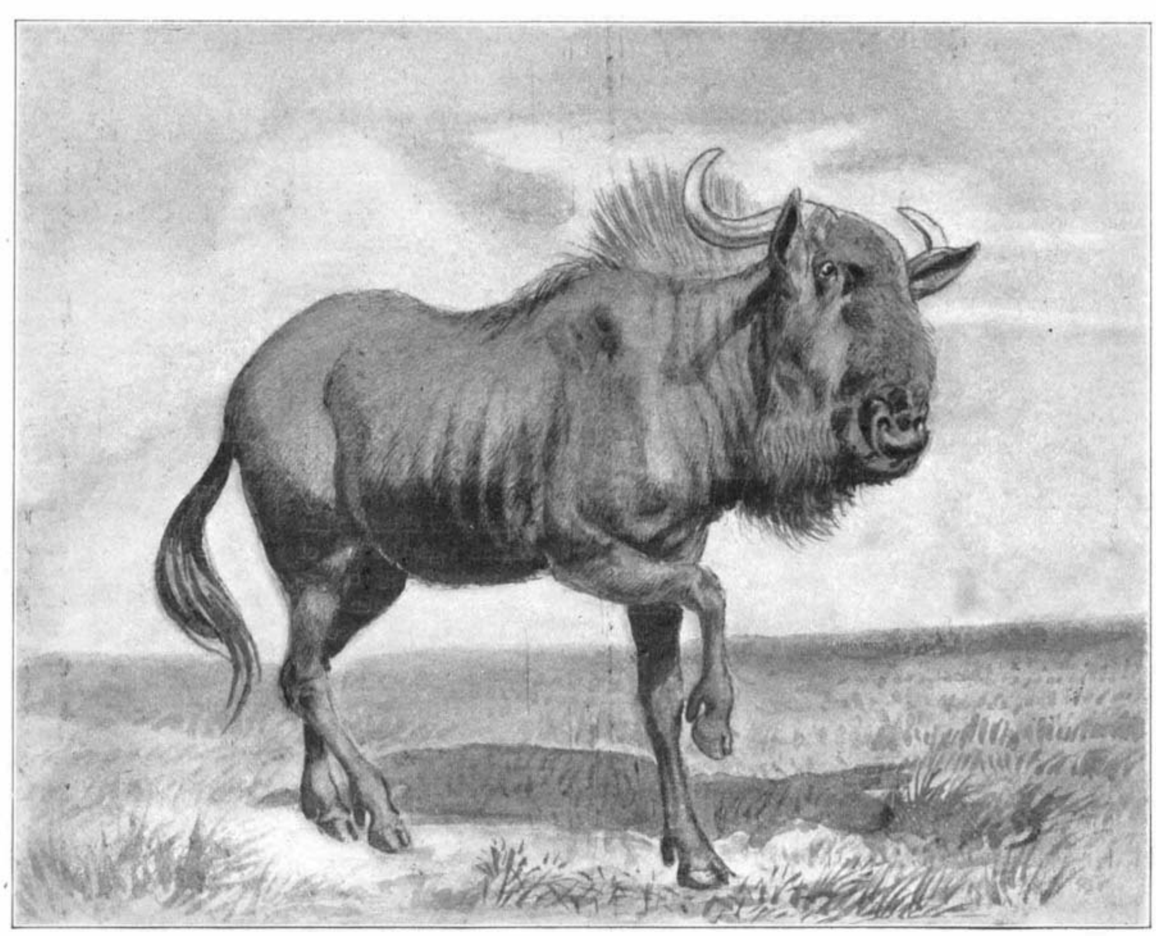
The number of volumes lost has not yet been established.

The fire practically lasted twenty-four hours, and it seems certain that three thousand volumes of Greek, Latin, and other codices were consumed, as well as the precious Venetian collection of books from the library of Cardinal Della Rovere. The codices from the celebrated Bobbio Abbey appear to have been saved, as was the incunabula collection.

Among the codices saved is a very ancient codex of the fourth century containing the Gospels, as well as many others of later date. A classic mediæval book of the greatest value, called "Heures de Turin," by the Duc de Berry, which Great Britain once sought to purchase, now appears to have been destroyed, as was an ancient French translation of Dante. Of this latter, however, there fortunately exists another copy in France.

THE BLUE GNU.

An exceedingly interesting animal now on exhibition at the Zoological Park is the new blue gnu. It would be hard to imagine a more fantastic-looking animal. It suggests to one coming unexpectedly upon it, and seeing it for the first time, a sort of impossible dream creature, a cross perhaps between a buffalo and a nightmare. To the buffalo belong the neck and the horns, but the tail and the hindquarters are those of a horse. The legs are a deer's legs, but the head resembles that of no other living animal. The specimen at the park came from South Africa, where the species ranges from Orange River north to Victoria Nyanza. There seems to be no doubt that the wild grotesqueness of the appearance of the gnu is a provision of nature to protect the animal. When frightened or disturbed, these remarkable antelopes go through a series of strange evolutions and extraordinary postures, in order to enhance as much as possible the oddity and hideousness of their appearance, and to frighten away intruders.



THE BLUE GNU.

Cotton Experts.

Although the consumption of cotton in this country is greater than that of any other country in the world, yet, in addition to supplying the home market, the South exported last year over 3½ billion pounds of cotton, worth 317 million dollars.

Legal Notes.

AN UNFAIR COMPETITION CASE.—The suit brought by the Enterprise Manufacturing Company vs. Lander, Frary & Clark (124 Fed. Rep. 923) brings out a state of facts which may be considered fairly typical of one class of unfair competition cases.

Complainant for many years made and sold coffee mills of different sizes, each having a distinguishing number, but all of a distinctive shape, design, and color by which they became known to the public and acquired a high reputation and large sale. Defendant, later, began the manufacture of mills of exactly the same pattern, admittedly copying those of complainant in shape and design, and even in coloring, the only distinction being in the numbers used, which were also similar, and in the initials and address of the maker, which were not conspicuous. It was shown that purchasers had in fact been deceived, and had bought and used defendant's mills supposing them to have been made by complainant.

The plaintiff's case came perilously near to being one of trade-mark law, pure and simple. For many years it had, without deviation, so prepared its coffee mills, by the use of various devices constantly employed, that they had come to be generally known as the "Enterprise" mills, and of the plaintiff's manufacture. If it had adopted one distinguishing and identifying mark or device for that purpose, and had succeeded with the one as it has with the many, a trade-mark case would have been presented, upon which a court of equity would have passed. If any mistake had been made, it grew out of the abundance of devices adopted; but, multitudinous as they were, their constant use as an identifying collocation of devices was admitted. Any possible weakness from the standpoint of a technical trade-mark case rendered the situation exceptionally strong, considering the facts of the case presented, from the standpoint of unfair trade and competition.

The boldness and evident sincerity exhibited by the defendant, which may be gathered from its answer and from the brief of counsel, was a refreshing combination. In the answer it said that it was doing what the plaintiff said that it was doing, and that it had an inherent natural right to do so, and proposed to do the things which it was alleged that it threatened to do, and that such action also was right and proper and defensible.

The fallacy of the defendant's contention has been more than once called attention to by federal judges. The plaintiff claimed no monopoly in the manufacture of coffee mills.

"The world at large and its products are open to the defendant. It can ransack the universe, and, avoiding possible patents, put together and market what it will in the way of coffee mills, with this one exception—it shall not so arrange its materials and so dress its goods as to produce and market a coffee mill which will be liable to be mistaken for the mills upon which, by long and persistent effort, the plaintiff has been enabled to obtain a distinctive reputation."

The whole case resolved itself down to this: Had the defendant, by placing its name in some instances, and in others its initials, upon its coffee mills in the manner shown, sufficiently distinguished them so that likelihood of misconception by the ordinary purchaser, acting in the ordinary way, was eliminated? It failed to prevent one customer from sending the defendant's mill to the plaintiff for repair, and such a demonstration of fact is worth any amount of hypothesis. "If the defendant was excessively anxious to keep off the plaintiff's territory, why did it not make some change in color, configuration, or design? The confusion could have been avoided with ease. He prepared the couch with eyes wide open and he ought to occupy it now with grace. The absolute similarity of the mills in an almost endless variety of ways is so marked, the finger directing the purchaser to the plaintiff is so imperative, that it cannot be possible that the letters on the periphery of the wheels could blot from the ordinary mind the forceful evidence of plaintiff's production which the extremely attractive collocation of colors, shape, and design presents. When the first glance of the eyes fixes the idea of origin firmly upon the mind, a minor detail must in the ordinary case pass unnoticed. By dint of comparison and constant repetition in the quiet of the courtroom, such a detail may grow distinct and exceedingly luminous, but in the crowded store, in the rush and hurly-burly of everyday business life, it would fade into nothingness when opposed to the general attractiveness of the entire structure. That the defendant put into the hands of the retailer or jobber the means of deceiving, whether with or without intention, is too obvious to deserve further discussion."

The injunction granted was narrow enough not to interfere with the inherent right of the defendant to make coffee mills of such design and dress as it pleased to employ, and broad enough to prevent the defendant from marketing a material which, by reason of its shape, design and arrangement of color and number, so resembled the coffee mills of the plaintiff as to be likely to create a misapprehension in the purchasers.

AN IMPORTANT ENGLISH PATENT DECISION.—Before Lords Justices Vaughan Williams, Romer, and Stirling, the case of Davis vs. Curtis & Harvey, Ltd., was brought on appeal for judicial revision. The facts of the case are brief. Davis was the inventor of a new gunpowder for blasting purposes, afterward known as "Argus" powder, in respect of which a provisional specification was lodged in April, 1898. In January, 1899, an agreement was made between Davis and Curtis, Harvey & Co., Ltd., by which Curtis, Harvey & Co. agreed to pay Davis, during the continuance of the agreement, royalties on the manufacture of the "Argus" powder, and it was provided that improvements in and additions to Davis's invention should be within the agreement. Curtis and others were afterward granted letters patent in respect of another gunpowder which afterward came to be known as "Bulldog" powder. Curtis, Harvey & Co. proceeded to manufacture and sell this "Bulldog" powder. Davis thereupon brought an action for royalties under the agreement, contending that "Bulldog" was identical in composition with "Argus" powder, or alternatively, was an improved modification of "Argus," and was subject to the agreement. At the trial it was held that the use of lignite instead of ordinary charcoal as the source of carbon in the composition of the "Argus" powder was of the essence of the plaintiff's patented invention; and that the defendants in manufacturing "Bulldog" powder without using lignite were only doing what all the world were entitled to do and without infringing Davis's patent; and that such manufacture did not come within the agreement; and also that "Bulldog" powder was not an improvement in or addition to the "Argus" invention. The action was dismissed with costs. The plaintiff appealed.

The defendants denied the identity of the "Bulldog" and "Argus" powders; but in the judgment of the Court of Appeal, the evidence fully proved the identity, with the exception that in another invention, disclosed in the complete specification filed by the plaintiff and C. W. Curtis, lignite is designated as the source of carbon. In the complete specification, the inventor points out what quality of lignite is best suited for his purpose, and then states that in case lignite in its natural condition does not conform to his requirements, it may be "subjected to a carbonizing operation at a very low temperature, in order to bring it into the desired condition." In other words, this point is expressly limited, so far as the carbon is concerned, to lignite or to lignite which has been subjected to the carbonizing operation. The argument in favor of the validity of the patent was this: That this patentee, for the first time, had used in connection with a sulphurless powder a new material in the form of carbon, and a new form of carbon, which had a special mercantile advantage, inasmuch as it was cheaper than the ordinary commercial artificially-made charcoal, which was the material ordinarily used in these sulphurless powders.

To the court it was perfectly clear that the agreement which was sought to be enforced in this action did not make the defendants liable to pay royalties on any powder which, admitting the validity of the patent, could be manufactured by anyone without infringing the patent. If any person, notwithstanding the exigencies of this patent, treating it as a valid patent, had taken the plaintiff's powder, but substituted the ordinary charcoal for lignite or lignite carbonaceously treated, that person could use the powder he so made without infringing the patent. That being so, it was clear to the court that the defendants here could have used such a powder under the agreement without paying any royalty to the plaintiff. It was clear, too, that the "Bulldog" powder, not being an infringement of the essence of the plaintiff's invention, there had been no infringement of the patent, for which reason no royalty was payable under the agreement.

The court's decision, therefore, came to this: That the essence of the plaintiff's invention was the use of lignite or lignite subjected to a carbonizing operation, and that the defendant's "Bulldog" powder was not an infringement of the plaintiff's or an improvement or addition to his invention. This was really not so much a patent case as the case of a construction of an agreement.

THE IMPORTANCE OF THE PATENT "CLAIM."—Imagine that a single individual were the originator of wireless telegraphy as it stands to-day. What would his protection depend upon? It would depend finally upon the skill of his solicitor of patents in formulating the claims of the patent. The inventor might be literary, a great scientist, an engineer, and an electrical expert, and he would therefore be able to explain his invention better than anyone else, and yet, if the description were not according to form, and especially if the solicitor should not have sufficient skill to word the claims properly to protect the invention, the invention would be practically given to the public.

The reason I consider the matter of vital importance, arises from the observation often made in the examination of a patent that is cited as an anticipation of a claim filed later. The first step in such an examination consists in determining if the patent has a claim as broad as the one alleged to be anticipated, for if the patent has such a claim, and is not too old, it is advisable to purchase it, for evident reasons. Too often the claim in the patent is found to be short of its aim. The defect can be remedied, if at all, only by a reissue, which cannot always be possible.

My object is to show the principle underlying the difference between a properly broad claim and a narrow one, so that an inventor, in writing a description of the invention for his solicitor, may define his invention after the manner of a sufficiently broad claim. Electrical inventors are, in the present age, highly educated and should be perfectly competent to define their invention from a broad standpoint, and then the solicitor can improve the wording and form, and supplement applicant's claims by subordinate and perhaps by a slightly broader claim.

The inclination is to leave all to the solicitor, but this is not advisable, because however expert he is, he is not infallible. The attorney is superior on all formal matters, but the client is superior on the merits. The solicitor should acquire as much as possible of the technical points, and the client should have a fundamental knowledge of the nature of claims.

A few years ago there was an inventor who was the first to invent a new rheostat element adapted to be varied. His claim on this feature reads:

"The combination, with a box or case, of a pile of thin sheet-metal resistance plates therein, and a screw for regulating the pressure upon said plates, substantially as specified."

An inventor should not only make the invention in one form, but think of several ways of carrying out the device, and then formulate a definition to cover all the devices. All such devices could, I think, be covered by a claim reading:

"A variable electric resistance, consisting of the combination of a pile of electrical resistance plates, and means for varying the pressure upon said plates."

Another case is that of a photometer for measuring mean spherical candle-power. The method consists in revolving two mirrors about an axis passing through the source of light under such conditions that the light from the source is reflected in different successive angles of a single plane upon the screen of a photometer, and also transmitted in this reflected passage according to a certain simple harmonic law. The broadest combination claim reads:

"In an apparatus for measuring the mean spherical luminous intensity of a source of light, the combination of two revolving mirrors, and means for varying the intensity transmitted to the photometer according to a simple harmonic law."

Why limit the protection to mirrors, leaving a loophole for another inventor to use refraction? Why confine the scope to a simple harmonic law, when the inventors are entitled to broad protection upon any arrangement of reflecting or refracting devices for securing the same result.

The claim could have read as follows:

"In an apparatus for measuring the mean spherical luminous intensity of a source of light, the combination of a photometer, and revolvable devices so disposed as to illuminate said photometer proportionally to the mean spherical candle-power of said source."

This claim would have protected the invention, whether on the principle of a simple harmonic law or some other law. The patent claim is also faulty in the narrow term "two revolving mirrors." Other means could easily be invented, and infringement avoided. If the scope is not defined by a proper wording of the claim, the patent is about as valuable as a house standing on a lot having a defective title.—Edward P. Thompson in Stevens Indicator.

The fact that an invention constitutes an important and desirable improvement in an art, in the development of which many inventors have participated without making such improvement, affords persuasive evidence of patentability.

Equity is without jurisdiction of a suit for infringement, where prior to its commencement defendant had ceased to infringe, and was at that time neither threatening nor intending to continue infringement.

A patent for a device, which states that a part is preferably made of a stated material, is not rendered invalid by the fact that when such part is made of a certain other material the device is inoperative.

RECENTLY PATENTED INVENTIONS.

Apparatus for Special Purposes.

KILN.—H. M. BUCK, Burlington, Wash. Mr. Buck's invention relates to improvements in kilns for drying shingles, lumber, and other substances; and one object he has in view is to construct the kiln in an airtight manner in order to retain the heat and overcome warping or buckling of the parts, thus contributing to economy in the use of steam or other heating medium and mininizing repairs.

Electrical Devices.

INSULATOR.—L. STEINBERGER, New York, N. Y. The several objects of this inventor are to product a neat, simple, efficient, and cheap construction admitting of a cable being secured thereto in more than one manner and having advantages of strength and thorough insulation, safety connection with the cable, and perfect adhesion between the portions made of metal and insulating material.

BINDING-POST.—L. STEINBERGER, New York, N. Y. In this case the purpose is to produce a device adapted for service in a great variety of places in or about electrical machines and to provide a mode of attachment which, while forming a perfect electrical contact between conductors shall also mechanically clamp them together securely without diminishing their tensile strength and which shall, at the same time permit them to be attached to or detached from the support when necessary and admit of either wire being attached or removed without disturbing either of the remaining wires.

ELECTRIC FIRE-ALARM.—J. A. BARTEN and S. R. SNEERINGER, Philadelphia, Pa. The invention relates to automatic electric fire-alarms of the type in which a fusible substance is melted when the apparatus reaches a certain temperature, thereby sounding an alarm. This substance may be paraffin, stearic acid, rosin, wax, tallow, or lead or a mixture of several substances. When it melts and flows upward around the piston, the movable contact member closes upon the fixed contact and sounds the alarm.

AUTOMATIC ELECTRIC PUMP.—F. L. ORR, Thurman, Iowa. Mr. Orr's improvement is in the nature of an automatic electric pump designed to lift and force water or other liquid to any desired height, to be automatically started into action or stopped, according as the tank is empty or full, and operating in a smooth and practically noiseless manner and with an economic expenditure of electric current.

Engineering Improvements.

BOILER-BRACE.—E. COOK, Portland, Me. The object of the invention is the provision of a new and improved brace which is simple and durable in construction, cheap to manufacture, readily applied, and arranged to prevent the boiler-head from bulging outwardly and loosening the joints of the tubes in the head.

ROTARY ENGINE.—W. S. CHAPMAN, dec'd, C. A. HASTINGS, Lewiston, Idaho, Administrator. In this patent the invention consists in the novel construction and arrangements of parts designed to form a rotary engine of high efficiency adapted to operate with steam at a high pressure of three hundred pounds, more or less, and in which the steam exerts a steady pressure with little or no back pressure and a great economy of steam.

Heating and Lighting Apparatus.

HOT-AIR FURNACE.—T. F. MEINHARDT, Charlottesville, Va. This inventor has made an improvement in hot-air furnaces, and particularly in that class of such furnaces wherein the products of combustion are caused to traverse a somewhat circuitous passage in order to extract as far as possible all the heat units. The furnace may be made of steel, wrought or cast iron, or other material, in one piece or in several sections.

Machines and Mechanical Devices.

PUNCHING-MACHINE.—O. P. WOODBURN, Pierce, Texas. In this patent the object of the improvement is to furnish a new punching-machine more especially designed for punching holes in hollow bodies—such as pipes, casings, and the like—and arranged to punch the holes from the inside of the hollow bodies in a very simple and economical manner.

COMBINED LOCK AND LATCH.—B. SCHACHT, New York, N. Y. The invention has reference to improvements in combined locks and latches of that class wherein there is united a lock-bolt adapted to be operated by a key and a latch-bolt normally under control of a knob-spindle and adapted by a push-button controlled dog mechanism to be locked in a projected or shot position.

WIRE-WORKING TOOL.—B. B. FELTUS, Mingary, South Australia, Australia. In this instance the invention pertains particularly to improvements in tools for manipulating wire in building wire fences, the object being to supply a tool of simple construction and having in its several devices implements for stretching, twisting, holding, and cutting wire, and other devices found useful in fence-building.

AERIAL WHIRLING TOWER.—J. H. WELSH, New York, N. Y. The object in view of this inventor is to provide a simple and secure form of apparatus wherein provision is made for carrying passenger-cars to a desired height above the ground and for moving the cars in a circular horizontal path during the elevation and lowering movements, whereby the cars travel in spiral paths and a good panoramic view of the locality is afforded to the passengers.

FAN-ACTUATING MECHANISM.—J. F. CARR, Coushatta, La. This inventor's improvement refers to a class of actuating mechanism driven by the descent of an attached weight, and has for its object the provision of novel simple details of construction for an apparatus which adapt it for the vibration of a plurality of fans connected therewith. Means are provided for adjusting the length of the arms that carry the fan-blades, so that a current of air may be produced at different heights from the floor in rooms of various heights.

WINDMILL-PUMP COUPLING.—C. W. DECKER, Charles City, Iowa. In this case the invention pertains to a windmill-pump coupling of that form in which the windmill-rod and the hand-lever may be alternately coupled to the pump-piston to allow the latter to be worked either by hand or by the windmill without interference with each other, the change being made by a mere adjustment of the hand-lever of the pump.

MIXING-MACHINE.—C. E. FOOTE and C. T. FOOTE, Nunda, N. Y. The purpose in this instance is to provide a mixing-machine, particularly designed for producing concrete, mortar, and the like and arranged to insure a thorough mixing of the ingredients to produce a mass of uniform composition throughout and to allow of running the machine either as a continuous-discharge machine or for forming and discharging the mass produced in batches.

Of Interest to Farmers.

TONGUE-SUPPORT AND SIDE-DRAFT CHECK FOR GRAIN OR GRASS HARVESTERS.—C. F. ORTMAN, Martinton, Ill. The invention relates to means for supporting the tongue of a grain harvester and binder or of a wide-cutting grass mower. The object is to provide a device which embodies details of construction that adapt said attachment for convenient adjustment to compensate for turning movements had by the harvester while in operation and also reliably counteract side draft incidental to such machines.

Pertaining to Vehicles.

DRAFT MECHANISM FOR TRACTION-SLEDS.—N. E. BROWN, Robbinsdale, Minn. The object here is to provide means for anchoring forward ends of a doubled transmission-cable having the rear or intermediate portion connected with a winding-drum or an engine which is placed on a sled, the operation being in such a manner that while the portion used for draft is being wound on the drum the opposite portion is being unwound and laid forward for repeated use, and means for reversing the winding-drum simultaneously with each change of anchorage, so as to make draft and forward motion practically continuous.

SPRING DRAFT ATTACHMENT.—G. W. KING, Washington, D. C. The present invention is an improvement upon a device shown in a former patent granted to Mr. King. Its operation is that of a draft-spring to favorably modify by elasticity all irregularities of action, receiving with safety sudden shocks and blows which might otherwise injure the animal, load, harness, or vehicle. The spring is subject to no more strain than is sufficient to counterbalance its resistance to compression, the remaining strain being confined to the trace and other connections. If the spring breaks the accident should not involve the separation of the draft connections.

Railways and Their Accessories.

RAILWAY.—S. E. JACKMAN, New York, N. Y. This railway is for amusement use in pleasure resorts, etc., and Mr. Jackman's object is to furnish a new and improved switch-back or inclined railway arranged to take up a comparatively small amount of ground or floor space and to afford a long and exciting ride, especially as a car during a part of its journey races side by side with a preceding car and again with the next following car to the great diversion of the occupants.

BRAKE-SLACK-ADJUSTER.—W. J. KEVILLE, Denver, Col. Mr. Keville's invention relates to improvements in devices for taking up or adjusting the slack in railway-car air-brake mechanism, an object being to provide a simple device for this purpose that will automatically take up any slack that may occur through the wearing away of parts or other abnormal travel of the brake-operating system.

GRAIN-CAR DOOR.—E. E. KENFIELD, Washburn, Wis. In this instance the invention has reference to grain-car doors. It consists, broadly stated, of a peculiar door adapted for ready adjustment across the doorway. The special object in view is to provide a door or barrier specially adapted for freight-cars in hauling wheat or other cereal grain, the barrier being placed on the inside of the car-doorway and secured together by cleats.

Miscellaneous.

HANDLE FOR BASKETS.—B. J. RAGATZ, St. Joseph, Mich. Broadly stated, the invention comprises a rod having at one or both ends for attachment to a basket or the like a substantially U-shaped portion with parallel sides lying in close proximity and one of said sides having at its lower portion a projection arranged to engage under the supporting-strip at the top of the basket. The handle can be quickly and easily applied to the top edge of a basket having on one or both sides a reinforcing-strip.

BOX-FASTENER.—E. T. REILLY, Evansville, Wis. Mr. Reilly's invention has reference to fastening means for boxes in general, but intended more particularly for boxes in which tobacco is packed. The invention as a whole provides a box specially adapted for packing leaf-tobacco, owing to the fact that the box is many times opened for tobacco inspection. The improvement affords material advantage over any similar box, as a protection to original packages of leaf-tobacco against rough usage.

BELT AND GARMENT FASTENER FOR SUPPORTING SKIRTS OR TROUSERS.—G. SCHMITT, Pittsburg, Pa. That class of devices which are adapted for detachable connection with a shirt-waist and belt for the purpose of supporting either skirts or trousers is improved by this invention, which provides attaching devices of novel form arranged to be concealed when in use whether a belt be worn or not. It is thus adapted to be worn by either sex and is so constructed that it may be quickly applied or detached.

SQUARE.—G. A. STEPHENS, Memphis, Tenn. This invention refers to a class of plate-metal squares used by woodworkers and other mechanics, and has for its purpose to so construct a tool of the class indicated that its two members are rockable one on the other, so as to permit them to be folded flatwise together and also to adapt the members for instant adjustment to form a true square when desired.

OPTICAL DEVICE.—M. F. SHEA, Newport, R. I. This device is designed to contain views or pictures. In the present instance the inventor has in contemplation providing an optical device which may contain a number of views or plates, each of the views or plates being brought into use in line with the vision as the box or main body of the device is turned in various directions.

GLAZED STRUCTURE.—J. A. PAYNE, Jersey City, N. J. In this patent the invention relates to the construction of greenhouses, sky-lights, and similar structures; and its object is to provide a structure arranged to combine strength with lightness and preserve the wood against the ill effects of moisture, thereby insuring long life to the structure.

CABINET.—I. MASON, New York, N. Y. The object is to provide a cabinet of novel construction and particularly adapted for the convenient storage of cigars, beverages, and the like and so arranged that the top and front closures will swing together, whereby the contents of the cabinet may be reached both from the top and front, the top closure serving as a support for articles when in either closed or open position.

CLASP.—O. J. JONES, Bangor, Pa. In this case the invention pertains to improvements in clasps particularly designed to be used in lieu of buttons for securing suspender-ends to trousers, an object being to provide a clasp of simple construction that may be quickly engaged with the waistband of trousers and as readily detached.

ROLL NOTE-BOOK.—O. HULBACK, Crookston, Minn. This invention refers particularly to improvements in devices for holding rolls or thick strips of note-paper for the use of stenographers, an object being to provide a device for this purpose that shall be simple and inexpensive in construction and of great value and convenience in making notes from extended discources or dictations.

FLASK FOR VOLATILE OR OTHER LIQUIDS.—H. GOETZ, Frankfort-on-the-Main, Germany. Inconveniences often result from the obstruction of the capillary exit in flasks of the sort designed for the issue of ethyl chlorid, the obstructions being generally caused either by the rubber which closes the capillary orifice at its upper part directly pressing upon its upper part or by dust in the flask or liquid, which dust clogs the capillary canal at its lowest part. By making the capillary orifice independent of the flask the inventor obviates this objection.

INSTRUMENT FOR DETERMINING THE POSITION OF CUTTERS ON MOLDING CUTTER-HEADS.—J. FAY, Jersey City, N. J. Mr. Fay's invention has reference to an instrument for determining the position of knives on the cutter-heads of wood molding or planing machines, and the object in view is the provision of a device which may be used advantageously in ascertaining the extent or distance that any kind of knife or cutter should project from a cutter-head of any style or pattern.

HORSESHOE-CALK.—C. L. DAHLY, Decorah, Iowa. One of the principal objects of Mr. Dahly's invention is to overcome numerous disadvantages and objections common to many similar devices and also to provide devices of this kind which are effective and reliable in use, besides being easily applied and comprising few parts not easily broken and not liable to get out of order. A new calk may be substituted by simply removing the screws, sliding the calk-plate back out of its retaining portion of the shoe, and attach a new plate.

FLY-CLOSER FOR SHOE-UPPERS.—S. CLOUTIER, Lewiston, Me. The object of this invention is to provide a closer or holder for the convenient and reliable closure of the fly for a shoe-upper which will without injury thereto be adapted for a removable engagement with the perforations of the edges of the fly in the vamp or shoe-upper and hold the edges from spreading apart while the shoe is manufactured.

MOVABLE TOP.—S. CLOUTIER, Lewiston, Me. In this patent the object of the invention is to provide novel details of construction for an ordinary peg-top, which facilitates the raising of the top, while it is spinning and changing its position without materially checking the speed of rotation. The top is spun in the usual way by the use of a cord.

PROCESS OF MANUFACTURING VARNISH SUBSTITUTES.—R. BLUME, 46 Kaiser-strasse, Magdeburg, Germany. This invention has reference to a process for the manufacture of a varnish substitute from rosin-oil, the said product being distinguished by great elasticity and uniform drying qualities. Varnishes and varnish substitutes as manufactured heretofore by the employment of rosin-oil presented the inconvenience of being difficult to dry and of becoming sticky after a short time upon the action of heat. This process avoids a liability of the coating cracking, becoming sticky again or getting brittle.

NECKTIE-RETAINER.—M. C. LEWELLYN, Buffalo, N. Y. The object in this improvement is to supply a device that can be readily applied to a tie after it is put in position that will effectually prevent the displacement of the tie and keep it from moving upward. A strip or plate has projections at one end arranged to engage the tie, while the opposite end contains a slot or similar means for engaging a portion of the adjacent wearing-apparel.

COMBINED SCHOOL SEAT AND DESK.—J. H. SUTHERLAND, Dawkins, Col. A prominent object in this improvement is to furnish a structure which is simple in construction and also in which the desk is bodily adjustable as to height, while the top thereof is independently adjustable to varying inclinations, whereby a scholar or pupil is enabled to occupy a natural position seated at the desk perusing a book or studying a lesson placed upon the top of the desk.

COOLER FOR LIQUIDS.—J. L. STEITZ, Chicago, Ill. The invention refers to improvements in cooling devices for liquids under pressure—such, for instance, as beer—the object being to provide a device for this purpose designed to be placed in a box of cracked ice and not liable to be broken or injured by the ice, as often happens to the usual coiled pipes.

CURLING-IRON HEATER.—O. WALSH, New York, N. Y. In this patent the invention has reference to curling-iron heaters, the inventor's more particular object being the production of a neat and simple heater, preferably made from a single sheet of metal and otherwise suitable for an article of manufacture. The structure affords a maximum of strength and ornamentation with a minimum of metal.

MEGAPHONE.—C. MELVILLE, New York, N. Y. Among other advantages this inventor has for an object the production of a collapsible article which may be folded compactly to facilitate storage and transportation and at the same time may be easily and quickly adjusted in a way which prevents collapsing of its parts, so that the device can be used like an ordinary rigid megaphone.

REVOLUBLE WINDOW.—E. C. SOMERS, deceased, N. L. Somers, administrator, Corning, N. Y. The aim of this inventor is to provide a new and improved window which is simple in construction and arranged to permit of conveniently locking the sash to the slide, to move the sash up and down or to unlock the sash from the slide for turning the sash on its pivots.

BAG-CLOSURE.—G. WINKLER, Sardis, Ohio. Mr. Winkler's invention pertains to improvements in bag-closures, the same being designed for use more especially on flour and grain bags; and the object he has in view is the provision of a construction for easily and quickly closing the mouth of a filled bag without tying or sewing the same, and which also allows the bag to be renewed by securing a new bag to the closure.

MINNOW-BUCKET.—T. B. WILSON and A. L. DAVID, Epes, Ala. In this case the invention is an improvement in that class of minnow-buckets which are provided with an air-pump for forcing air through the water for the purpose of aerating the liquid, and thereby extending the life of the minnows to an indefinite period.

TOY GOLF-PLAYER.—P. A. VAILE, Auckland, New Zealand. One object of this invention is to produce a toy figure in which the parts normally take the position assumed by

a player in "addressing" a golf-ball, a part of the figure being capable of movement in a correct or true manner to strike the ball by a miniature golf-club in the hands of the figure.

WASHING-MACHINE.—W. T. RUSK, Sterling, Neb. This apparatus belongs to that class of washing-machines in which an agitator is mounted to operate in a tub, and the water caused by this agitator to circulate through the clothes to clean them. The invention resides particularly in the construction of the agitator and in the relative arrangement of the same with the tub, the operating means, and the framing of the apparatus.

ICE-CREAM FREEZER.—J. PRADE, Waco, Texas. This invention comprehends generally a peculiar co-operatve arrangement of an insulated jacket, a cream-holding cylinder endwise movable into the jacket joined with a feed member for feeding the liquids to be frozen into the cylinder, a rotary dasher operable within the cylinder for agitating the material being frozen, and a second rotary dasher device operable between the cylinder and jacket for keeping in agitation the refrigerating mixture.

CASE.—J. F. PRENTICE, New York, N. Y. The case invented by Mr. Prentice comprises a base and a cover, the latter being fitted with a suitable handle and mounted to slide on the base. Fastening devices are provided for holding the cover in active position and means are also provided for automatically moving the cover back out of position as soon as the fastening devices are released. The case is for use in inclosing type-writing, adding, sewing, and other machines.

STOVEPIPE-LOCK.—W. A. PETRIE, Petoskey, Mich. The aim in this improvement is to provide a novel simple device for automatically locking the inserted end of a stovepipe in the aperture it occupies in a draft-flue or chimney and also to provide convenient means for releasing the stovepipe-lock when this is desired.

TROUSERS CREASER AND PRESSER.—E. GRAHAM, Orangeburg, S. C. In this patent the invention relates to improvements in devices for creasing and pressing the legs of trousers, an object being to provide a device for this purpose of simple construction that may be operated by any one and that will form a lasting crease without employing a hot iron.

DRAWERS.—J. GUGENHEIM, G. A. CAPITON, L. D. HERRICK, and H. JACOBS, Scranton, Miss. These inventors have made an improvement in that class of undergarments which are composed of fabrics of different degrees of elasticity, one being preferably a woven fabric and the other a knitted one. In the drawers the invention is embodied in the particular form and arrangement of the knitted or most elastic portions with reference to the woven or less elastic portions, whereby certain advantages are attained.

STAIR STRUCTURE.—N. BOIS, Brooklyn, N. Y. In this case the invention has reference to improvements in metallic stairs, an object being to provide a stair structure of novel construction in which a plurality of steps and risers are formed from a single length of sheet metal. The stair structure embodying this invention is very light, yet sufficiently strong for the purpose designed.

FLUE-EXPANDER.—J. W. FAESSLER, Moberly, Mo. This invention is an improvement in flue-expanders of the roller type—that is to say, in expanders whose body is provided with a longitudinal bore to receive an expanding-mandrel and with antifriction-rollers working in contact with the mandrel and adapted to move laterally in longitudinal slots. Mr. Faessler has invented another improvement in that class of flue-expanders which are composed of a cylindrical body having a longitudinal bore to receive the expanding-mandrel and longitudinal slots to receive antifriction-rollers and are further provided with an enlarged circular collar, the latter forming a circumferential shoulder which in practice works in contact with the end of a boiler-flue when the same is being expanded. Means are provided to work in contact with the end of a flue when the tool is used for expanding the latter.

KETTLE.—R. BRANDT, Athens, Ga. The object in this improvement is to produce means whereby the surface within a given area exposed to the heat may be increased in order that the contents of the kettle may boil in less time than with the flat-bottomed kettle, and the invention may be embodied in kettles, including double boilers for kitchen use, boilers for candy-making, those used in preparation of chemicals, in cabinet-makers' glue-pots, chafing-dishes, tea-kettles of all kinds, evaporating-pans, and the like.

KNOCKDOWN UMBRELLA.—H. FESENFELD, Hoquiam, Wash. The umbrella is of the so-called "Knock-down" type. It is made up of parts which may be readily assembled or taken apart. If almost any piece be broken, it may be replaced by another without the aid of a workman. It is strong, cheap, and durable.

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. 5082.—Wanted, the two following addresses: C. C. Stuart, maker of horizontal band saws; also D. A. Kennedy, maker of sawmill machinery.

Inquiry No. 5083.—For manufacturers of advertising novelties.

Inquiry No. 5084.—For machinery for making water-colored and oil-finished shade cloth.

Inquiry No. 5085.—For makers of sheet metal stampings.

Inquiry No. 5086.—For the makers of the Merrill hand paper punch, made of stamped metal.

Inquiry No. 5087.—For makers of paint grinders' and mixers' machinery.

Inquiry No. 5088.—For makers of a small, light-weight jack screw, also for makers of spring washers for bolts,

Inquiry No. 5089.—For makers of machines for beveling glass.

Inquiry No. 5090.—For makers of electric registers for use with single dry battery and counting exact number of revolutions.

Inquiry No. 5091.—For makers of a check board to be used as a time clock or register.

Inquiry No. 5092.—For manufacturers of electrical pumps.

Inquiry No. 5093.—For makers of machinery for manufacturing strawboard fillers for egg cases.

Inquiry No. 5094.—For manufacturers of all kinds of handles.

Inquiry No. 5095.—For manufacturers of spring motors as are used in phonographs and show window turnstiles.

Inquiry No. 5096.—For makers of machines for making cloth buttons and for stamping the tin parts for such buttons.

Inquiry No. 5097.—For manufacturers and distributers of electric carbon.

Inquiry No. 5098.—For the address of the Monoplex Telephone Co.

Inquiry No. 5099.—For makers of optical and photographic novelties.

Inquiry No. 5100.—For a machine for manufacturing small seamless rubber tubing or small rubber rod.

Inquiry No. 5101.—For manufacturers of glass paper weights.

Inquiry No. 5102.—For makers of tools for repairing watches and clocks.

Inquiry No. 5103.—For makers of castings for gasoline motors.

Inquiry No. 5104.—For the makers of the X-ray slot machine.

Inquiry No. 5105.—For makers of iron fence and tree guards.

Inquiry No. 5106.—For machines for making concrete building blocks, bricks, fence posts, pipes, etc.

Inquiry No. 5107.—For makers of revolution counters.

Inquiry No. 5108.—For manufacturers of water motors.

Inquiry No. 5109.—For addresses of a parachute factory, an umbrella factory and a place to buy thin, light-weight steel tubing.

Inquiry No. 5110.—For makers of finished hand wheels about 4 and 6 inches in diameter.

Inquiry No. 5111.—For a small, hand portable fire escape.

Inquiry No. 5112.—For manufacturers of ice-making and refrigerating machinery.

Inquiry No. 5113.—For manufacturers of cast steel tubing.

Inquiry No. 5114.—For manufacturers of rubber mucilage.

Inquiry No. 5115.—For a hand power loom which is suitable for weaving rag carpets.

Inquiry No. 5116.—For makers of coin-operating, engraving and name-plate machines.

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.

(9306) C. C. asks: 1. Has nitrogen ever been liquefied? If so, by whom, at what temperature, and under what circumstances? A. Nitrogen was liquefied many years ago in an experimental way, but can now be liquefied in large quantities with the oxygen in liquid air. It liquefies at −318 deg. Fahr. For the process and apparatus for liquefying gases see Sloane's "Liquid Air," which we can send you for $2.50 postpaid. 2. What is the full meaning of the term oxidizing agent? A. An oxidizing agent is one that will furnish oxygen to some other substance to change it to an oxide. 3. What temperature is acquired when carbon is gasified? A. Carbon is vaporized at the temperature of an electric arc, 6,300 deg. to 7,000 deg. Fahr. 4. The following experiment was to be performed before the physics class, taken from our text, Carhart and Chute, illustrating the disappearance of heat during solution: Pour a few cubic centimeters of water into a beaker, and ascertain its temperature. Then add a few crystals of sodium sulphate. The temperature will fall as they dissolve. The temperature of the water was 21 deg. C., and when the sodium sulphate was added, the temperature rose to 25 deg. C. What was the cause? A. It would seem as if there were some error in the substances used. The experiment of dissolving sodium sulphate in water to show the latent heat of solution is a common one. If hydrochloric acid were used in place of water, the drop in temperature would be much greater. If by mistake a substance were used in which some chemical action took place, then heat would be produced.

(9307) L. A. S. asks: 1. Why will a polished receptacle hold heat longer than one not polished? A. Bright polished surfaces are well known to radiate less heat than the same surfaces that are rough or colored. Roughness increases the surface area of a radiating vessel or object, and hence the increase in the amount of radiation over the same area with a perfect polish. 2. Will a certain amount of gas heat a room more quickly when burning in a stove, or is directed against a piece of metal heating the metal first, or when it is burning openly in the room? And if it heats the room more quickly when burning in the stove, what is the reason why? A. There is no more heat created in either case by the perfect combustion of the gas, but the low radiant heat from the surface of the metal plate, as well as from the metallic surface of a gas stove, has a soothing effect upon the nerves, and thus induces the feeling of warmth. 3. What is the construction of small barometers, used by the side of thermometers, that crystallize something in a liquid indicating fair, change, and stormy weather? Also what is the cause of this action? A. The so-called weather-glass barometer is a sealed glass tube nearly filled with a saturated solution of camphor in alcohol, which crystallizes more or less by changes of temperature. It is of no value as a barometer, and is not influenced by changes in atmospheric pressure.

(9308) J. R. D. B. asks: Is it possible to produce a perfect vacuum? A. A perfect vacuum cannot be produced by a pump. Some air always remains. A vacuum may, however, be made by a pump so good that electricity cannot pass through it. It is said that a perfect vacuum has been made by taking a long piece of hard glass tubing closed at one end and filling it with a soft glass which melts at a much lower point. Now connect this to a pump, so that the tube may be heated and the inner soft glass be melted while the air is pumped off around the lower end of the tube. The soft glass will slide down the tube, leaving a vacuum above it. When allowed to cool, a perfect vacuum would exist in the space at the top of the tube, but no use could be made of it. even if such an apparatus were ever actually constructed.

(9309) J. H. G. writes: 1. If a cylinder is equal to 4 square inches in diameter, and the piston stroke is say 12 inches, and the discharge pipe is equal to one square inch in diameter and 100 feet high, will the friction in the pipe and the friction against the upper end of the cylinder require the same amount of energy to empty the cylinder as it would to lift the 4-square-inch column of water one hundred feet? A. The arrangement as described in your inquiry is rather ambiguous as regards friction, which is a small item in energy of pumping. The pressure and velocity of the fluid pumped control the conditions of friction. The energy of the pump piston to force a column of water 100 feet high is the same in a 1-inch and a 4-inch pipe, save the friction, which is greater in the 1-inch pipe for a given time. 2. If a bottle or vessel is tightly corked, and a weight attached so that the vessel is submerged, will it sink to the bottom of 400 feet of water, or will it require more weight to keep it at the bottom? If so, how much, or what is the proportion? A. The condition of a bottle tightly corked and weighted to sink beneath the water is the same as any solid body of the same density, and if it sinks at all, it will go to the bottom at great depths. Although water pressure increases with the depth, its density is but little changed, as water is but very slightly compressed under great pressures. At the depth of a mile a cubic foot of water will weigh about a half pound more than at the surface. The elasticity of any body sinking in the ocean will have its density increased by the pressure as much or more than the increase in the density of the water.

(9310) G. N. L. asks: Can you furnish formulas for solution for oxidizing copper and another for producing satin finish on brass? A. For oxidizing copper, dip the finished article in a solution of one drachm of nitrate of iron in one pint of water for a few minutes or until the desired color is obtained. The ormolu dip or satin finish on finished brass is made in proportions as follows: to 1 gallon sulphuric acid add 6 pounds niter, ½ pint nitric acid, ½ pint muriatic acid. Add the nitric and muriatic acids a little at a time. The brass must be perfectly cleaned by dipping in hot soda water; wash in hot water, and dip for a few seconds, and wash in hot water.

(9311) G. G. G. asks: Kindly tell me which is correct in his opinion: A says a live organic body dropped into a pool, which has been heavily charged by passing an electric current through it, will be thrown into space by the temporary *annihilation* of gravitation; B says that if any such result is obtained, it is due to the action of said body's muscles in opposition to gravitation. A. Several things may be said in reference to "a live organic body dropped into a pool which has been highly charged with electricity." A pool cannot be charged with electricity. The earth would conduct the electricity away as fast as it reached the water. There would be no difference between dropping a live organic body into the water of a charged pool and a dead organic body into the water of a charged pool, or dropping a stone for that matter. There is no such thing known, as a possibility, as the "annihilation of gravitation." A live organic body would be very likely to jump when it struck water in falling, and if the water was shallow it might jump from the bottom, and so jump out. This could not be called an annihilation of gravitation by any stretch of language whatever; it would be "the action of said body's muscles in opposition to gravitation." Why not say in plain English, if an animal is dropped into the water, it will jump out of it if it can?

(9312) R. M. S. writes: Two large buildings erected by the State for the Northern Normal and Industrial School at Aberdeen, S. D., have caught fire, the one over a year ago and the other December 31, 1903, under peculiar conditions, the theory being that both fires were due to spontaneous combustion, and I write to name the conditions and solicit an opinion. In the case of the last fire, the building was practically completed, no stoves or fires of any kind were in or around the structure, which was heated by steam. The fire caught about five o'clock in the morning, on the first floor above the basement, where workmen had been busy all day oiling the floors. At night the doors were all closed and locked, the rooms being kept warm all night by the steam heating system. The temperature outside was 25 degrees below zero, and on the inside of the building about 70 degrees above zero F. An opinion from so able an authority as the SCIENTIFIC AMERICAN as to the cause of this fire, would be greatly appreciated. A. Woodwork, such as floors that have been oiled with linseed oil, generally boiled oil with a drier, is not known to take fire by spontaneous combustion; but the rags or cloths used for oiling or rubbing the floor are very liable to take fire by spontaneous combustion, especially if thrown together in some out-of-the-way place. It will be well to make a rigid inquiry of the workmen as to what they used in oiling the floors and where they deposited the articles used in rubbing the floors. A single rag bunched, not larger than 4 or 5 inches in diameter, left behind or close to a radiator, will take fire in a few hours, and if several such bunches of oily rags are thrown together in a corner or closet, fire will surely follow in a room heated to 75 degrees F. Very interesting articles on spontaneous combustion and its causes are contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 81, 132, 798, 929, 936, 10 cents each mailed.

(9313) W. G. S. writes: The feed water for a boiler is contained in an air-tight tank, and it is to be forced into the boiler by

means of compressed air acting upon the surface of the water in the tank. The three following experiments are supposed to be tried, so that at the beginning of each surrounding conditions are precisely alike, viz., pressure, temperature, quantity of heat or heat energy in the boiler, quantity of water delivered, etc. No heat is to be added to nor taken away from the boiler except as mentioned; the air compressor is to be run by some entirely separate source of energy, as a water power. The loss of heat by radiation is to be ignored. A cubic foot of feed water is to be delivered into the steam space or above the water line, and in the form of a jet or spray, in order to condense as much steam as possible. In this case the feed water absorbs the heat of the condensing steam. The temperature and pressure would change, but not a particle of heat or heat energy would be lost or used in any sense of the word. Heat is a source of energy solely on account of its position in the boiler, and under the conditions of the experiment the only possible loss or escape for the heat is by radiation, and this we are to ignore. We therefore have in the boiler, after the experiment, precisely the same amount of heat energy that we had before the experiment began; in other words, we have the same amount of available energy. In a water power, in order to derive energy therefrom, the water must be allowed to pass through the wheel into the tail race, and in this position the water is absolutely void of energy in so far as the water power is concerned. The boiler is the pond, so to speak, for heat, and the tail race must be some place outside of the boiler; for we could no more have the tail race inside of the boiler than we could have the tail race of a water power in the pond itself. The amount of energy that must be expended in order to force a cubic foot of feed water into a boiler against a pressure of 100 pounds per square inch is about $144 \times 100 \times 1 = 14,400$ foot pounds. The same amount of feed water is to be delivered to the boiler, but this time it is to enter below the water line. It is clear that the final results would be the same as described above. In this case the water is to be delivered through an injector which is to be in operation on its own account, and the delivery pipe from the tank is to be the suction pipe of the injector. Now, the injector, according to all the best authorities, returns all the heat used with the feed back to the boiler, and it is a fact that cannot be disputed, so that the final results as to temperature, available energy, etc., are precisely the same as in experiments 1 and 2; in other words, the injector has used neither heat nor heat energy. The mere fact that the steam in passing through the injector is condensed cuts no figure, or no more than in the first case. It is heat and not steam that is a source of energy, and the fact that it remains in the boiler will prove to anyone in his right mind that it is not used in any sense of the word in any of the above cases. In the latter case no energy is required to run the air compressor, since atmospheric pressure is sufficient, if allowed to press upon the surface of the water in the tank. It plainly follows from the above that since the injector uses no heat, it is not an instrument in which heat is used as a source of energy; or in other words, the steam or heat passing through an injector furnishes no energy whatever. In this case there is work done, and none of the medium supposed to be the source of energy is used or lost. Were a perpetual motion possible, it would do the same thing. Why is it that since the injector uses neither heat, heat units, nor heat energy, and therefore cannot assist the air compressor, there is such difference in the amount of energy required to force a cubic foot of water into the boiler in the above cases? A. We find no difference in the amount of work or energy to force a cubic foot of water into a boiler under pressure, whether it is done by the boiler through an injector, or by some outside power. Heat is a potential form of energy, and its conservation in this case is of two methods of utilizing it. By the injector the boiler furnishes the total amount of heat energy to raise the cubic foot of water to the boiler temperature, and has to expend exactly the same amount of energy to heat the cubic foot of cold water pumped in by other means. The assertion that the air compressor uses no energy is an error; air pressure is potential energy in the tank, produced by the energy expended in the air compressor.

(9314) W. J. S. asks: In G. E. Bonney's "Induction Coils," on page 228, it says the secondary wire best adapted for this coil is No. 36 single silk-covered. Does this mean Birmingham wire gage or Brown & Sharpe? I ask you this to make sure that I will be right. A. Bonney's "Induction Coils" is an English book printed in London. There is no reference to the B. & S. wire gage in it. All sizes are to be understood as those of the Birmingham wire gage.

(9315) C. G. McC. asks: Will you kindly give me formulas for the manufacture of dry powder fire extinguisher, at the same time kindly indicating what you consider the most reliable? A. The following formula is copied from our Cyclopedia of Receipts, Notes, and Queries: Common salt, 60 parts; sal-ammoniac 60 parts; sodium bicarbonate, 80 parts. Sal-ammoniac, 100 parts; sodium sulphate, 60 parts, sodium bicarbonate, 40 parts.

NEW BOOKS, ETC.

DISEASES OF A GASOLENE AUTOMOBILE AND HOW TO CURE THEM. By A. L. Dyke and G. P. Dorris. St. Louis: A. L. Dyke Automobile Supply Company. 1903. 12mo. Pp. 232. Price $1.50.

This is the most practical book we have seen on this subject. It will save time, temper, and money. Theory does not enter into the present volume, but the information conveyed is of just such a nature as will prove of value to a man who owns or repairs a machine. A thorough knowledge of its contents would result in far fewer strandings by the roadside. It would not be a bad idea to carry a copy of this book in the tool box. The diagrams are particularly clear. Tires, transmission gear, and batteries also come in for a fair share of attention. Automobilists will read this book with pleasure.

THE NEW INTERNATIONAL ENCYCLOPÆDIA. Edited by Daniel Coit Gilman, LL.D., Harry Thurston Peck, Ph.D., L.H.D., and Frank Moore Colby, M.A. New York: Dodd, Mead & Co. 1903. Vol. xi. 4to. Pp. 1050.

The present volume includes "Larrey to Maximianus II." The quality of the work is very sustained—rather a difficult thing to do in a book of this kind. The same admirable treatment of scientific matters is continued. Many of the articles are very interesting. Thus we find under "Leitmotiv" that it applies to the musical phrases which constitute the basic material out of which Wagner constructed his music-dramas. Then follow musical examples and references to literature. Under "Libraries" we find an able discussion of the history of libraries, types of libraries; then buildings, reading rooms, book shelves, furniture and fittings, library administration, are taken up. This is followed by classification, library schools, library associations and clubs, a bibliography, and an excellent table of library statistics. Our own Congressional Library ranks fifth. It is by its thoroughness that this book commends itself to the user.

SOLAR HEAT. Its Practical Applications. By Charles Henry Pope, A.B. Boston: Published by the author. 1903. 16mo. Pp. 160. Price $1.

Many illustrations are reprinted from the SCIENTIFIC AMERICAN. There is little question that the time will come when solar heat will be utilized to a much larger extent than has ever been done in the tentative experiments which have shown the possibilities of the subject. The author has conducted a number of experiments on solar heat, and in the present treatise he endeavors to trace the history of attempts and successes in the utilization of solar heat.

BUILDING SUPERINTENDENCE. By T. Clark. New York: The Macmillan Company. 1903. 8vo. Pp. 306. Price $3.

This is not a treatise on architectural art or the science of construction, but a simple exposition of the ordinary practice of building in this country, with suggestions for supervising such work efficiently. It is a book which we can specially recommend to the young architect, as well as to those persons not of the profession who are occasionally called upon to direct building operations. It is written in simple language, which can be understood by all.

TASCHENBUCH DER KRIEGSFLOTTEN. V. Jahrg. 1904. Herausgegeben von Kapitän-Leutnant a. D. B. Weyer. München: J. F. Lehmann's Verlag. $1.

This new volume of Capt. Weyer's is, if anything, better than the book which we had the pleasure of reviewing twelve months ago. How well it has answered the purpose for which it was prepared is shown by the fact that the Austrian marine almanac, at one time the only reference book in Germany which officers of the imperial navy had at their command, has been completely displaced. Chief among the subjects that find a place in the book may be mentioned complete lists of the fighting ships of all nations, pictures of the various types of ships of all nations, comparisons of fighting strengths, navy budgets, the shipbuilding programmes of most countries, naval ordnance, organization of navies. Constant reference to last year's volume convinces us that Capt. Weyer's annual is in every way a most accurate reference volume. We have no doubt that this year's work is no less precise.

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AND EACH BEARING THAT DATE

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