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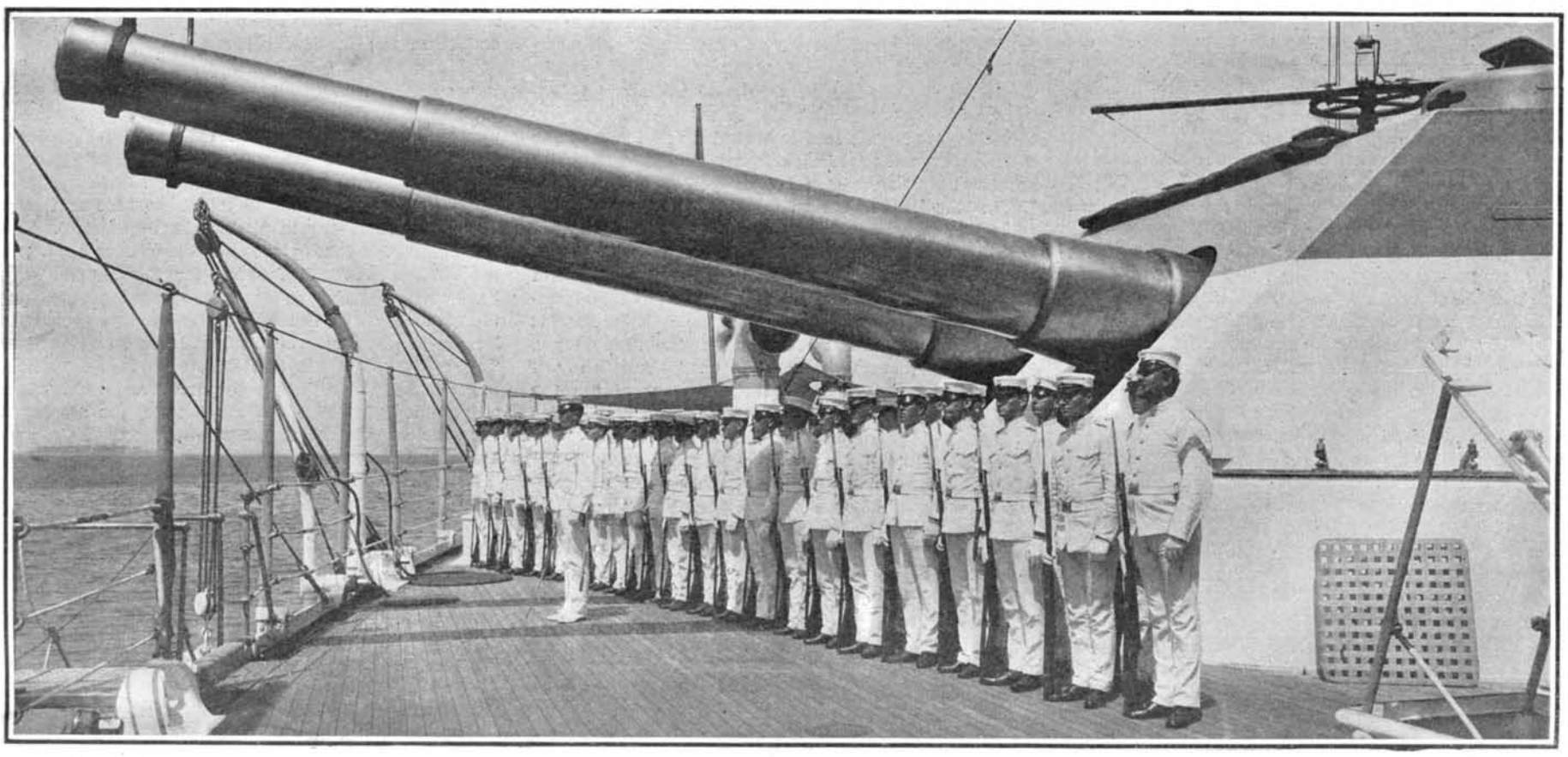
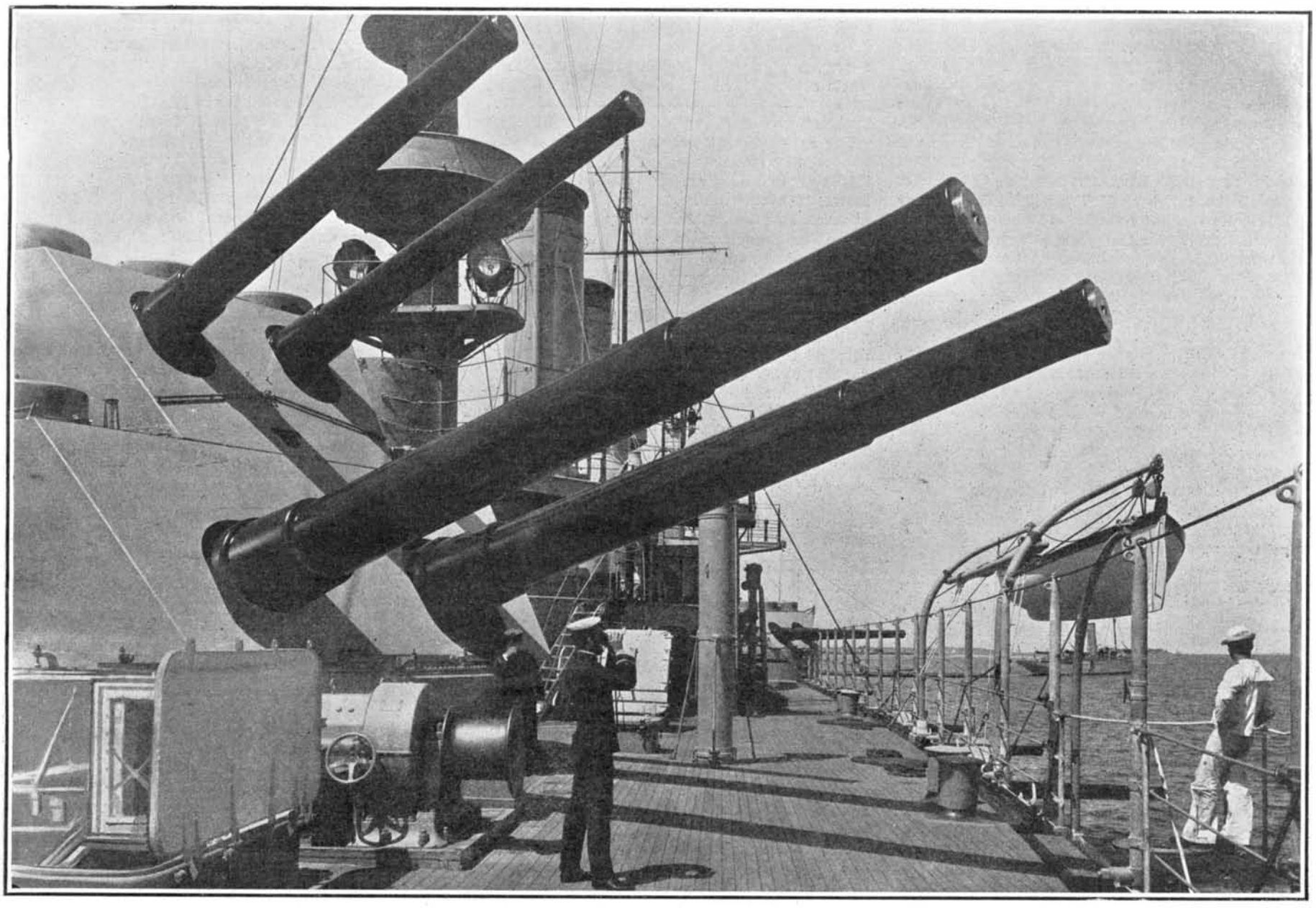


After Pair of 12-Inch Guns on the Battleship "Missouri."



Double Turret on the Battleship "New Jersey," with Two 12-Inch and Two 8-Inch Guns.

OYSTER BAY REVIEW, SHOWING THE GROWTH OF OUR NAVY SINCE THE WAR.--[See page 194.]

SCIENTIFIC AMERICAN
ESTABLISHED 1845

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NEW YORK, SATURDAY, SEPTEMBER 15, 1906.

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.

STUPENDOUS TRAFFIC OF GREATER NEW YORK.

The growth of New York city is full of surprises, and in no respect are the evidences of growth so striking as in the statistics of electric railway traffic. Herein is added proof of the fact that the electric trolley is one of the most potent factors in promoting the increase in a city's population. Close upon the heels of the motor car there ever follows a crowd of eager homeseekers, to provide for whom the resources of the real estate agent and the house-builder are taxed to the utmost. So urgent is the demand for increased transportation facilities, that it would seem to be scarcely possible to build an electric line, whether elevated, surface, or subway, into any district of Greater New York, which will not be almost immediately carrying a fairly voluminous traffic, if it is not indeed crowded at once to its full capacity.

That it is scarcely possible to build electric lines faster than they are required, is shown by the total figures of travel for the quarter ending with June of this year, during which over 332,000,000 cash fares were collected in New York city; and the significance of this total is emphasized when we learn that it represents an increase of about 30,000,000 fares, or between nine and ten per cent over the corresponding quarter of the previous year. The largest increase took place in the Borough of Manhattan, where it amounted to 17,700,000; while the increase in the Borough of Brooklyn amounted to over 8,000,000. The largest percentage of increase is that in the Borough of the Bronx, where it reached 48 per cent, the relative percentage in Manhattan being 9, and in the Borough of Brooklyn 8½ per cent. The enormous traffic existing in New York city is perhaps best realized by a statement of the figures showing the heaviest traffic on any single day. Thus, during one day of last April, the Interborough Rapid Transit Company carried on its elevated lines 938,959 passengers, while the New York City Railway Company carried on one day in May 1,846,538 passengers on its various surface lines. The largest total, however, is that for Brooklyn, the Brooklyn Heights Railway Company having carried on one day during last June 2,129,264 passengers.

With a rate of growth as rapid as is indicated by these figures, it is incumbent upon the city authorities to push forward, with all possible speed, the construction of the new system of subways which has been approved by the Rapid Transit Commission. It took four years to build the present Subway, and it will scarcely take less to construct the proposed additions. At the present rate of growth, the increase in the number of passengers within Greater New York will be something enormous, and must surely put an exceedingly heavy strain on existing facilities.

THE WORST ENEMY OF THE GOOD ROADS MOVEMENT.

The worst enemy of the good roads movement is the stupid neglect to which the newly-made roads are so often subjected—a neglect which dates from the very day on which they are completed. The indifference of the public and the parsimony of legislatures are not more hurtful to this good cause than the fact that in so many cases the new highways are suffered to fall into disrepair, just as fast as the traffic and the weather can wear them down. It is likely that everyone who reads this statement can call to mind one or more stretches of macadamized road in his immediate neighborhood, which to-day present a surface which is merely a mockery of that over which they rode when the roads were first opened to the public. This rapid deterioration was evident even in the days when the bicycle was popular, and before the automobile had commenced to tear loose the top dressing of the roads and scatter it to the winds under the united traction and suction of its rubber tires. The deterioration of newly-made roads was far too rapid, even in those days; but in this age of the automobile, the rate at which our highways have been torn to pieces, mainly because of lack of maintenance, or of maintenance that is properly applied, is simply appalling.

Of all the works of man that come within the province of the civil engineer, there are few, if any, which call for more careful attention, and more immediate repair on the first signs of disintegration, than the common turnpike macadamized road. Perhaps the nearest to it in this respect are the track and roadbed of a steam railroad; though we doubt if even that heavily-worked system shows the lack of upkeep so quickly as does a frequently-traveled highway. The amount of ignorance, or indifference, displayed in the neglect of new macadamized roads would scarcely be credible to a European, who has been accustomed to witness the watchful care with which the famous roads of Europe are maintained and the very first signs of wear corrected. Instead of keeping a gang of men employed in the constant, day-by-day, repair of weak spots, hollows, and ruts, our authorities in many cases seem to think that it is sufficient to spread a few loads of top dressing over the whole surface of the road annually or biennially, as the case may be, and let it go at that. Under this method the solid portions of the road receive just as much care as those which have developed soft spots and shown the need of more extended repair. The top dressing serves no better purpose than to temporarily cover up the damage of the last season's travel, and in a few weeks' time the surface is about as badly, if not more, broken up than before. Matters go from worse to worse until there is a call for drastic remedies. In nine cases out of ten the drastic remedy consists in breaking up the entire surface, and practically rebuilding the road.

Now, it has been proved to a demonstration, not merely in Europe, but in certain sections of this country where the maintenance of roads is intelligently and conscientiously carried on, that if a macadamized road be properly built in the first instance, with firm foundation, adequate drainage, and an ample crown to shed the water from its surface; and if a small force of men, answering to the section gang on a steam railroad, be kept constantly employed in repairing any incipient wear of the road, such a highway need never be rebuilt, but will be good for all time. That is the great lesson which needs to be enforced by the advocates of good roads. When it has been brought home, and commissioners have learned to maintain their new roads in absolutely first-class condition, so that the value of a macadamized road will be apparent, not merely in the first few months of its life, but continuously through the succeeding years—then, and not till then, we may look for the rapid extension of a system of macadamized highways throughout the whole of the United States.

EROSION—THE LAST PROBLEM FOR THE GUNMAKER.

The splendid results which have been obtained by the designers and manufacturers of heavy ordnance are highly creditable to the art. At the proving ground, in the field, and on the high seas, the modern high-powered rifle has achieved truly wonderful success. Guns have been constructed which will stand enormous pressures without failure, and deliver projectiles of extraordinary toughness and hardness, at velocities which were undreamed of a few years ago, and with an accuracy of fire in the first few rounds which leaves nothing to be desired. At present, the powder is not equal to the gun, not at least in respect of its accuracy and reliability; but as soon as a powder has been made which is perfectly stable, and can be relied upon to give unvarying results for a given charge in a given gun, the art of heavy-gun manufacture will have been brought, with one very serious exception, to a point of practical perfection. The exception is to be found in that nightmare of the ordnance expert, gun erosion, or the more or less rapid wearing away of the bore of the gun by the action of the powder gases. It is to this point that the artillerist of to-day, whether he is working in the laboratory, in the gun shop, or at the proving ground, should devote his best energies; for gun erosion is a trouble which, in some guns, will, after a few rounds have been fired, entirely upset the calculations as to its range and accuracy. The disintegration of the face of the bore by erosion is most severe in the grooves of the rifling; and as these become worn away, they cease to get a good grip on the rifling band, with the result that the projectile is not given a sufficient speed of rotation about its axis to maintain the axis parallel with the line of flight, and the shell begins to tumble end over end.

So much fruitless effort has been directed to the cure of gun erosion, but there is discernible a distinct note of discouragement on the part of our ordnance experts; as witness the recent recommendation of the Army Board of Ordnance, that high velocities and heavy powder pressures be abandoned, and that we return to the old system of firing heavier projectiles with smaller velocities and corresponding lower powder pressures. The SCIENTIFIC AMERICAN, at the time of the publication of this recommendation of the Army Board, protested against such a complete acknowledgment of defeat, and we urged that it was too early yet to assert that the problem of gun erosion had been subjected to its last analysis, or that every possible method of prevention had been tried. We are still decidedly of that opinion, and for the following reasons:

It is found that the most severe erosion of the bore takes place near the breech, and that it diminishes rapidly toward the muzzle. This fact would agree with the theory that the wearing away of the metal of the bore is due to the rush of the white-hot gases between the projectile and the bore, the gases finding vent through the small openings, and there are many of them, which are left when the shell is rammed home into place. The velocity with which the shell is rammed home is never sufficient to force the copper rifling band far enough into the grooves to completely seal them up; for if one looks into the gun, after a shell has been driven home, it is frequently possible to see daylight between the shell and the bore. When the gun is fired, the gases, under the enormous initial pressure of twenty or more tons to the inch, pour through these interstices with a frictional effect which, added to their heat of many thousand degrees, is sufficient to wear away the metal of the bore as though it were made of wax in place of hardened steel. This abrading action takes place until the powder has driven the shell far enough forward for the copper rifling band to entirely, or at least more completely, seal up the grooves of the rifling, when the escape of gases is largely or entirely prevented, and the scoring ceases. This will explain the fact that, even in some of the latest guns, where the powder pressure is maintained at a high figure right to the muzzle, the scoring is nevertheless confined to the neighborhood of the powder chamber.

Evidently, if this explanation be correct, the remedy is to be found in some more perfect method of obturation, or sealing up of the base of the projectile; and this might be done, either by a liberal increase in the width of the rifling band, or by the provision of some additional obturating device at the rear of the band. Some years ago we published in this journal a sketch of a device of this character designed by Vickers, Maxim & Co., which consisted of a copper plate covering the entire base of the projectile, and provided with an annular lip, which was driven firmly against the bore of the gun by the gases, and held there with an action similar to that of the leather pad in the Brahma press. For reasons which have not been made public, the device did not prove to be altogether successful, although the principle was correct. Apparently, all that is necessary to prevent this initial erosion is, as we have tried to show, to provide some form of sealing device, back of the rifling band, which will bar the passage of the gases until the band has been driven home sufficiently to fill the rifling grooves, and entirely seal the gun. Here is a field that will well repay investigation, one which has not received the careful study which the magnitude of the interests depending upon its solution demands. We believe that there are no inherent mechanical difficulties to prevent the design and manufacture of a thoroughly operative device of this kind; and when it has been produced, and not till then, the modern, high-powered rifle will be a practically perfect piece of mechanism, with powers of endurance that are comparable to that of any other. Furthermore, it will open great possibilities, either of vastly increasing the pressure, velocity, and energy of the gun for the same weight, or of greatly decreasing the weight for the same energy. What that means will be appreciated by the naval constructor, who will find himself able to increase the fighting power of his ships without increasing their size, or by the artillerist in the field, who can, at a stroke, greatly lighten the load to be transported, without decreasing the power of the gun when it is unlimbered for fighting.

Mons. Vercier tested the preservation of flowers by means of refrigerating apparatus, and he obtained extremely interesting results. In August, 1904, he exhibited before the Société l'Horticulture some China peonies gathered ninety-seven days previously. He put them back into an ice-house, and forty-one days later several of them were still found to be in a fair state of preservation. The experiments have been taken up again upon a larger scale, the peonies being cut with stems about 15¾ inches long and placed in glass bowls filled with water. The ends of the stems were trimmed every three weeks, and the water was renewed every month. Under these conditions buds of China peonies gathered ready to open on May 31 were still in pretty fresh condition on September 22. Tree-peonies gathered half open May 11 were withdrawn from the refrigerating cellar June 16; they remained open in the room for thirty-six hours. The leaves hinder the preservation. It is better to preserve but one of them, that nearest the flower; it stays very green. Of all the flowers subjected to the treatment, the peony in general and the red and white China peonies in particular showed the most endurance.

THE "VIRGINIA" POTATO.

BY W. R. GERARD.

In an interesting article on Harvard's Botanic Garden, in a recent number of the SCIENTIFIC AMERICAN SUPPLEMENT, the author remarks that "almost the earliest mention of potatoes, after their introduction from Virginia into Ireland in 1584 by Sir Walter Raleigh, is made by Falstaff in The Merry Wives of Windsor, where he says: 'Let the sky rain potatoes; let it thunder to the tune of Green Sleeves, hail kissing-comfits, and snow eringoes.'" The potato of Shakespeare, however, and of all writers from the middle of the sixteenth to about the middle of the seventeenth century, was the root to which the name rightfully belongs—that of *Batatas edulis*, Choisy (*Convolvulus edulis, L.*), one of the most widely distributed plants of Central and South America.

The first mention of the aboriginal name *botata* or *batata* is found in the Ninth Book of the Second Decade (published in 1516) of the New World of West India by Peter Martyr, who gives it as the designation of an edible root found in use among the natives of the province of Uraba, Darien.[1] In the Fourth Book of the Third Decade, he mentions the *batata*[2] among the vegetable products found in Honduras when Columbus, in his fourth voyage, landed on that coast in 1502. The Spaniards adopted the name[3] and thereafter applied it wherever they found the root in cultivation or wherever they themselves introduced it, and thus gave the Darien appellation (varied by different writers to *patata*, *potata*, *potato*, *potada*, *padada*, etc.) a wide dissemination.

According to Gomara (Hist. de las Indias, 1553), Columbus carried the potato, among other products of the New World, to Spain on his return home in 1504, and presented it to Queen Isabella. The consequence was that the culture of the plant, which is well suited to the climate of that country, was soon afterward begun there, and subsequently in other parts of southern Europe, and by the middle of the sixteenth century had become common.

At an early period the roots were imported from Spain and the Canary Islands into England, where, when steeped in wine or made into confections, they were believed to have the power of restoring decaying vigor, a fact to which, as well as to the supposed aphrodisiac properties of eryngo root, covert allusion is made in the above quotation from Shakespeare.

The transfer of the name to the tuber of *Solanum tuberosum* is due to John Gerard, who in his description of it (Herball, 1597, p. 781) says: "Because it hath not onely the shape and proportion of Potato's but also the pleasant taste and vertues of the same, we may call it in English *Potatoes* of America or Virginia." Such a transfer was unfortunate, since it was subsequently to involve the necessity of using epithets, colloquially and in print, to distinguish the two esculents—those of "Irish," "English," "round," "common," etc., for the *Solanum*, and of "sweet," "Spanish," "Carolina," "Bermuda," "West India," "long," etc., for the *Batatas*.

The common potato (which, by the way, is a thickened underground branch of the stem, and not, like the sweet potato, a tuberous root) was, at the time of the discovery of America, in cultivation from Chili, to which it is indigenous, along the greater part of the Andes, as far north as to New Granada. It was introduced from Quito into Spain about 1580 under the name of *papa*,[4] which, in Spanish, it still bears. From Spain it found its way to Italy, where it became known as *tartuffalo*,[5] and thence was carried to Mons in Belgium by one of the attendants of the Pope's legate to that country. In 1588 it was sent by Philippe de Sivry, governor of Mons, to the botanist de l'Ecluse, professor at the University of Leyden, who, in 1601, published the first good description of it under the name of *Papas Peruanorum*, and stated that it had then spread throughout Germany. Recommended in France by Caspar Bauhin, the culture of the tuber rapidly extended in 1592 throughout Franche Comté, the Vosges, and Burgundy; but the belief becoming prevalent that it caused leprosy and fever, it underwent an ordeal of persecution from which it did not recover until three-quarters of a century afterward.

It is positively known that the potato found its way into Ireland in the later part of 1585 or the beginning of 1586, and all authors, with scarcely an exception, who have written on the subject, ascribe its introduction into that country to some of the colonists who were sent to Virginia by Sir Walter Raleigh in the middle of 1585, and who, becoming discouraged, returned home in the fleet of Sir Francis Drake in the fall of 1586. Dominique Chabrée, a Genevese botanist, who wrote in 1666, tells us that the potato was known to the natives of *Virginiæ insula* (Roanoke Island) by the name of *Openauk*, a statement repeated by Sir Joseph Banks (1805), and deemed worthy of credence by de Candolle (1883). Let us see what basis there is for the belief, as well as for the statement that has passed unchallenged for three centuries, that the potato was found in cultivation among the Indians of Virginia. Thomas Hariot (the surveyor and historian of Raleigh's first colony, of 1585), in his "Briefe and True Report of the New Found Land of Virginia" (written in 1588), gives the native names of and describes sixteen vegetable productions which were used as food by the Renape Indians of Roanoke Island, and of which six were subterranean. As the latter have never hitherto been identified, it may prove of interest if I enumerate them and give their native and scientific names and their uses. They are as follows:

(1) *Okeepenauk* (pl. of *okeepen*), "earth tubers." These were those round or roundish objects, often as large as a man's head, that are occasionally turned up by the plow in old fields, and which were formerly supposed to be fungi, and, as such, were described under the name of *Pachyma cocos*. The productions are now known to be due to a disintegration of the cellular tissue of the roots of certain trees (mainly coniferous), through a pathologic process called pectosis. The interior white mass consists entirely of pectose and is of little or no nutritive value. It was used by the Indians only when there was a scarcity of other food. "Indian bread," "Indian loaf," "Indian potato," "Indian truffle," and "tuckaho" (from *p'tukweu*, "it is round") are some of the popular names of the object.

(2) *Coscushaw*, a root which was taken by some of the colonists to be cassava. It was the thick, fleshy rootstock of *Peltandra alba*, the "arrow-arum," "wampee," and one of the several roots called "tuckaho." This, after having been sliced and placed in the sun or near a fire in order, by drying, to dissipate its acrid juice, was pounded into flour which was used as a bread material. Its nutritive value is due to the large amount of starch which it, in common with the rhizomes of most of the Araceæ, contains. The acrid and pungent berries of the plant were used by the Indians for boiling with their venison.

(3) *Tsinaw*, "a kind of roote like vnto the which in England is called the *China root*." It was the tuberous rootstock of *Smilax Pseudo-China*, the brown fecula obtained from which was employed for making bread, and, by boiling, for making a jelly, which Hariot pronounces "a very good spoonmeat." *Tsinaw* is not an Indian word, but represents an attempt of the natives to pronounce the word "China," heard from the mouths of the English.

(4) *Habascon* (miswritten for *habonsikan*), "used with what is boiled." It was the aromatic root of *Ligusticum actæifolium*, called "angelico" or "nondo,"[6] which was highly esteemed by the Southern Indians as a flavoring material for their soups, stews, and boiled meats.

(5) *Kaishucpenauk* (pl. of *kaishucpen*), "sun roots," a name which shows that the capitula or flowerheads of the plants were called *kaishuckanauk*, or "imitation suns." They were the tubers of *Helianthus tuberosus*,[7] the "Jerusalem artichoke," which were boiled as food.

(6) *Openauk* (pl. of *open*), the general Algonkian name (with slight variations according to dialect) for the tubers of the leguminous plant *Apios tuberosa*, popularly called "wild potato," "Indian potato," "ground-nut," "potato-pea," etc., and, by the French of Canada, "*pomme de terre*."[8] *Open* is from *pen*, meaning "root" in composition, and a vocalic prefix which has lost its meaning, if it ever had any. The tubers, which are numerous, white, and like small artichokes, are farinaceous and tender and very good boiled or roasted. They are extensively employed by the Indians as food wherever the plant grows, that is to say, from New Brunswick (British America) to Florida, and west to Minnesota, Kansas and Louisiana. It was the tubers of this widely-distributed leguminous plant (very well described by Hariot) that were mistaken by Chabrée, Banks, and De Candolle for those of the *Solanum*, with which, as may be seen, the Indians, as might be expected, were unacquainted. How, then, did the belief originate that the potato was introduced into Ireland from Virginia? That is a question that can be easily answered. Sir Richard Grenville, acting for his cousin, Sir Walter Raleigh, sailed from Plymouth April 9, 1585, with a fleet of seven ships carrying 108 emigrants for founding a colony in Virginia. Reaching the coast of North Carolina (then Virginia) late in June, he landed his charges, and, after seeing them safely established on Roanoke Island, set sail for England. On his way thither, somewhere in mid-ocean, he fell in with a 300-ton Spanish ship, homeward bound from St. Domingo, which attacked him, but was soon overpowered and captured and taken as a prize to Plymouth. It was undoubtedly from the cargo of this ship, which is said to have been richly laden with products of the New World, that came the potatoes which Raleigh sent to the manager of his estates at Youghal, County of Cork, Ireland.[9] The culture, begun here on a small scale, gradually extended, and the "spud" (as the Irish call it) became an important article of food in Ireland long before it was even known in England. From Ireland the culture was introduced into Lancaster, where, by the end of the seventeenth century, it had assumed large proportions. At the beginning of the eighteenth century the tuber became an article of export from Ireland and Lancaster to Jamaica and the British colonies of North America, where, from its place of shipment, it received the name of "Irish" and (more rarely) "English" potato.

Potatoes were served, perhaps as an exotic rarity, at a Harvard installation dinner in 1707; but the "murphy" (as the tuber is sometimes humorously called in Canada, New England, and New York, in allusion to the commonest of Irish surnames) was not brought into cultivation in New England till the arrival of the Presbyterian immigrants from Ireland in 1718.

[1] "They dygge also owte of the ground certeyne rootes growyng of theim selues, whiche they caule *Botatas*." Martyr, Decade II., Book 9 (Eden's translation, p. 82). The expression "growing of themselves" is interesting in view of the statement that has been made that the plant was never found in a wild state.

[2] The word *batata* belongs to the Urabak language of Darien. Oviedo (Hist. general y natural de las Indias, 1525) states that he had observed the root in extensive cultivation in St. Domingo. Its name there must have been, among the natives, *hayiti*, since the Arawaks of the Greater Antilles substituted *y* for the *l* and *r* of other dialects, and the Arawak name of the root in South America was *haliti* or *hariti*. The Caribs of the Lesser Antilles called it *mabi*, whence the word "mobby" adopted in English as the name of a fermented beverage made from the root.

[3] Except in Mexico, where they adopted the word *camote*, from Aztec *camotl*, and afterward introduced it into Peru, where it supplanted the Kechua name *apichu*.

[4] According to the late Prof. James Orton (The Andes and the Amazons, p. 102), *papa* is the name of the potato in the language of the Napos, a people whose country, called by the Quito government "La Provincia del Oriente," lies on the eastern slope of the Ecuadorian Andes, and was formerly part of Peru. The trade in the natural products of the country is monopolized by Quito.

[5] From Ital. *tartuffalo* ("earth tuber") was derived M. H. Ger. *Tartuffel*, and, by dissimilation of the two *t's*, the Ger. *Kartoffel*. French *pomme de terre* is a translation of *aardappel*, the Dutch name.

[6] From the Powhatan (Renape) name of the root, viz., *wondeu*, "it is boiled" (pronounced *wondo*, and corrupted by the inhabitants of Virginia to *nondo*.)

[7] The Jerusalem artichoke is one of the plants characteristic of the Middle West, although now pretty widely distributed as an introduced plant, and extending in this way to Maine and south to Pennsylvania. It was never found indigenous in the country east of the Mississippi River. The fact of the cultivation of the plant on Roanoke Island, and, apparently, on the Chickahominy (although perhaps sparingly there), is interesting in more respects than one. Taken in connection with the presence in the southern Renape dialects of some loan and radical words and of a few inflections not found in the Renape dialects of Delaware, Pennsylvania, New Jersey, and New York, but common to the Algonkian languages spoken around the Great Lakes and in the region formerly known as the Northwest Territory, it shows that these southern members of the great Renape (or Lenape) group entered Virginia in prehistoric times, *via* the northwest, from the country beyond the Ohio River.

[8] The potato is called by the French of Canada *pataque*, a corrupt form of *patate*.

[9] Possibly with the information that they came from America, which at that time would naturally have been understood to mean Virginia.

A NEW AIRSHIP.

A new airship is being prepared for its first flight at Mrs. Phoebe Hearst's country home at Verona, Cal. It is the invention of C. H. Toliver, who has patents pending in Germany and other foreign countries, the laws of which do not permit a means of transportation of this kind to be taken on a trial trip until the letters patent have been issued. The machine has a propeller at each end and four at the sides for steering purposes. The balloon is rigid and non-collapsible; it contains 190,000 feet of material and will carry 6,700 pounds in addition to its own weight. This is equivalent to about thirty people.

The machine is 223 feet long and 40 feet in diameter; it is cylindrical and tapers at both ends. Its distinguishing feature is that the cabins are inside the balloon, from which nothing is suspended except the propellers. There are four 18-horse-power gasoline engines, the propellers being worked with a ball and socket and being arranged in such a manner that the machine can be steered without a rudder and can be turned without being under headway. It is intended that the new craft shall rise above storms.

PHOTOGRAPH OF THE "PENNSYLVANIA."

Owing to an oversight, the copyright notice was omitted from underneath our engraving of the "Pennsylvania," on the front page of our issue for September 1. The picture was taken by Mr. E. Muller, who holds the copyright.

There is now hardly a town or even a village in the district of Bilbao, especially when situated in the vicinity of running water, where electric light is not used. A great use has been made during the year of electric motors for small industries and workshops, these replacing in many cases small steam engines. As far as Bilbao is concerned, some further 4,000 horse-power was introduced from Guipuzcoa, while 1906 will see some 8,000 horse-power more employed.

ROAD TARRING IN FRANCE.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

On the Continent the oiling or tarring of roads is making considerable progress. The methods which seem to be the most successful can be divided into two general classes. In the first case we find products such as Westrumite, Pulvanto, and the like in which the liquid tar obtained from mineral or vegetable oils is formed into an emulsion or a solution in water and thus sprinkled upon the road. The solution in water can be obtained by adding alkali such as ammonia, or by the use of casein or other products. The liquid which is thus obtained can be applied to the road from an ordinary sprinkling cart. Another way of applying it is to pipe the water from the mains through a hose and use a special form of nozzle into which the oil or tar is fed from a reservoir. For use in cities this is quite practical. M. Forestier has designed a good form of mixing nozzle which consists of two conical pieces fitting into each other in such a way that the water stream acts by aspiration to draw in the oil and mix it with the water in the nozzle. The distance between the two cones can be adjusted to suit the conditions of the case. From the side of the nozzle a rubber hose leads to the oil tank, which can be well carried on the back of the man who is doing the sprinkling. For a larger supply the hose is placed directly into the oil barrel, and the latter is run along on a cart by a second man. To avoid the use of a valve in the supply pipe to regulate the flow, the nozzle carries a small air-valve which can be permanently adjusted for a given supply.

Much more efficient than the method of sprinkling is the application of a layer of hot tar compound upon the road, which has just been thoroughly swept so as to leave the surface quite clean. In this way the road absorbs the hot tar and this forms a very solid coating, as the tar sinks for a considerable depth below the surface. According to the report which was made recently by Chief Engineer Heude, the hot tarring method is to be considered one of the best to be used upon roads on a large scale. In 1905 he treated some 150,000 square yards of roadway in France and finds that the results are excellent and quite justify the expense which is occasioned. The dust which usually results from the wear of the road had disappeared, and at the same time the annual expense of keeping up the road diminished so as to more than compensate for the cost of the process. This comes from the great reduction of expenses for watering the road, sweeping and mud-scraping as well as from the greater durability of the road-bed, so that not only does the tarring process cost nothing, but it gives an annual economy of $0.01 per square yard yearly. One coating of tar lasts about a year.

To carry out this method practically, the treatment should be made during warm and dry weather and at certain hours of the day. To avoid an unexpected rainfall it is necessary that the operation should be done quickly. With the primitive apparatus which was used at first, requiring a great deal of hand labor, it was hardly possible with gangs of a dozen men to tar more than 1,000 square yards of road per day, applying the tar by means of hand brushes. This led to the use of an automatic system which could be used for applying on a large scale and in a continuous manner, so that it is now possible to treat more than 2,000 square yards per hour. We also avoid heating the tar over a fire, which is always dangerous, and the steam-heating system is employed here. The apparatus of the Lassaily system is illustrated here. It consists of a tar-heating car and a spreading car. The tar which is used here is the semi-liquid product which comes from the gas works.

The tar-heating car is composed of three main parts. In front is placed the boiler, which furnishes the steam for the heating. The cylindrical tank carried in the rear communicates with the boiler and is designed to heat the tar by means of a worm piping in which the steam passes. Below the main tank is the receiving tank of square section, placed between the side beams of the truck. It is designed to receive the cold tar from the barrels. A small hand pump is also carried on the car. The apparatus works as follows: The tar is delivered either in tank-wagons, which are emptied directly by piping into the receiving tank, or in oil-barrels, which are easily drawn upon the car by a pulley and are emptied into the tank. After the tar is fed into the tank the remaining operations are carried out entirely by the steam. First the cylindrical tank is filled with steam and then it is cooled off on the outside by means of a small quantity of water, some 20 gallons, which is fed upon the top cover of the tank by the above-mentioned hand-pump. As the steam condenses it forms a partial vacuum and causes the tar to be sucked up from the lower tank through a pipe provided with a valve. It takes up about 250 gallons in this way. The second operation is to make the steam pass in the worm piping of the tank so as to heat the tar until it reaches some 200 to 212 deg. F. When this point is reached the tar commences to boil over, and this can easily be observed. Third, the steam is again sent into the tank from the boiler, and it acts by pressure to force the hot tar through a suitable piping which leads to the outside and serves to discharge it into the top of the tank-wagon so that it can be applied by the latter upon the road. When the heating reservoir has been thus emptied the steam which it contains is again condensed by a cold water feed as above and by closing the outer valve a partial vacuum is created which sucks up a fresh supply of tar from below.

There is no loss of water by this system, and all the hot water coming from the tar heating and the cooling spray is recovered. It passes through a worm piping placed in the cold tar tank, thus heating up the latter somewhat, and is cooled down so that it can be taken up by an injector and used for the boiler feed. While the tar-spreading wagon is automatically applying the 250 gallons of hot tar on the road, the fresh supply of tar is being heated in the first apparatus, so that the work goes on without stopping and at a very rapid rate, inasmuch as it only takes half an hour to charge, heat, and discharge 250 gallons of tar, or 2,650 pounds weight. The wagon which is used for spreading the tar on the road is observed in the first view in actual operation. It is automatic in its action and is made up of four principal parts, namely, the tank for carrying the heated tar, a smaller tank which is used for regulating the supply, a spraying tube provided with a set of holes, and in the rear a set of spreading brushes. The tar which is contained in the main tank passes by a pipe into the regulating tank where a float indicating device enables it to be kept at a constant level, thus giving a uniform speed of flow and consequently a regular spread on the road. For the spreading the car has a spray tube about two yards long pierced with holes which are calculated so that with a horse going at the average speed the feed of tar is one-half what is needed for a new road. In this case, which is the most general, two coats of tar are used on the road. For a road which has already been tarred, a single coat serves to keep it in good condition.

The set of four spreading brushes takes the hot tar as it is fed on the ground and spreads it automatically in a thin and very regular layer. The brushes are movable and are attached to the wagon by chains, being weighted with ballast to give the right pressure on the road. In this way we suppress the gang of hand spreaders which causes the greater part of the expense in a tarring system, and the result is quite as satisfactory. Thus equipped, the spreading car is able to apply 5,300 pounds of tar, which is furnished from the heating wagon in one hour. This amount serves to cover 2,400 square yards, from which it will be seen that the process is a rapid one.

The Tarring Wagon at Work.

Notes on a Dissected Porpoise.

BY W. K. GREGORY.

For the first time in several years a dead puffing pig or harbor porpoise (*Phocæna communis*) floated near the shore here at Wood's Hole, Mass., last summer. A young man swam out and dragged it in, and I joyfully carried it off in a wheelbarrow to the Fish Commission laboratory for dissection. I say joyfully; for although everyone knows that a porpoise is a whale, and whales are mammals, it does not fall to the lot of every one to verify this remarkable fact by dissection. My porpoise was about as fish-like as any of its kind, and several people on the road to the

Sprinkling with Oil by Means of a Portable Mixer.

One Way of Applying Tar or Oil Consists in Piping the Water from the Mains Through a Hose. Oil or Tar is Fed to a Special Nozzle and Mixed with the Water.

ROAD TARRING IN FRANCE.

laboratory thought it was a shark, a mistake that seemed justified by its high back fin, shark-like flippers, overhanging upper jaw, and white belly.

The skin, however, was quite unshark-like, since it lacked the minute enamel denticles that so thickly bestud the skin of the shark; and except for its lack of hair, the skin, which was very tender, rather resembled that of a young pig.

Below the skin a layer of fatty tissue, or blubber, completely enveloped the animal. This blubber was variously modeled all over the body, so as to produce a fish-like external form, especially in the back fin, tail-flukes, and the superficial portions of the flippers or fore-limbs. The fins of fishes are elaborate structures with a complex bony framework and musclature, but in the porpoise the corresponding organs were seen to be mere superficial imitations, trumped up, as it were, after the amphibious ancestors of the porpoise had entered into competition for a living with the denizens of the sea. These parts were here quite simple, lacked a bony framework, and were formed wholly of skin-covered blubber, which, however, contained so much tough connective tissue that it rapidly dulled my knife. The thick coat of blubber also served to keep the animal warm, for being a mammal and breathing with lungs, it requires a constant body temperature, far higher than that of fishes, which have a temperature much nearer to that of the cold medium surrounding them.

After the fish-like disguise of skin and blubber was stripped off, I came upon great masses of very red muscle. The most superficial layer was of great power and thickness, and evidently corresponded to the panniculus carnosus muscles, that cause the skin to twitch in land mammals. In man these muscles are almost vestigial, but are represented in the feeble muscles that move the scalp and wrinkle the forehead. In the porpoise, as in other whales, these superficial muscles attain all over the body an extraordinary development, and being everywhere attached to the underlying flesh and bones, impart mobility and great strength to the motions of the body in swimming.

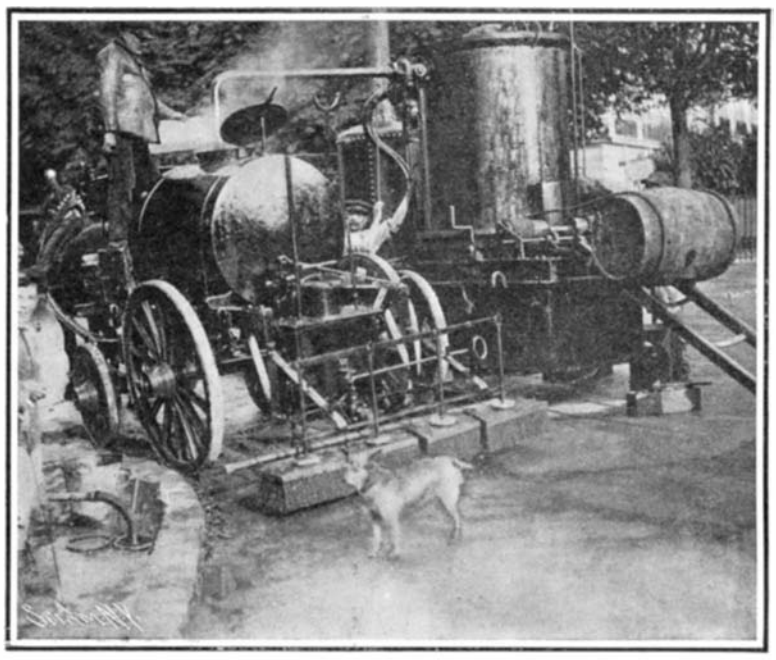
Below the superficial muscles the other muscles, bones, and soft parts corresponding to those of quadrupedal land mammals were uncovered, but here they were seen to be variously modified to suit the peculiar mode of life. The animal was a young female, and I removed the reproductive organs for preservation in formalin. These, part for part, were remarkably similar to those of ordinary mammals. A peculiar modification was seen in the stomach, which was divided into three connecting pouches, or sacks, and in its complexity suggested the stomach of a cow. However, the suggestion that a porpoise might ruminate was long ago refuted by a close comparison of the stomach of the porpoise and of the cow, which exhibit essential differences. The first division of the stomach was lined with comparatively smooth whitish tissue, which exhibited irregular rugose folds. The interior of the second stomach-pouch presented a very coarse network of blood-filled and glandular tissue. After the third division, which was again of different nature, the small intestine followed in seemingly endless coils, the whole intestinal tract measuring not less than fifty-four feet in length.

The lungs appeared to be much like those of ordinary mammals, but the windpipe, or trachea, showed a remarkable adaptation to aquatic conditions. The trachea, in order to prevent the accidental entrance of food or water, was continuous, with a tube leading right across the throat, its end tipped with cartilaginous lips, and fitting neatly into those openings (called choanæ) in the back of the palate which lead up through the skull to the nostrils. This "intra-narial epiglottis," as it is called, is also developed in the young of the common opossum. The mouth of the young opossum is fastened to the teat of the mother, and the milk is squirted by the mother down the throat of the young, but the "intra-narial epiglottis" prevents the milk from entering the trachea and choking the young animal. The occurrence of this organ in two such widely-separated mammals as the opossum and porpoise is doubtless a response to a similarity of needs. However, the embryos and young of many other animals retain this organ in a more or less vestigial condition; and since the operation of sucking milk is far more complex than that of swallowing the milk squirted into the mouth, it is quite probable that the latter method is the more ancient one, and that both porpoise and opossum have inherited the intra-narial epiglottis from those very ancient mammals of the Cretaceous period which undoubtedly gave rise to all the later or viviparous mammals.

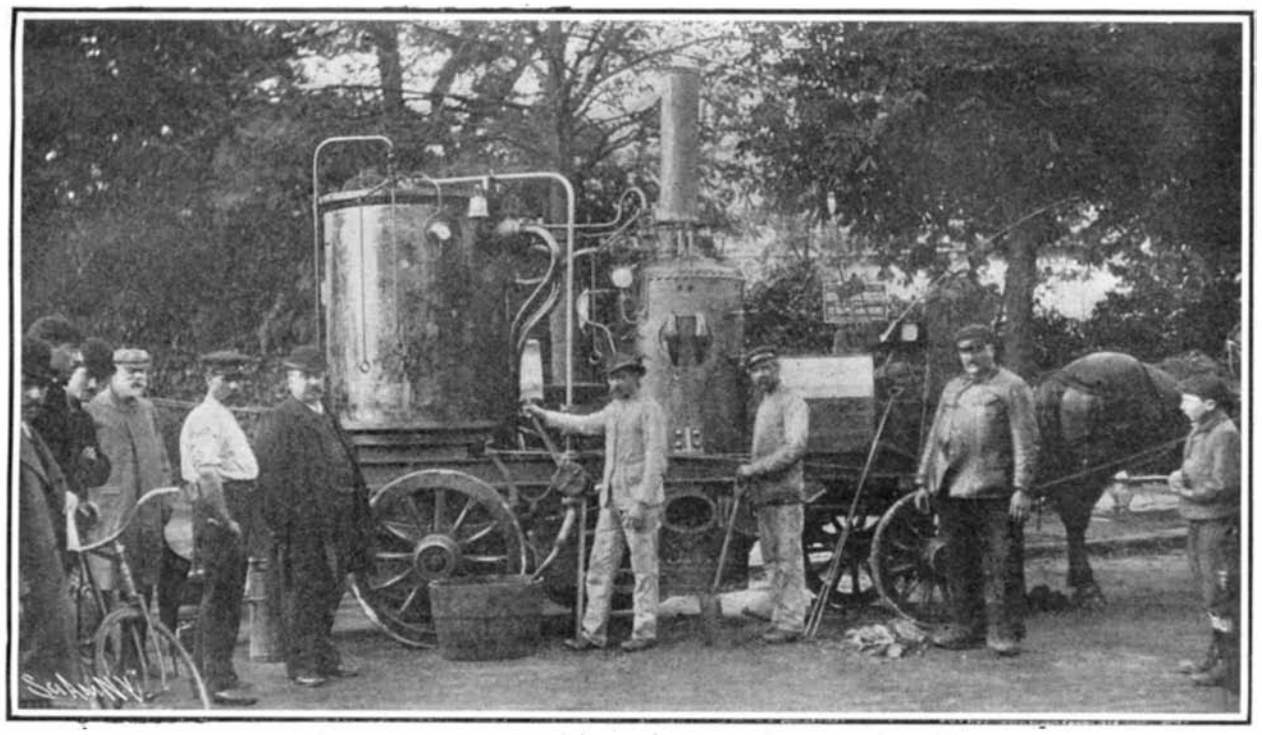
The nostril or blowhole, on the top of the head, was guarded by a valve to prevent the inrush of water. In front of the nostril, and beneath the blubber, I exposed a pair of long coiled tubes, provided internally with irregular folds. These organs are thought to regulate the pressure of the already inhaled air before it is delivered to the lungs, since the pressure of this air of course becomes greater as the animal dives into deeper water. The necessity for the animal to remain long under water and to breathe at long and irregular intervals seemed to explain the excessive quantity of blood, which flooded everything while I was dissecting the animal. For obviously, long-delayed breathing would require an unusual amount of oxygenated blood, which in turn would require an increase in the total carrying capacity of the arteries. This was effected by the frequent breaking up of the arteries into a network of fine vessels, before they passed into the ordinary capillary vessels of the organs. The brain of the porpoise was seen to be large and richly convoluted, but to lack the olfactory or smelling lobes, which project so conspicuously in the lower foreward portion of the brain of ordinary mammals.

A feature highly suggestive of the long evolutionary history of the porpoise was observed in the dorsal or back fin. This showed on its front edge, on the surface of the black, rubber-like skin, a series of small, horny, almost prickly projections. Now, in the dolphin, *Neomæris*, these peculiar hardenings of the skin are much more prominent and better formed, not only along the front edge of the back-fin, but also in several rows along the back, where they take the form of small horny tubercles. In the armadillo, to cite a familiar case, the horny surface plaques are supported by bony scutes imbedded in the skin. Hence certain naturalists have suggested that the horny tub-

A Road-Tarring Wagon.



The Tar-Heating Apparatus.



Machine for Preparing Tar to be Spread on Roads.

Portable Apparatus.

ROAD TARRING IN FRANCE.

ercles in the dolphin *Neomæris* and the porpoise represent the last stages of degeneration of a former body armor, that in the ancestral dolphins the skin may have been largely overlaid by horny plaques, supported by bony scutes; and this hypothesis is strengthened by the finding of bony scutes in association with the fossilized bones of certain dolphins, so that armor-clad whales may have been as characteristic of certain former geological epochs, as unarmored whales are of the present. Furthermore, it has been suggested that since whales are undoubtedly descended from land mammals, the earliest whales must have lived along the seashore, and that an armored skin would be useful in protecting the animal from the pounding of the surf. But this is, of course, mere hypothesis.

HOT-WATER SUPPLIES TO TOWNS.

BY THOMAS PARKER.

Fortunately for some of the inland towns of Queensland, good supplies of potable water from artesian wells have been obtained within the municipal areas, and the towns have been reticulated with pipes to convey the water throughout. When the temperature of the water is not too high, the water mains are connected direct to the bore pipe at the surface, and the water is used, at its original pressure, for domestic and fire-extinguishing purposes. These waterworks have been a great boon to up-country towns, where hitherto the only water supply was derived from stagnant surface tanks, and obtained, in most cases, very irregularly, and at the expense of a long haulage. As wooden buildings are the rule in these towns, the value of the water supply for fire purposes is very great indeed.

When, however, the heat of the artesian water is abnormal, or, say, over 120 deg. Fah., it has been customary to cool the water by spraying it into a cool water tank of iron elevated 60 feet, thus losing part of the pressure of the water, or by conducting a portion of the supply into an earthen water tank containing coils of pipes, through which the hot water from the well is passed before entering the town mains. Otherwise, the expansion of the mains, due to the heat of the water coming into them direct from the artesian well, would cause breaks at the lead joints of the pipes in the streets.

Recently, however, a scheme has been designed by the writer, and carried out successfully in two towns, for conveying the water hot, and direct from the bore well to the town. As this method has been found to be much less expensive than the usual cooling schemes, and as it retains the full pressure of the bore supply, so valuable for fire purposes, it has been considered a great improvement on the old method of cooling the water before conveying it to the consumers. The heat of the water is also found to be valuable for baths and laundry purposes.

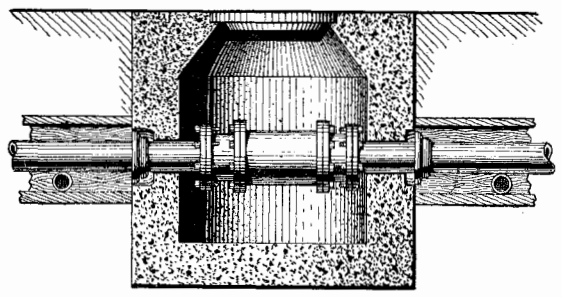
A description of the reticulation of the town of Muttaburra, in Central Queensland, on this new method will give a good idea of the system. The site of the bore which supplies the water is about half a mile from the center of the town. The depth of the artesian well is 2,707 feet, and the flow is about 750,000 gallons per day. The temperature of the water is 138 deg. Fah.

Before entering the town mains, the water passes through a stone trap, the gratings in this trap serving to keep back from the mains the gravel or stones which are sometimes thrown up by these underground water springs. The trap has a large base, and is set upon a concrete foundation, about 4 feet below the street level, and the whole is surrounded by a concrete-walled chamber, and a cover at the ground surface.

From this stone trap the mains are carried about 3 feet below the surface of the streets, and incased in wooden boxing. A reference to the drawing will show the mode of inclosing the pipes. The pipes rest upon rollers, formed of short lengths of one-inch galvanized iron piping, laid crosswise on the bottom of the wooden boxing. At intervals of about 200 feet, expansion joints are inserted in the mains, which are so set as to allow the lengthening and shortening of the sections of the mains between the fixed points, which will be afterward described. When the hot water is turned into the mains, the system works in the following way: The heat of the water causes the pipes to expand and increase in length, and each end of the section of main, which enters the expansion joint at opposite ends, moves toward the center of the expansion joint, like the piston in a steam cylinder. Here, between the ends, a space of three inches is left to allow for the lengthening of the section of main, without allowing them to touch each other. The expansion and lengthening of a section of main, about 200 feet in length, does not amount to over half an inch, so that the 3-inch expansion space at the ends of the lengths of pipes allows ample margin of expansion space. The reverse process and movement, of course, takes place when the water is—on rare occasions—shut out from the mains, and the pipes cool. The section of main affected by cooling shortens, and the ends draw back within the expansion joints, like the back stroke of the piston in a steam cylinder. The wooden boxing in which the street mains are inclosed is formed of 1½-inch planks of cypress pine of the locality, a timber which has been found, by repeated tests, to be proof against the ravages of white ants, which are very prevalent, and destructive of timber constructions, in the district, and, indeed, in the State of Queensland generally. At each intersection of the streets, a fixed point is constructed. This consists of a cast-iron cross piece, with four ways, bedded firmly in a large block of concrete. The cross streets are about 700 feet apart; this being the interval between the fixed points, the expansion and contraction of each section of main takes place within these limits. The four ways of the cross piece are made with socket ends to receive the main pipes.

In each section of the mains a sluice valve of the usual type is placed to control the section. Fire plugs are also provided at intervals of about 250 feet apart, to which a hose can be attached for fire extinction. At the lowest point of the town a pressure valve is placed, which can be set to open at any pressure, and is intended to act as a safety or escape valve, to relieve the mains from any accidental shock, or occasional undue pressure, from the too quick opening or shutting of valves, or undulation of the original pressure of the water at the bore pipe. This latter pressure is about 60 pounds per square inch, and the pipes and other castings of the system were all tested with a hydraulic pressure up to 100 pounds per square inch. The cost of the bore was about £2,707, and of the reticulation of the town about £2,013, making a total expenditure of about £4,720.

One of the hitherto undeveloped resources of artesian wells in Queensland is the available power due to the pressure and flow of the water. At one Queensland town it is estimated the flow from the bore will



EXPANSION JOINT FOR HOT-WATER MAINS.

develop nearly 30 horse-power, and it is intended by the municipal authorities to utilize this power for electric lighting purposes.

Official Meteorological Summary, New York, N. Y., August, 1906.

Atmospheric pressure: Highest, 30.31; date, 2; lowest, 29.75; date, 27; mean, 30.01. Temperature: Highest, 93; date, 6; lowest, 63; date, 25; mean of warmest day, 84; date, 6; coldest day, 68; date, 25; mean of maximum for the month, 81.2; mean of minimum, 69.4; absolute mean, 75.3; normal is 72.7; average daily excess compared with mean of 36 years, +2.6. Warmest mean temperature for August, 77 in 1900; coldest mean, 69 in 1903. Absolute maximum and minimum for this month for 36 years, 96 and 51. Precipitation: 3.68; greatest in 24 hours, 1.37; date, 7 and 8; average for this month for 36 years, 4.59; deficiency, —0.91; greatest precipitation, 10.42, in 1875; least, 1.18, in 1886. Wind: Prevailing direction, south; total movement, 6,443 miles; average hourly velocity, 8.7 miles; maximum velocity, 36 miles per hour. Weather: Clear days, 6; partly cloudy, 11; cloudy, 14. Thunderstorms: Date, 4, 7, 11, 21 and 23. The temperature of June was 2.5, July 0.9 and August 2.6 in excess, making the summer of 1906 2 degrees above the normal. These months were each below normal in rainfall, the total summer deficiency being 3.72.

New Island in Bering Sea.

A well authenticated story comes from the far North to the effect that an island has very recently been created in the Bering Sea. This new island has evidently been thrown up by a submarine eruption. Advices have been received from Seward, Alaska, which state that the new land is located not far from the island of Boroslow, which was upheaved in the same manner about a century ago.

News of the formation of this new land reached Seward from Unalaska, being carried to the latter port by Bering Sea fishermen. Vast quantities of rock were thrown up with the earth, thus forming acres of bluff, rugged headlands, according to the accounts given by these fishermen. That this upheaval was due to volcanic displacement seems very evident from what the fishermen say. They assert positively that the waters of the sea were very warm for a wide radius around the newly created island, and the atmospheric heat was so fierce that they were unable to approach near the land. This reported new island will be the subject of scientific investigation in the near future.

Science Notes.

Sponge fishing in Florida waters until about a year ago was all done by the use of poles with three-pronged hooks attached at an end, and the sponging operations were necessarily confined to shallowish water, the depth varying from fifteen to thirty feet. About a year ago, a Greek workman, who had been employed in one of the sponge-packing houses, tried the experiment of diving for sponges, and this method of securing them was attended with such good results that diving for them has now become a common method of sponge-fishing. Most of the sponge-divers are Greeks, and they are looked upon as trespassers upon the premises of the native spongers, and as likely to seriously damage future sponge-crop prospects. A bill prohibiting aliens from sponge-fishing in Florida waters, and another making it unlawful to deliver at any point in the United States any sponges taken from the Gulf of Mexico or Straits of Florida by diving, have passed both houses of Congress and will soon become laws; and a State law prohibits the taking of sponges by diving, and affixes a heavy penalty for a violation of the law. It is claimed that gathering sponges by diving, accompanied as it is by considerable tramping among them, will injure the beds seriously, and eventually deplete them.

It seems likely that we are to have some improvement over the present methods of obtaining hydrogen for balloons. Not content with the process of compressing hydrogen into steel bottles for use on the field and especially for military ballooning, inventors are looking for a chemical product resembling carbide of calcium or the new product "oxylithe," which will give off hydrogen when placed in contact with water. M. Güntz, of Nancy, has brought out a process for manufacturing the hydride of barium and which may no doubt be applied to the hydride of calcium as well. This latter body has the property of giving off hydrogen when treated with water. In the above process, electrolysis is carried out, using a mercury bath and a solution of barium chloride. A barium amalgam is formed here, and the mercury is driven off from it by distillation *in vacuo*, then the barium which remains is treated in a current of hydrogen so as to form the hydride. An industrial hydride of calcium has lately been brought out by M. George F. Jaubert, a prominent chemist of Paris and the inventor of "oxylithe," which latter product gives off oxygen when placed in water. The new product, known as "hydrolythe," produces hydrogen in the same way, and one pound of it in a pure state, when treated with water, will give about 10 cubic feet of hydrogen. To fill out a military balloon of 600 cubic yards it suffices to transport about 1,200 pounds of the product, while at present we need some 5 tons of steel cylinders and suitable vehicles must be provided for these, besides, the empty tubes must be taken back for refilling. For military work we thus have a great advantage which more than balances the higher price. The latter will bring the cubic yard of hydrogen to $1.00 or $1.50. At present, the cost of the product will no doubt prevent its use for ordinary ballooning, but by improvements in the method we may see the price lowered.

According to the latest official returns of the British government, great activity is being shown in ascertaining the extent of the thorium-bearing minerals in Ceylon which were first discovered during the mineralogical survey of 1904. Of these the most important is thorianite, a mineral new to science, and containing 70 to 80 per cent of the rare earth thoria, which is used in the manufacture of incandescent gas mantles. In England thorianite containing from 70 to 72 per cent of thoria realizes $150 per 112 pounds. With a view to encouraging further search for this valuable mineral a notice was published by the Ceylon government giving the above particulars and also stating the places where thorianite and thorite had been found. Intending prospectors were informed that the government would for three years undertake to levy no royalty on this mineral, except in those cases where extraction was made on crown lands, where the permission to wash is by agreement on liberal terms. There is a large area including all the province of Sabaragamuwa, and part of the central, western, and southern provinces, where the mineral may be looked for. Search is now being made in many localities. It is not possible to say at present how far a regular supply can be anticipated. About 140 pounds of thorianite, which were received from Mr. W. D. Holland, who first discovered this mineral, were sent to the crown agents in November, and sold by Prof. Dunstan of the Imperial Institute in London for $475. Prof. Dunstan is taking further steps to obtain reports on the commercial value of the sample sent to him and for supplying such further information as may lead to more discoveries. The mineralogical survey is further engaged in examining the gemming districts in Sabaragamuwa, and the southern province, in investigating discoveries of corundum and of heavy minerals containing rare elements, as for example allanite and several minerals belonging to the samarskite group.

Correspondence.

Curious Course of a Bolt of Lightning.

To the Editor of the SCIENTIFIC AMERICAN:

Some of your readers may be interested in the following experience, which occurred during a severe thunderstorm, which seemed to charge the entire atmosphere in our vicinity with electricity. The instance in question is another refutation of the saying that lightning never strikes twice in the same place, as the house in which I was at the time, was damaged by two separate bolts striking scarcely two minutes apart. One entered at the southwest corner of the building through a tower, and the other at the northeast corner. Both flashes set the house on fire, the first conflagration bursting out at the southwest corner, but it was so shut in that the fire was not discovered until after the fire company had arrived, and had started to extinguish the fire at the second point. The bolt which struck the dome of the tower passed along a large nail through a studding in my room, incidentally melting the head off the nail; it passed between the frame of a mirror and the frame that secured the latter to the dresser, and flashed toward my head, passing close enough to blind but not shock me, then completed the circuit and returned to the mirror, smashing the southeast corner of the latter, and then it passed out of the room within two feet of where it had entered, again running along a nail through the studding. The bolt burnt the glass at the top of the mirror and melted some of the quicksilver, leaving a "powder burn." The question which has puzzled me is why the bolt did not run down the mirror, as the quicksilver presented a conductor? Furthermore, what caused the bolt to form a circuit and return to a point near the place at which it entered the room?

N. HARVEY ROGERS.

Sedalia, Mo., August 8, 1906.

Uniformity of the Fleet Individuals.

To the Editor of the SCIENTIFIC AMERICAN:

In connection with the review of the North Atlantic fleet, it should be interesting to note the degree of uniformity of the United States squadrons.

The American public as a whole views everything pertaining to naval matters in a favorable light. Strict criticism, as in other navies, is hardly ever heard, and journalism does its best to encourage praise toward any party undertaking. How powerful the battleship squadrons are is commented upon by all newspapers, but how efficient they might be is never looked after. I therefore think it my duty to unveil certain facts about United States squadrons.

Everybody knows that a squadron's speed is determined by its slowest vessel. Did it ever occur to anybody that our first squadron in the review, consisting of our most modern battleships, has a speed of 16 knots? But the fact stands that the "Kearsarge" and "Kentucky," which are members of the said squadron, have only a four-hour-trial-trip speed of 16 knots.

To class the "Maine" and "Missouri" with 18 knots speed, the "Louisiana" with 18½ knots, and three ships of the "Virginia" class with 19 knots, together with the two "Kentuckys" (16 knots) does not show any marked sign of ingenuity. The same may be said of the third division, second squadron. There the "Indiana," with 15 knots (this is her actual speed now), the "Iowa" with 16 knots, and the two "Alabamas" with 16½ knots, form a squadron. The climax, however, is reached in the sixth division and in the Asiatic battleship squadron. In the former three 16-knot "Chattanoogas" and the 23-knot "Minneapolis" go together, while in the latter we have the 15-knot "Oregon," the 17½-knot "Wisconsin," and the 18-knot "Ohio." Fortunately, a reorganization of fleets will take place in the spring. As a suggestion to that effect, I propose the following alterations:

First battleship squadron: Three "Maines," five "Connecticuts," speed 18 knots.

Second battleship squadron: Five "Virginias," speed 19 knots.

Reserve: Three "Oregons," speed 15 knots. One "Texas."

Pacific battleship squadron: Three "Alabamas," one "Iowa," two "Kentuckys," speed 16½ knots.

In this plan it will immediately be seen that except in the reserve, the maximum speed of each squadron as a whole corresponds with the maximum speed of each individual ship. H. LEHMANN.

New York, September 3, 1906.

"Wanted: Brains to Dissect."

To the Editor of the SCIENTIFIC AMERICAN:

The recent article of Mr. Stirrup's in the SCIENTIFIC AMERICAN, on "Wanted: Brains to Dissect," is an indication that scientific men in America are giving some thought to the anatomy and physiology of the central nervous system. The one man in America who has made some original investigations concerning the brains of eminent men is Dr. Edward Anthony Spitzka, of New York city; and the theory advocated by this fearless and painstaking investigator is calculated to upset all of our fetich devotion to the older theory, viz., that the intelligence of the individual, race, or nation, is dependent upon, and related to, "the enormous bed of gray matter." While science advocates that the "gray matter" is closely associated with the intelligence of the individual, Spitzka, of New York, has shown that the corpus callosum, the great bundle of transverse nerve fibers which connect the two hemispheres of the brain together, more than the gray matter itself, has to do with the degree of intelligence of the individual or the race. In the brain of the late Dr. Leidy, the anatomist, Spitzka has shown there was an enormous development of the corpus callosum. On the other hand, where the corpus callosum is smaller than normal, and not highly developed, that individual's intelligence is proportionally less. It is known that the frontal lobes of the brain are concerned in the higher intellectuality of man; while the Rolandic area, the posterior portion of the superior, middle, and inferior frontal convolutions, and the anterior portions of the superior, middle, and inferior convolutions of the parietal lobes, have nothing to do with the execution of the fiats of the higher intellectual faculties, but that this great area is concerned in executing the muscular movements of the mouth, jaws, hands, arms, and lower extremities of the opposite side of the body. The cuneus, the little wedge-shaped area of the occipital lobe, is concerned in vision, and if a lesion occurs in the cuneus, hemianopsia occurs. While the right angular gyrus is concerned in the storing up of the names of objects seen, the angular gyrus of the opposite hemisphere, in right-handed persons, is concerned in storing up the color, shape, and forms of objects of the image, of the name of the object "seen" by the right angular gyrus. Thus the right angular gyrus is connected with the left angular gyrus by bundles of "associate fibers," and the cuneus, the temporal convolutions, the Rolandic, or great motor area of the brain and the frontal lobes, with their convolutions, are connected with the corresponding areas of the brain on the opposite side by bundles of associate brain fibers; all of which pass from one side of the brain to the other through the transverse bundle of fibers, which compose the corpus callosum, and it is upon the relative degree of development of these great transverse fibers, which are associative in function, depends the relative degree of intelligence of the race or individual, and not upon the number of grammes or ounces of the entire brain. Because the weight of the brain of the Esquimau exceeds the weight of the brain of the average American Anglo-Saxon, while "men of encyclopedic minds have large and heavy brains," it is not a scientific warrant that all large-brained individuals are intelligent. Because the brain of the American negro weighs somewhat less than the brain of the Arctic Esquimau, yet the intelligence of such individuals as the late Mr. Douglass or Booker T. Washington exceeds that of our hypoborean neighbors. The school of anatomists who follow Spitzka have inaugurated a new era in brain anatomy by calling attention to the important function of the great bundle of transverse fibers—the corpus callosum—as an index to the intelligence of a race or individual. "Wanted: Brains to Dissect." JAMES M. BODDY.

Troy, N. Y., August 28, 1906.

Henry or Hendrick Hudson?

To the Editor of the SCIENTIFIC AMERICAN:

As a reader of your always interesting paper, will you kindly permit me to trench on your good nature in respect to the article "Hendrick Hudson Memorial Bridge," in so far as it deals with the personality of Hudson himself?

The statement is made in this article that Hudson signalized his appreciation of the royal welcome by the Dutch by changing his name of Henry to Hendrick, and that this according to the best authorities is the name under which he sailed.

Will you permit me to point out that the contract under which Hudson sailed, drawn up by the Amsterdam company and signed by the Amsterdam directors, plainly gives the name as Henry and not Hendrick Hudson.

The person with whom Hudson conducted the negotiations was the Dutch consul at London, Van Materen, who knew Hudson personally, and through whom on his return and detention in England Hudson forwarded the report of his voyage to the Amsterdam directors. In his supplement to his History of King Philip II. (1611), two years after Hudson's return, he distinctly states that Hudson did not know a word of Dutch, and that he had been compelled to have certain documents relating to the voyage translated for him, and he refers to him not as Hendrick Hudson, but as "Een Kloeck Enghels Piloot Herry Hutson" (the experienced English pilot Henry Hudson).

Evidently Van Materen knew nothing of his change of name or nationality. Hudson's whole connection with the Dutch occupied one voyage and lasted less than seven months. He never returned to Amsterdam, but was detained on landing at England on his return, and ordered by King James to return into the service of the Muscovey company. Evidently the King considered him an English subject, and as Hudson obeyed, Hudson considered himself an English subject and not a naturalized Dutchman, which is conclusive proof enough of his nationality and also of the appreciation in which his services were held. His voyages thereafter were all made in the service of the Muscovey company.

As for the statement made that his employment by the Dutch East India Company was for lack of encouragement in his own country, the following transcript from the report of President Jeannim to King Henry IV. of France shows conclusively that it was the Dutch East India Company that was seeking Hudson, and not Hudson the Dutch East India Company:

"He (LeMaire) sent me his brother to inform me that an English pilot had been called to Amsterdam by the East India Company to tell them what he had found. . . . (They had, however, been unwilling to undertake at once said expedition, and they had fully remunerated the Englishman, and had dismissed him with the promise of employment in the next year, 1610). . . . Because the East India Company fears above everything to be frustrated in this design. Isaac LeMaire would not converse with the Englishman except in secret. . . . This letter having been terminated, LeMaire writes me that some members of the East India Company who had been informed that the Englishmen had secretly treated with him, had become afraid I might wish to employ him. For the reason they have again treated with him."

On the strength of this one voyage of six months' duration we are expected to believe that this man, born in England, whose career was mainly continued and which ended in the service of the English Muscovey company, who could not speak a word of Dutch, who considered himself and was considered by the Dutch consul and by the King as an English subject, should be represented to us under a Dutch name and Dutch personality.

In the collections of the Hakluyt Society will be found, published under the title of "Henry Hudson, the Navigator," a large amount of collected material relating to Hudson. This includes the contemporary accounts of his voyages in English, Dutch, French, and Latin, with their English translations.

The man who was responsible for the name "Hendrick" being given to Hudson was Washington Irving, who took a poet's license.

Holland does not need to borrow the fame of others, she has plenty of her own to do her honor. X.

Hartford, Conn., May 7, 1906.

[In the article above referred to by our correspondent, the popular theory in regard to the name Hendrick Hudson was alluded to, and it is to us a matter of some satisfaction that the committee having the construction of the bridge in charge should have adopted a name which has become endeared to the popular mind, through him who has done so much to immortalize the Hudson River and to beautify its traditions. Had our correspondent gone still further in his examination into the facts of the case, he might perhaps, with propriety, have deprived Henry Hudson or Hendrick Hudson of all claim to immortality for his discovery of the river named after him; for it is fairly well accepted by historians to-day that this river had been discovered some years before by the Florentine explorer Verrazzano.—EDITOR.]

The Current Supplement.

The opening article in the current SUPPLEMENT, No. 1602, is an interesting and well illustrated one on the archæology of the Yakima Valley, Washington, by Harlan I. Smith, of the staff of the American Museum of Natural History. The late Nicolas Pike contributes an article on the "Coco de Mer," one of the most remarkable plants of the Seychelles Archipelago, where several of the islands have some magnificent forests of this unique palm. Of interest to agriculturists is the illustrated article entitled "Clearing New Land," by Franklin Williams, Jr., of the Department of Agriculture. Prof. E. Ray Lankester's article on "The Increase of Knowledge in the Several Branches of Science" is concluded. An interesting article specially prepared for the SCIENTIFIC AMERICAN SUPPLEMENT by John D. Isaacs describes a Rifled Pipe for Conducting Heavy Crude Fuel Oil. Another specially-prepared article describes a new excavating machine. F. A. Kummer discusses Recent Developments in Wood Block Paving. R. T. Lozier's paper on the Fundamental Principles of Gas Engines and Gas Producers is concluded. Dr. George E. Bolles discusses Chemical Affinity and Its Possible Causes. A well-illustrated and interesting article is contributed by W. H. Wakeman on Reversing Shaft Governor Engines. Finally, there is an interesting description of a New Substitute for Soap.

The output of brass in the United States for 1905 was 300,000,000 pounds.

GILA MONSTERS.

BY D. A. WILLEY.

The Gila monster of the United States has been well named by the naturalist *Heloderma suspectum*, for the reason that it has been a subject of discussion for fully fifty years among scientists. It is perhaps the most interesting of the reptile family in the United States, for in spite of the investigations which have been made authorities still differ as to whether its bite is fatally poisonous or not.

In addition to the variety found in the States, another called the *Heloderma horridum* is found in Mexico. Indians and Mexicans residing in the localities where the monsters have been captured, sincerely believe that their bite is fatal to a human being; but so far as known no person has ever died from the effects, although many cases are recorded of people being bitten. These peculiar lizards are found principally in Arizona, New Mexico, northwestern Texas, while a few have been seen in Southern California. They are most numerous in the Mohave desert of Arizona, also along the San Pedro and Mohave rivers, while the Mexican variety has its habitat chiefly in the State of Sonora. The lizards are found not only in the arid valleys, but at a comparatively high elevation, a proof that they are extremely hardy and can endure a considerable range of temperature. The extent of the territory in which they are found has enabled naturalists to secure a comparatively large number alive, and as already stated, their habits have been closely observed by naturalists, not only in this country but abroad.

The species in the Southwest form a distinct contrast to any other variety of lizard on account of the size, which, as is indicated by the photograph, is mammoth in contrast to the ordinary desert lizard, which is seldom as long as one's hand. The head is very prominent, comprising about one-fifth of the total length of the body. Like the back it is thickly covered with tubercles, forming a sort of armor. In the full-grown monster, these tubercles are tinted yellow and black. The exterior of the stomach and the surface under the tail are also protected, but by scales. One of the peculiarities of the lizard family is that the bones of the tail are extremely fragile, and this appendage frequently becomes detached by accident or when bitten by some animal. The Gila monster, however, differs in this respect, as its skin is so tough that the tail forms one of the strongest portions of its body. In fact, it can raise itself to a considerable height with its powerful fore-legs, balancing itself on the tip of the tail, thus enabling it to climb rocks and other steep ascents.

One of the most interesting features of its anatomy, and the one which has given rise to so much discussion as to its venomous qualities, is its teeth. Each jaw has from eight to ten, which are long, conical, and slightly recurved. Each tooth, however, contains a deep furrow extending from the sharp point to its base, terminating in a duct connecting with glands. This formation is so similar to that of venomous snakes, that it has been advanced as proof that the bite of the heloderma is poisonous. The teeth are so deeply imbedded in flesh that ordinarily only the points are revealed, but the grooves are so large that the saliva contained in the glands readily exudes. Naturalists who have made a study of the many varieties of the lizard family are of the opinion that this is the only one which has teeth. Consequently, interest has been increased in a study of its anatomy, and among those who have given opinions relative to the effects of its bite are some of the most noted authorities of this country and Europe. With the exception of the teeth and glands, however, the monster bears little resemblance to any variety of snake either poisonous or otherwise. It is very slow and clumsy in its motions on account of its shape. It is not timid like other reptiles, however, and when threatened with a stick will endeavor to grip it in its jaws, and if it seizes the stick, will hold on like a dog. When angered it emits its breath in a succession of quick gasps. The breath is very fetid, and its odor can be detected at some little distance from the lizard. It is supposed that this is one way in which the monster catches the insects and small animals which form a part of its food supply—the foul gas overcoming them.

In 1857 the *Heloderma suspectum* was made the subject of study by Dr. John Gray, of the British Museum. Prof. E. D. Cope, the eminent American anatomist, made a study of the salivary glands in the lower jaws and discovered their connection with the grooves in the teeth. Prof. Cope, however, failed to find that the glands were similar to those of poisonous snakes. On the other hand, Dr. S. Weir Mitchell and Dr. Edward T. Reichert made a series of experiments upon reptiles and small mammals. Saliva was injected into them by a hypodermic syringe, with a result that all died in a few minutes. From these and other experiments the naturalists drew the conclusion that the saliva was fatal, at least to birds and small animals. Dr. H. C. Yarrow at Tucson, Arizona, practically repeated the experiments made by Dr. Mitchell and Dr. Reichert, using chickens and rabbits, but in every case the victims recovered.

One of the instances where the Gila monster has bitten a human being is that of Dr. R. W. Shufeldt, who was thus injured while at work in the American National Museum at Washington. Realizing the opportunity to study the effects of the bite, Dr. Shufeldt closely observed the symptoms. The wound, however, healed in a few days, and apparently had no other ill results than the laceration caused by the teeth. Dr. Shufeldt perceived no symptoms of poisoning. Another instance of the effect of the bite of the Gila monster on animals and reptiles was noted in the Zoological Garden at London, where one of the monsters from America became enraged for some reason, and bit a frog and a guinea pig. Both died in a few minutes, apparently from the effects of poison. One reason why this interesting lizard is so feared by the natives of the Southwest is undoubtedly because of its repulsive appearance, but it has actually been tamed, so to speak, and instances are known where it would take food from the hand of its owner, crawling along the arm and shoulder without offering to do injury. The accompanying photograph shows a family of Gila monsters, consisting of two full-grown ones and a lizard about four months old.

A FAMILY OF GILA MONSTERS.

Automobile Omnibuses in Berlin.

The automobile omnibus system for passengers is now running very successfully in Berlin, and that city is ahead of most of the capitals on the Continent in this application of the automobile. The Omnibus Company, of Berlin, recently made propositions to the municipality, which were accepted, regarding a uniform rate of 10 pfennigs ($0.025) for all distances of the route. This rate is exceptionally low, seeing that all the new omnibus lines which have been put in operation have a length of over three miles. Some of the lines are nearly four miles long. Only the Schloss-part-Charlottenstrasse line is an exception as to length, seeing that it is not more than 1½ miles in length. In this case the rate will be $0.038 for the whole distance of the line and $0.025 for fractions of the distance. Paris has been somewhat behindhand in the use of the automobile omnibus. At the last automobile show a number of the leading makers brought out a form of omnibus which was designed after the standard city type. The Compagnie Générale has been testing the cars ever since then, and it is expected that the first lines of omnibus will soon be put in operation.

The Prussian Ministry of Public Works calls the attention of the several railways to certain defects which have been found in the superheated steam locomotives, and of the means taken to remedy them. In the steam chest of the Schmidt superheater the projecting ends of the steam tubes rust easily, and the crown plates of the superheating chamber become distorted and leak. To prevent rusting of the tube ends one railway has introduced drainage channels with valves into the steam box, and these valves open when steam is cut off. It has also strengthened the crown plates.

MODERN BELL CASTING.

BY DR. ALFRED GRADENWITZ.

After having attained a high stage of perfection at the end of the middle ages, the art of bell casting rapidly declined in modern times, and was not restored to anything like its previous standing before the beginning of the nineteenth century.

It should be borne in mind that the tone and harmony of a bell are mainly dependent on its proper shape, which is determined by accurate calculation. There are mainly three types of bell profile, viz., first, the "heavy" profile, being of Dutch origin, and which has been introduced into Germany by some artists of the middle ages. The "Gloriosa" in the cathedral of Erfurt is the main representative of this type of bell. In towers affording ample room, this is preferred to all others, especially for large bells. The type of profile most generally employed in Northern Germany is, however, what is called the German or "intermediary" profile, allowing equivalent effects to be obtained with a smaller expenditure of metal. Such bells, having more elastic walls, are more readily actuated, without requiring the heavy clappers of the former. It should be mentioned that in the case of the same weight, the pitch of the German type is about one tone lower than that of the Dutch bell. The third and lightest type of bell is of less importance.

Among the most famous modern representatives of the art of bell casting should be mentioned Messrs. M. and O. Ohlsson, of Lübeck, who about thirty years ago came from Sweden to Germany, there to introduce the family art inherited from their grandfather and kept a secret through generations. By the courtesy of these artists the writer is enabled briefly to describe the process of bell casting as carried out in their foundry.

The first and most extensive and laborious part of the work consists in preparing the molds. In our illustration the casting pit in front of the furnace is seen still open, containing the core of a large bell, which has just been erected from red brick. The pit is more than 6½ feet in depth, the core referred to being nearly 6 feet in height.

The core corresponds to what will be the hollow in the interior of the ready-cast bell. This core is first coated with loam, to which is imparted an accurate circular form by the rotation of a board, that lengthwise is shaped like half the cross section of the future bell. This pattern obviously cannot be made before calculating and designing the accurate shape of the bell. On the core is next slipped what is called a "false bell" of loam, accurately agreeing with the future bell as to its shape and thickness, and which is provisionally to replace the latter, being intended afterward to be withdrawn. The loam layers this false bell is made up of should accordingly be readily lifted from the underlying core. To allow of this, the loam of the core is coated with a watery pulp of wood ashes. If everything has been thoroughly dried by a fire made up in the hollow interior of the core, the false bell will be readily lifted at the right moment.

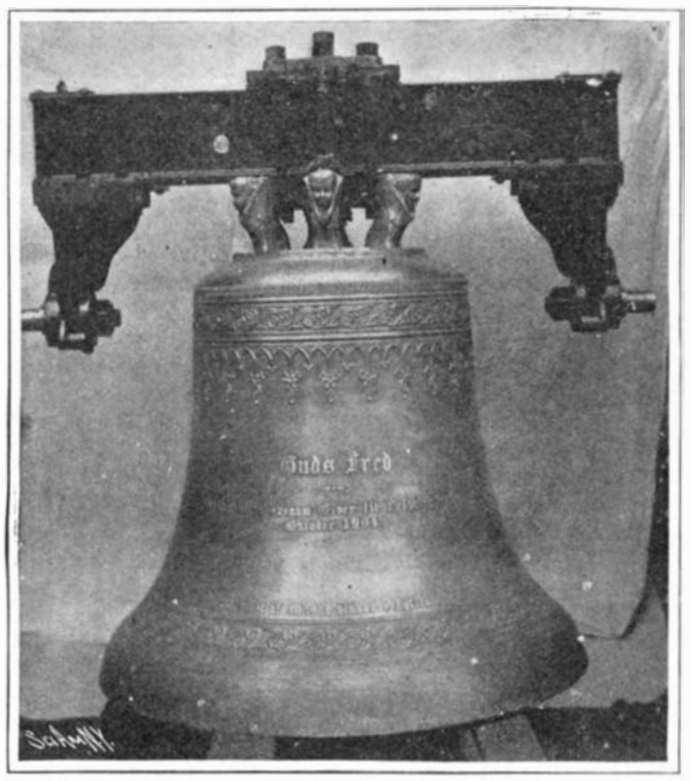
After accurately shaping the false bell with the aid of a wooden pattern, it is coated with tallow, to which any inscriptions and decorations are applied. The tallow coating prevents the false bell clinging to the third and last part of the mold, viz., the shell. (An addition of graphite, brick dust, and many other substances will, by the way, serve the same purpose.) After the first layer of the shell has been dried, a second and third layer and so on are applied, continuing until the shell is of sufficient strength. In order to increase its durability, the shell should be surrounded with hemp and iron ties.

As every layer must be thoroughly dried before applying the next one, in order to enable the mold to resist the enormous heat and pressure of the incandescent metal, the work proceeds only slowly and gradually. In order to utilize the time to better advantage, several bells are therefore in most cases molded at the same time.

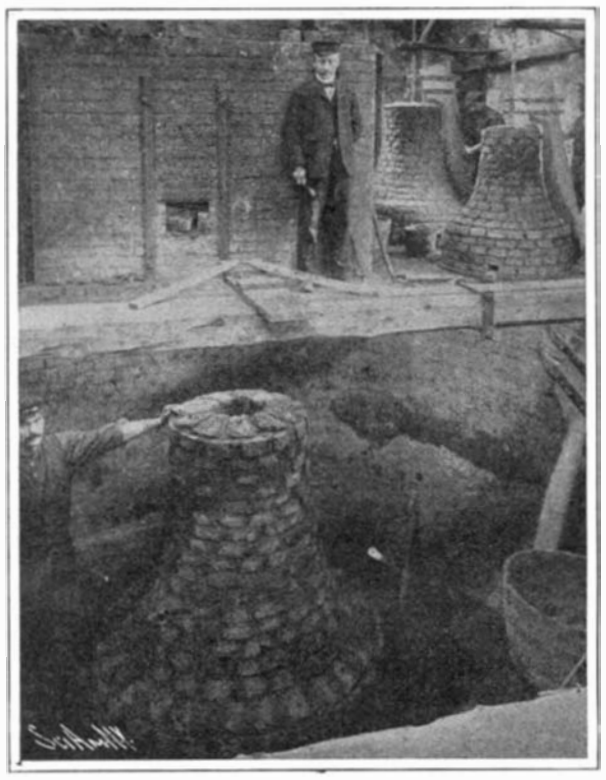
Before proceeding to the casting operation, the shell should be lifted by means of a crane, and the false bell placed underneath be crushed. In fact, after helping in the shaping of the shell, it has fulfilled its purpose, and should be replaced by the casting metal. The shell is, on the other hand, replaced in position, and the crown containing the casting aperture (and which later on serves for the suspension of the bell) is fitted on the top. All fissures at the lower edge are carefully smoothed out, while the free space in the spacious casting pit containing the molds is carefully filled with soil, even the best-shaped shell being not resistant enough to 70 hundredweights of the hot melt. Leading from the casting furnace to each of the molds there are channels to guide the metal, while "windpipes" are arranged to allow of any hot gases escaping from the mold.

After everything has thus been carefully prepared, the casting day arrives, which is always a rather exciting one, even to the most experienced bell-founder, deciding as it does on the success of many weeks' or months' work. Early in the morning of that day the furnace filled with copper is heated, long beech logs

being ignited to produce a lively fire. Coal would not be suitable for this purpose, on account of the impurities it would leave in the metal. The flames are allowed to penetrate through a choke in the furnace, surrounding the copper, and thence getting to the chimney. In spite of the enormous heat, large wood logs are added continually. Twenty-two parts of more readily melting tin are next added to the 78 parts of copper. As soon as the melting process is thought to be sufficiently advanced, a small sample is taken from the metal, and crushed after cooling, when the shape of the piece will enable any experienced bell-founder to ascertain whether the proper mixture and temperature have been obtained.



The Bell for the Free Harbor Church at Copenhagen, Showing the Balanced Suspension System.



Casting Pit and Bell Core During an Early Stage of Forming the Mold.

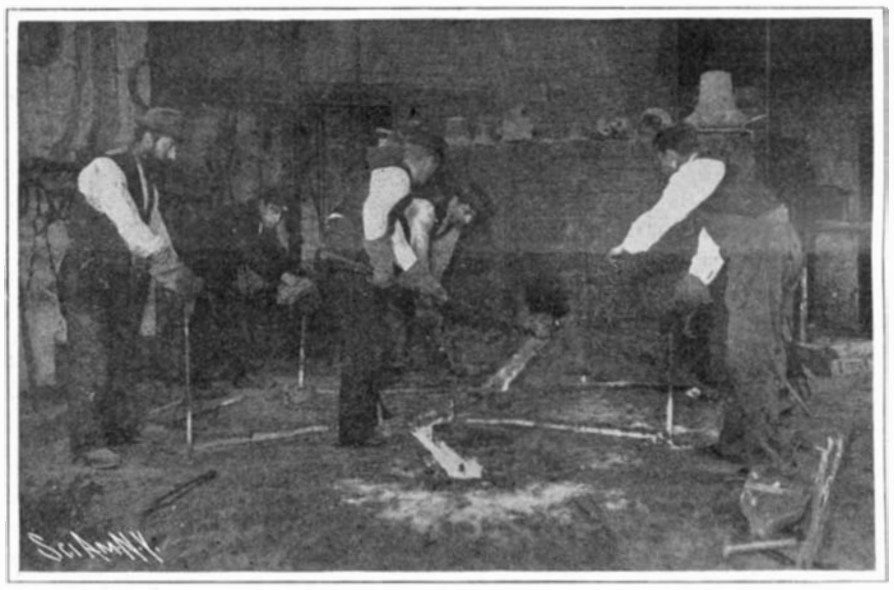
The most exciting moment is when the metal is discharged from the melting furnace. A loam tap closing the aperture is crushed by means of a long iron bar, when the glowing metal like a fiery current penetrates through the casting channel (which should be heated beforehand) into the first mold. The lively current of air issuing from the windpipe shows the mold to be filled, when a small sluice stopping the metal is rapidly withdrawn, and the second and third molds, etc., filled subsequently in the same manner. While the molding of the bells requires the patient work of weeks and months, the inflow of the bell is completed in a few moments. In fact, five bell molds are filled in no more than five and one-half minutes. All the workmen, being provided with enormous gloves to protect them against the unbearable heat, should be ready in the meantime to carry out every operation with an extreme swiftness. The most difficult is, however, the task of the master bell-founder, who should arrange everything with the utmost care, lest a large capital outlay be lost, and the whole of the work have to be started anew. The gases escaping from the windpipes are ignited, burning with a gloomy flare which is said to produce a magnificent effect.

After the casting operation has been completed, the bells are left in the soil for about a day, there to cool down, after which the soil being shoveled from the casting pit, the shells are removed, and the success of the operation ascertained.

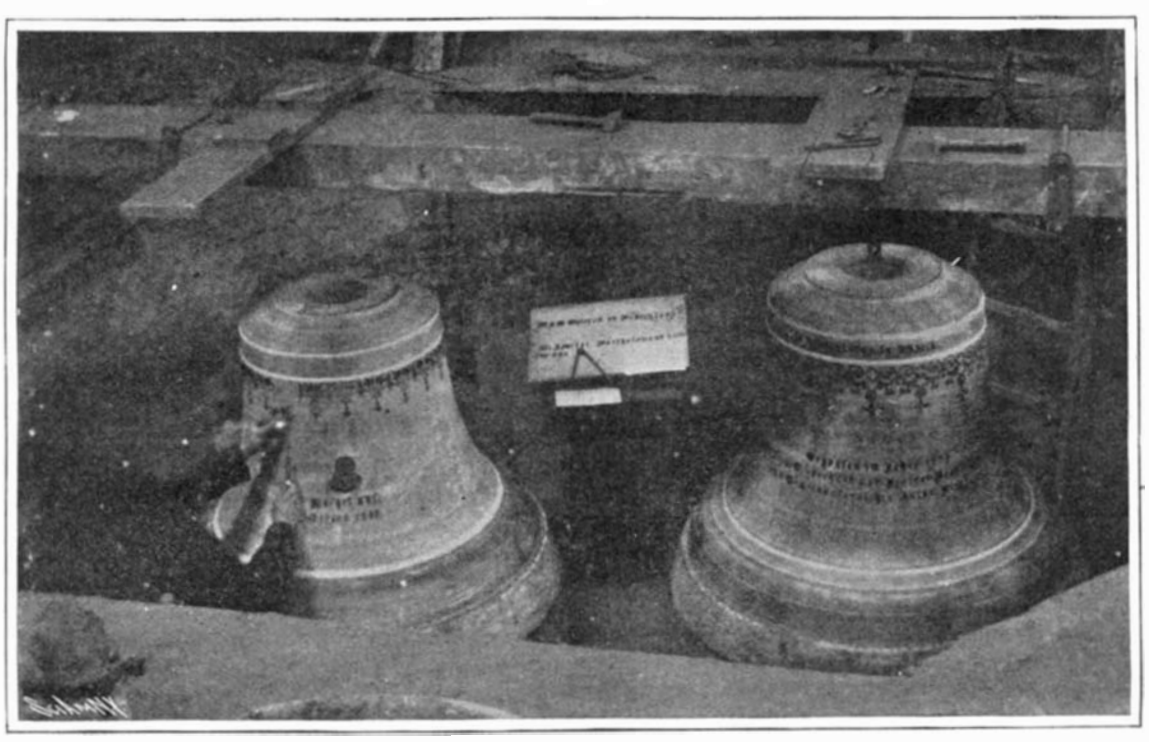
An important feature of a well-designed bell is its suspension, the system mostly used by Ohlsson being what is called the balancing system, which is based on the action of a wheel and rack. In opposition to the old method, the inverting point of the bell is, however, placed higher up, thus allowing of an elastic stroke of the clapper instead of the bumping stroke which is quite unavoidable in a lower suspension. As the bells are struck closer to the top, the sound is given off more fully. If the inverting points of the bells and clapper bear the proper ratio to each other, the bells can be rung with half the expenditure of energy.

One of our engravings shows a bell which was recently cast for the Copenhagen Free Harbor Church, and which is the gift of an anonymous donor. This shows the suspension system just referred to.

Digging Out the Cast Bells.



Running the Metal for Casting Five Bells.



Fastening Decorations and Inscriptions to the Bells.

MODERN BELL CASTING.

A New Element?

Some time ago it was announced that the university professor, Vattelli, of Pisa, had discovered a new element that is still more powerful than radium. We now possess details of this discovery, which has produced the greatest sensation in scientific circles. Prof. Vattelli discovered a year ago in the waters of San Giuliano remarkable luminous phenomena. After numerous experiments he established that these waters are in a high degree radio-active. Then it was further merely a question of condensing the emanations. The condensing of the products of the radio-active substances occurs by their being treated exactly like gas. After being greatly compressed, they are collected in special tubes. That is a very expensive operation, and therein really lies the greatest difficulty of the new experiments in radio-activity. The gas, obtained in a very complicated way, after it had been purified was introduced into small tubes dipped in liquid air and coated with aluminium paint. Here the condensed emanations at once became visible: they colored the aluminium wholly green. It cannot yet be said what kind of a substance it is from which these emanations proceed. But the mere establishing that they exist in great quantities in terrestrial water is a discovery whose bearing has not yet been discovered.—From New Yorker Staats-Zeitung.

Very good blue prints can be made from carbon copies on thin paper, if two sheets of carbon paper are used, one under and the other over the sheet which is to be printed from. Of course, both coated sides of the carbon paper are to lie next this latter.

THE GROWTH OF OUR NAVY SINCE THE WAR.

Apart from its attraction as a brilliant naval spectacle, the review of the Atlantic fleet by President Roosevelt at Oyster Bay was essentially a demonstration of the fact that our modern navy (at least as regards its most powerful fighting elements) has been built up during the years which have intervened since the late Spanish war. Proof of this is found in the fact that among the forty-five ships that were drawn up in those four great parallel lines, each over one mile in length, there were only five vessels that were prepared for hostilities at the opening of the war in 1898, and these, moreover, are among the least effective ships in the several classes to which they belong. Among the battleships that had received their baptism of fire were the "Indiana" and "Iowa"; among the monitors the "Puritan"; among the protected cruisers the "Minneapolis"; while the torpedo boat "Rogers" was the only vessel among the destroyers and torpedo boats that was in commission at the commencement of the war. Judged on the basis of modern requirements, and bearing in mind the vast improvement in guns, armor, and speed in our later ships, it is not stretching the point to say that ninety per cent of the effective fighting efficiency of the ships at Oyster Bay is to be credited to our naval development during the last eight years. In proof of this, we have only to state that if the 16,000-ton "Louisiana" were to engage the "Indiana" and "Iowa," it would be merely a question of time before the two older ships were crippled or sent to the bottom; for with her superior speed the "Louisiana" could place herself at a range at which her own guns were fully effective, but at which the low-velocity guns of the older ships would have difficulty in reaching the mark, or in striking a vital blow should they send a shot home.

The fighting power of the fleet is unquestioned; for its twelve battleships and four armored cruisers would be a fair match for the combined forces of Japan and Russia at the battle of the Sea of Japan, which included eleven battleships and eight armored cruisers of modern construction.

The present article, in conjunction with that published in our issue of September 1, enables us to present a summary of the present available fighting forces of the United States navy; for having shown in the earlier article the salient features of the ships assembled at Oyster Bay, we will now enumerate the other and larger portion of our fleet which, by virtue of its being absent in Pacific waters, or on other stations, was not available for the review.

Commencing, then, with the battleships, we find that in addition to the twelve at Oyster Bay, there are eight other battleships, most of them of recent completion, which are either in commission or about to go into commission, and that we have now under construction eight "Mississippi," of 13,000 tons, which are smaller editions of the "Louisiana," carrying the same battery of 12-inch and 8-inch guns, and mounting eight in place of twelve 7-inch guns, but designed for about one knot less speed, or 17 in place of 18 knots an hour. Of the same type as the "Louisiana" are the "Kansas," the "Vermont," the "New Hampshire," and the "Minnesota," all equaling the "Louisiana" in speed and armament, but including several minor improvements in the armor and the internal arrangements. Finally, we have the recently-authorized battleships "South Carolina" and "Michigan," of 16,000 tons and 18½ knots speed, whose main armament will consist entirely of 12-inch guns, of which eight will be carried.

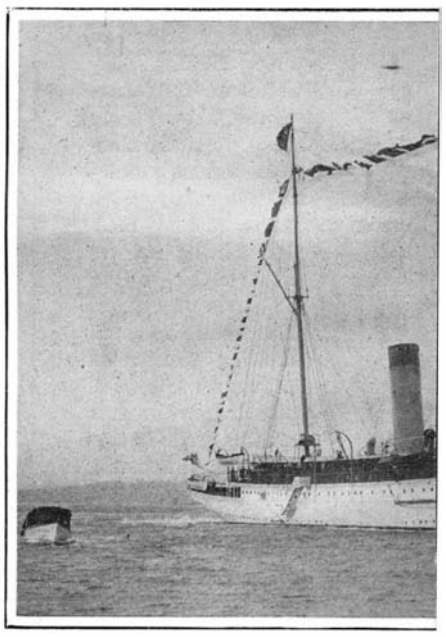
Summing up, we find that the United States navy includes, in addition to the twelve battleships that were present at the review, seven completed first-class battleships, and eight that are under construction, making a total of twenty-seven, as compared with a total of only six battleships built or under construction at the opening of the Spanish war. To these must be added the second-class battleship "Texas," which figured in the war. This gives a total of twenty-eight battleships of all classes.

In addition to the four new armored cruisers present at the review, our navy includes the "California" and "South Dakota," of 13,680 tons, which belong to the same class, and the older armored cruisers "Brooklyn" and "New York," the former of 9,215 tons, and the latter of 8,200 tons displacement. We have also under construction the "Tennessee," "Washington," "Montana," and "North Carolina," which are improved vessels of the "California" class, being of 1,000 tons greater displacement and mounting four 10-inch breech-loading rifles in place of four 8-inch, and also carrying an additional pair of 6-inch guns in the secondary battery. In the armored-cruiser class the advance since the war has been very satisfactory, for out of these ten powerful vessels, only the two smallest and least powerful were in commission in 1898; none of the other eight having been authorized until some years later. Our armored cruisers, and particularly the latest four, carrying 10-inch guns, are among the most satisfactory ships that have been designed by our Bureau of Construction, and their similarity in armament, speed, and protection gives us a fleet of eight of these vessels, which is even more complete and effective than the eight armored cruisers of the Japanese which did such good service in the late war.

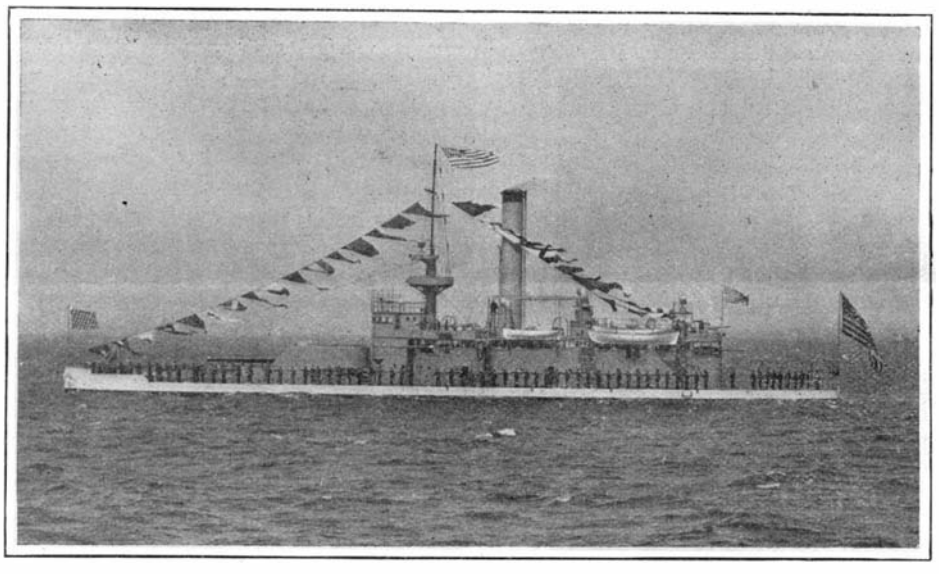
In the division of monitors the navy contains, in addition to the four which figured at the naval review, six others, the "Wyoming," "Amphitrite," "Miantonomoh," "Monadnock," "Monterey," and "Terror." These, with the exception of the "Monterey," are old vessels; and the services of the whole class would have to be confined strictly to harbor defense. Adding these six to the four at the review, we have a total of ten monitors on the effective list to-day.

In the protected cruiser class, in addition to the "Minneapolis" (which was present at the review), we have the sister ship "Columbia," of 7,350 tons and 22.8 knots trial speed; while in the "Tacoma" class of protected cruisers the navy includes the three vessels "Chattanooga," "Des Moines," and "Galveston," of 3,200 tons. The most modern of the protected cruisers not present at the review are the "Charleston," "Milwaukee," and "St. Louis," three new vessels of 9,700 tons displacement and 22 knots contract speed, each carrying as a main armament fourteen 6-inch rapid-fire guns. Outside of the vessels above named, there are twelve other protected cruiser of varying age and efficiency, many of which have been re built and rearmed; they will be useful for the many duties which lie outside of that of joining issue in a general lin engagement. In this class we have altogether twenty-thre ships, varying in size from the 9,700-ton "Charleston" dow to the 3,000-ton "Atlanta" and "Boston."

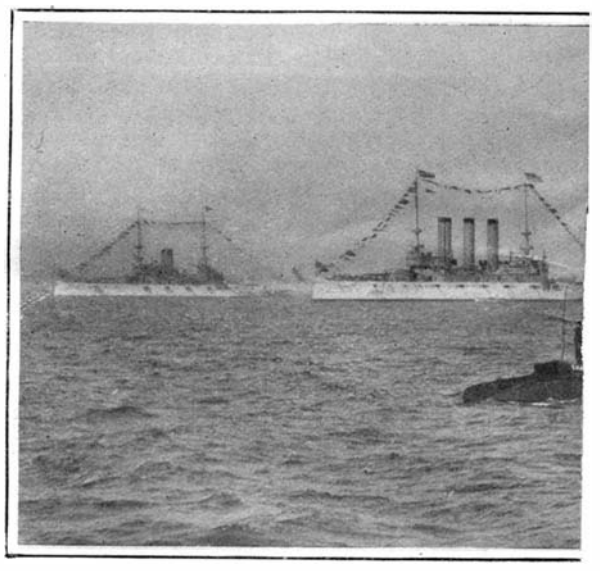
In the unprotected cruiser class, we have three vessels the "Detroit," "Marblehead," and "Montgomery," of abou 2,100 tons and 18½ knots speed, and allied to these ar



Yacht "Mayflower," From Which

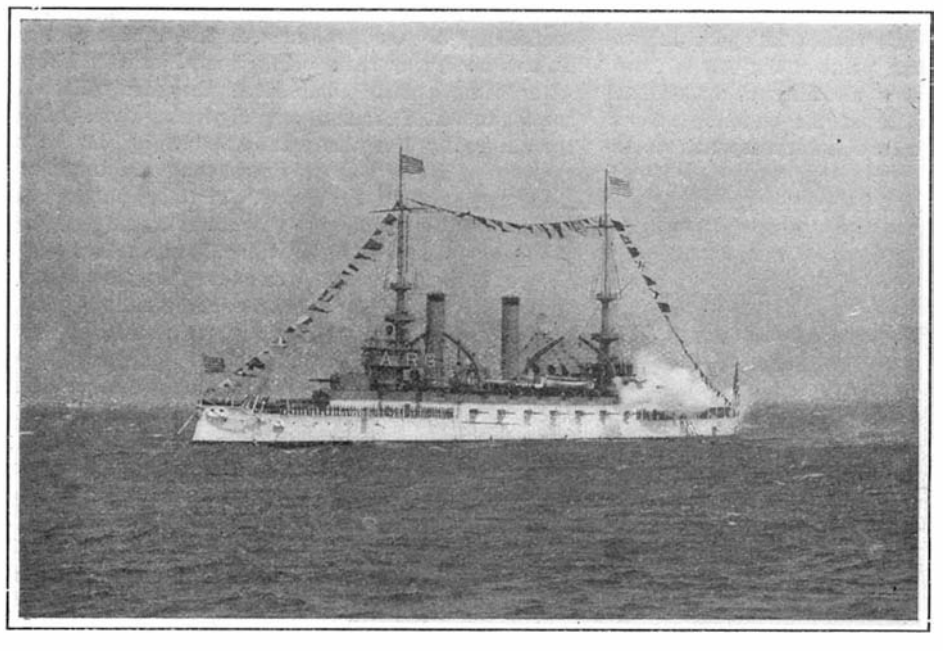


Monitor "Florida."
3,225 Tons; 12.4 Knots.

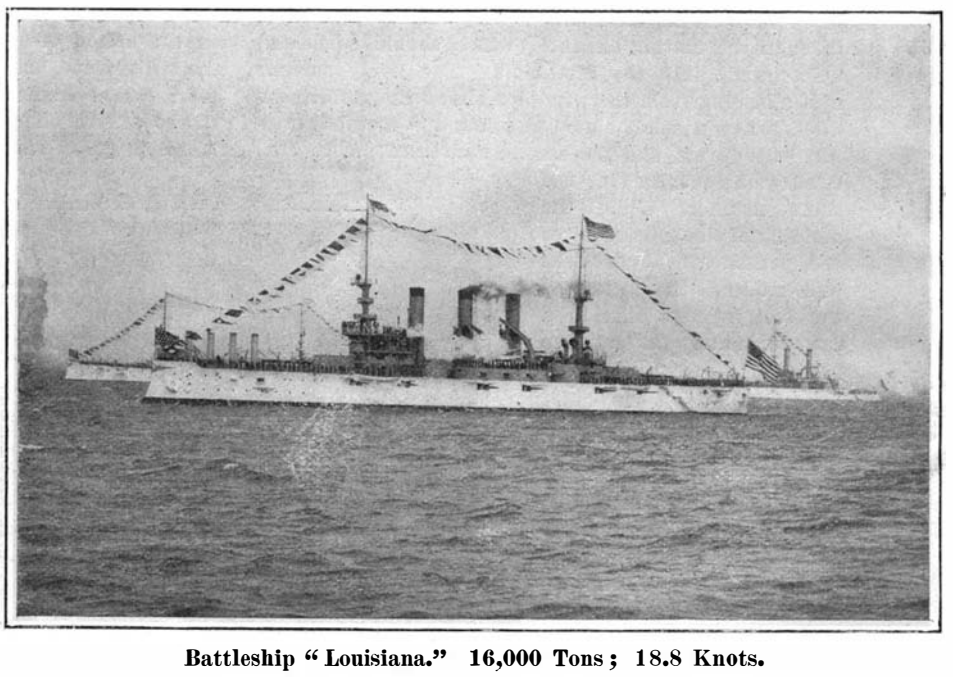


Battleship "Alabama."
11,552 Tons; 17 Knots.

Flagship "Maine."
12,500 Tons: 18 Kn
Submari



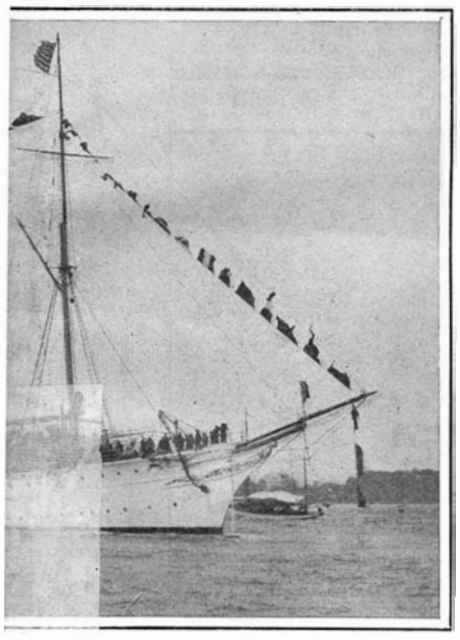
Battleship "Kearsarge." 11,520 Tons; 16.8 Knots.



Battleship "Louisiana." 16,000 Tons; 18.8 Knots.

WARSHIPS SALUTING AT THE OYSTER BAY REVIEW AS THE PRE

three scouts, the "Chester," "Birmingham," and "Salem," of 3,750 tons and 24 knots speed. The gunboat class includes sixteen vessels ranging from the 2,300-ton "Topeka" down to the 839-ton "Bancroft;" and following these in their order of value are eight unarmored composite vessels, in which are included such gunboats as the "Annapolis" and "Princeton;" four training ships; and a class of twenty-one small unarmored gunboats of 500 tons or under, which is largely made up of vessels acquired in the Philippines at the close of the Spanish war. In addition to the six torpedo-boat destroyers and six torpedo boats present at the review, the navy includes ten other destroyers of similar design, and also thirty additional torpedo boats. In the class of submarine boats are eight vessels, two of which, the "Shark" and the "Porpoise," were present at Oyster Bay. At the end of the naval list come twenty-two converted yachts; four



e "Shark."

the President Reviewed the Fleet.

cause of our strength in battleships and armored cruisers of the latest type, and the fine shooting of our men at target practice, we are entitled surely to be bracketed as second with the navy of France, even though numerically we are behind her.

Our illustrations taken during the review show the various ships in the act of saluting the President as he steamed slowly up and down the lines in the yacht "Mayflower." Each vessel saluted with 21 guns, the 6-pounders being used for this duty.

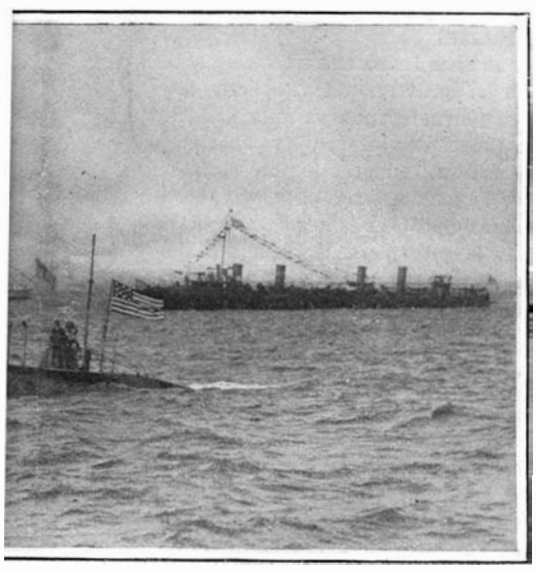
Armor and Its Attack.

Brevet Major W. E. Edwards, R.A., read a paper before the Engineering Section of the British Association on "Armor and its Attack." He said that the history of armor, as applied either to ships or to forts, went back to a comparatively recent date only. In 1805 Gen. Sir William Congreve put forward designs of a floating mortar battery. Nothing appeared to have come of the proposal, and it was not until 1853 that the absolute necessity of armor as a protection against shell fire was fully realized, and early in 1854 floating batteries were put in hand in the United States, France, and England. Throughout the American civil war of 1861 to 1865 the value of armor was constantly demonstrated, and since then instances could be multiplied, but it was sufficient to say that all reliable evidence, including that afforded by the recent Russo-Japanese war, went to show that armor did not behave in the erratic manner which was sometimes stated. There had been disputes as to the best material for armor and as to the best disposition for the latter in a ship with a view to giving the maximum of protection for the weight at the constructor's disposal, but the value of armor, *per se*, had seldom, if ever, been seriously questioned. The introduction of armor was, of course, met by an increasing power of the gun and the quality and shape of the projectile. This was replied to by thickening and improving the quality of the armor, so that in the twenty years between 1858 and 1878 the thickness of the armor increased from 4½ inches to 24 inches. In 1867 wrought iron armor was supplanted by steel and compound plates. Steel was harder, but more brittle than iron, while the compound plate had the advantage of combining a hard steel face to break up the attacking projectile with a tough wrought iron back to hold the plate together. The speaker then proceeded to deal in detail with the various hardening processes, and he went exhaustively into the piercing properties of projectiles. In conclusion he said that the tendency throughout the world was to mount nothing but the heaviest natures of ordnance upon battleships, and unless plates could be made harder and tougher throughout their mass—as at present appeared possible—it would seem inevitable that the needed protection must be given by using thicker plates, and eventually, perhaps, as the power of ordnance increased, they might go back to the 14 inches, or even thicker, armor of fifteen or twenty years ago. As there must be a limit to the size and displacement possible in a warship, this increase in thickness must entail a corresponding reduction in the area of the heavily armored portions. On the other hand, the existence of quick-firing guns and high explosive shells would always entail the retention of a large amount of thin armor, so that just as the modern battleship now carried but two classes of guns—a main armament of the heaviest that could be conveniently worked together with the smallest quick-firing guns capable of stopping a torpedo-boat destroyer outside torpedo range—the armor would be of two thicknesses only—that capable of stopping heavy armor-piercing shell at medium ranges, and that able to keep out high explosive common shell of 6 inches, or less, caliber.

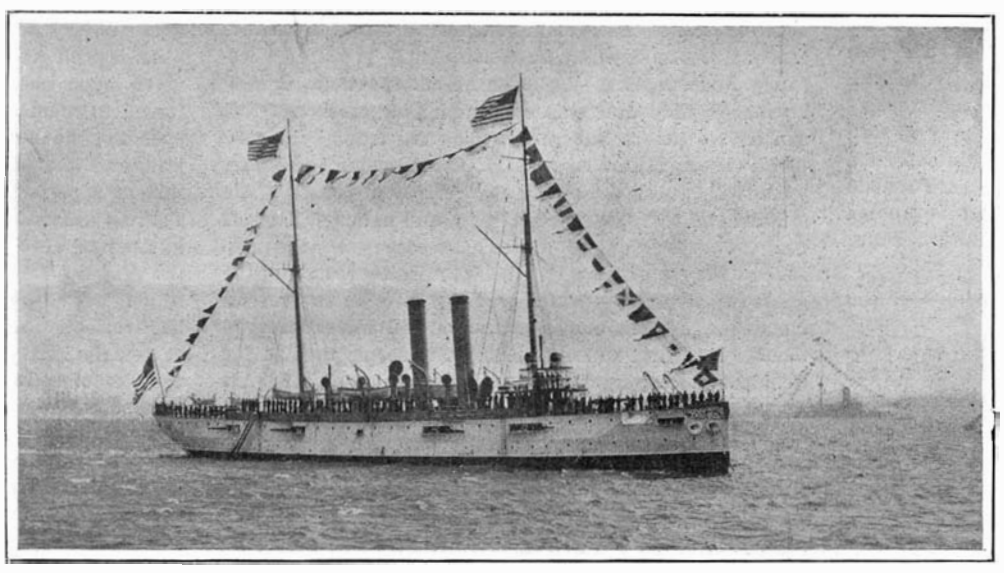
Death of Prof. Brouardel.

Through the death of Prof. Paul Brouardel, of Paris, on July 23, the world of science has lost a most valuable member. Prof. Brouardel died at the age of sixty-nine, and in his lifetime had held a large number of most important positions in the University of Paris and in the official life of France. He was widely known in English-speaking countries, as well as in France, for his work in connection with legal medicine and hygiene. He was born at St. Quentin, in 1837, and received his early education at the Lycée St. Louis, Paris. He took his M.D. degree in 1865, and after practising at various hospitals became professor in the faculty of medicine in 1879, and two years later a member of the Académie de Medecine. In 1890 Prof. Brouardel became a member of the Académie des Sciences. For many years he was dean of the faculty of medicine at Paris, his work in connection with the medical faculty being chiefly concerned with pathology and legal medicine. Prof. Brouardel occupied a most distinguished position as a medical jurist and delivered a large number of lectures covering many phases of this subject. He published many volumes upon legal medicine in connection with his work as professor at the University of Paris.

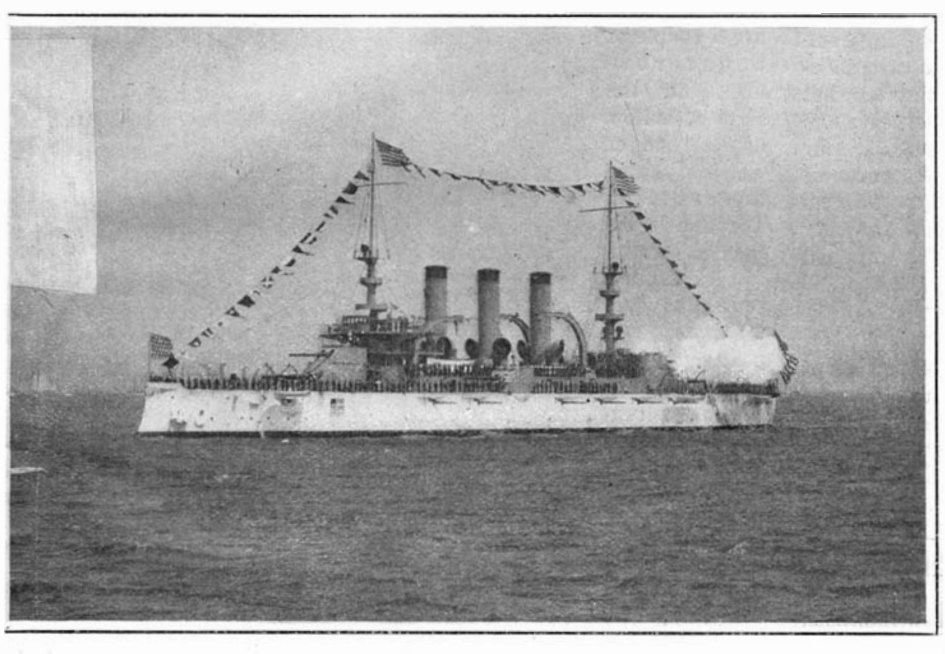
Persons called upon to handle paper in the form of sheets, or to turn over the pages of books rapidly, experience considerable difficulty, owing to the fact that the finger tips, soon becoming dry, refuse to readily perform their function in the separation of the sheets. The work is necessarily slow and tedious, and for this reason it is not always desirable to resort to the use of water from a sponge, as the delicate surface is marked in this manner, and at the same time there are some other inconveniences attached to the use of the sponge. A rubber finger pad has been recently placed on the market for this purpose, and is said to fulfill its mission perfectly. It enables the wearer to turn over the leaves rapidly and certainly, and much precious time is saved. Moistening one's finger by touching the tongue is unclean and exceedingly dangerous.



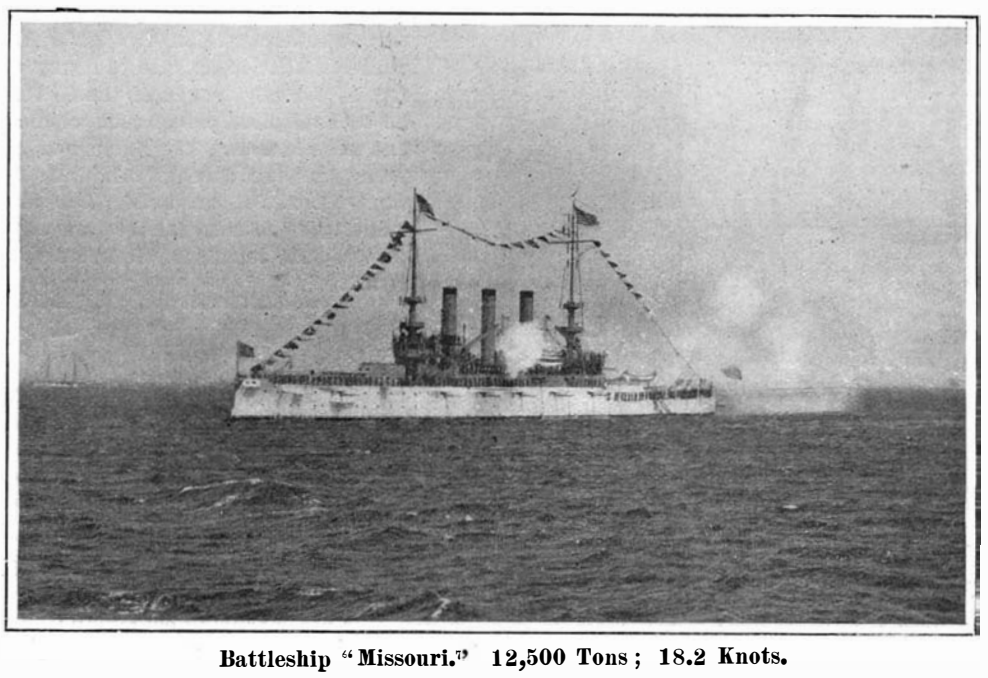
Destroyer "Whipple," 433 Tons; 28.2 Knots.



Protected Cruiser "Tacoma." 3,200 Tons; 16.6 Knots.



Battleship "Rhode Island." 14,948 Tons; 19.5 Knots.

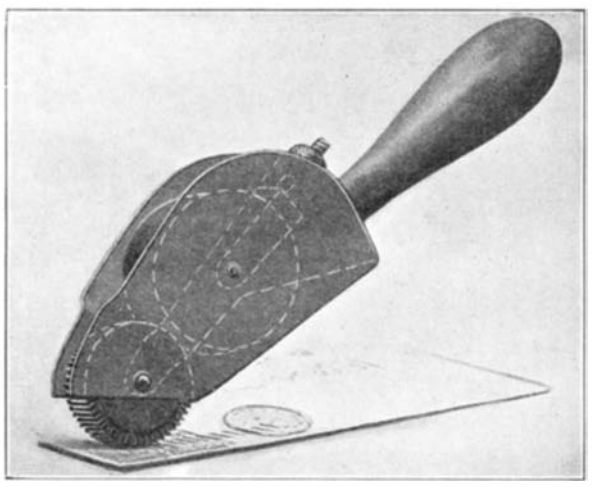


Battleship "Missouri." 12,500 Tons; 18.2 Knots.

DENT STEAMED DOWN THE LINES IN THE YACHT "MAYFLOWER."

A SIMPLE CANCELING MACHINE.

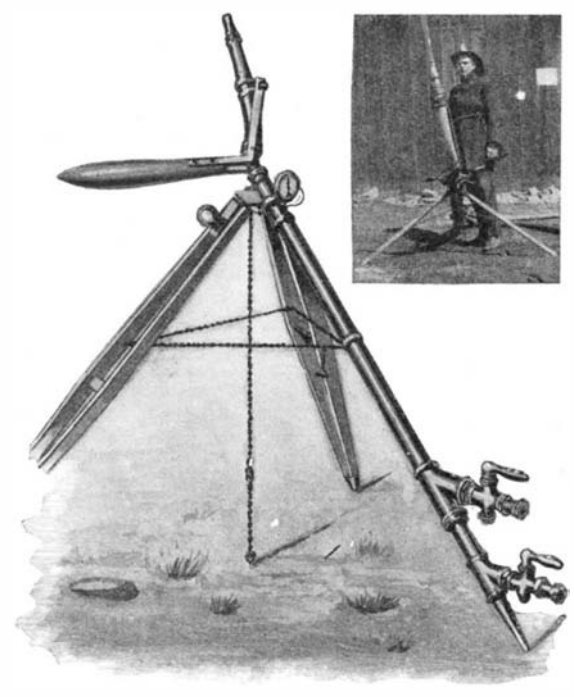
The accompanying engraving illustrates a novel canceling device for the use of postal authorities to cancel mail matter. It is not an automatic machine of the type used in the largest post offices, but it is designed to take the place of the usual hand stamp. The device is self-inking, and is provided with regulating means, whereby a clear impression can always be made. The usual hand stamp is not well adapted for use on uneven surfaces, because part of the cancelation is apt to be lost, and if the surface is not firm there is danger of breaking through the wrapper into the package itself. The new canceling machine avoids these difficulties by requiring a rolling instead of a stamping motion to produce the imprint. The simplicity of the device is apparent at a glance. It consists of two rollers supported in a U-shaped frame, which is provided with a handle. The lower one of the two rollers carries the rubber type representing the name of the post office where it is used. This roller is heavily weighted, so that it will automatically return to the starting position. The upper roller, which has a rim of felt, carries the canceling ink. This roller is mounted on a shaft, which is supported in slots in an inner U-shaped frame piece. The shaft carries a yoke, which is pressed by a coil spring tending to press the inking roller against the printing roller. A stud on this yoke projects through the outer frame near the handle, and is threaded to receive a thumb nut, whereby the pressure of the inking roller may be regulated. In use when the printing becomes faint, the thumb nut is turned to permit a greater pressure of the inking roller on the printing roller, and thereby more ink will be delivered. The inventor of this improved canceling machine is Mr. Arthur B. Pope, of 1408 I Street, Sacramento, Cal.



A SIMPLE CANCELING MACHINE.

SUPPORT FOR FIRE HOSE.

Fire hose is so heavy and cumbersome that it usually requires several men to handle a single line. However, there has recently been invented a device for supporting fire hose in such manner that a single man can control it and direct a stream wherever desirable, or the hose can be anchored and set to deliver a stream of water without requiring any attendance. The value of this feature will be appreciated in places where accident might occur from a falling wall, or where the heat is too intense for a fireman to remain. The device comprises a tripod, one of the legs being hollow or in the form of a pipe. Near the lower end of this leg there are several couplings by which connection can be made with a line of hose. The couplings are provided with valves whereby the pressure of water may be regulated, as indicated by a pressure gage. At the upper end of the hollow leg is a short curved pipe which has a rotary connection therewith, while a flexible tube connects this pipe with an elbow. A bifurcated lever is fulcrumed to the pipe and at its upper end is secured to a collar on the flexible hose. By means of a handle on this lever the nozzle may be swung in any desired direction. The tripod legs are prevented from spreading too far apart by chains. A central chain is attached at one end to the tripod head, and is provided at the opposite end with a screw eye which can be driven into the ground or the floor to anchor the support. The tripod may be compactly folded and a hook on the tripod head provides for securing it to the rung of a ladder. A patent on this hose support has been secured by Mr. John E. Malnburg, of Sacramento, Cal.



IMPROVED FIRE HOSE SUPPORT.

Steel and Bronze in Valves and Pumps.

BY LOUIS WAGNER.

In valves and pumps, when water attains a considerable velocity under high pressure, it has been observed very generally that gray castings and steel are quite often attacked by a peculiar kind of corrosion.

According to the learned German scientist Falkenau such corrosion takes place a good deal quicker and with greater force if two unlike metals come in contact with one another. By using steel traps and bronze bodies together in valves he found after a year or two that the steel trap was eaten through, as if by some acid. Surmising a possibility of acid or grit being present in the water, he put in filters so as to obtain a flow of perfectly clean, pure water. But the new valves which he had set in place soon were corroded as badly as the previous ones. It might have been also that the leather washers dropped a minute amount of tannic acid; he consequently procured absolutely clean washers—but with no better result. Again, it was possible that this corrosion had some electrical cause. He therefore replaced the steel traps by bronze traps, in order that like metals should come in contact with one another; and now corrosion ceased. He studied the corroded parts closely and satisfied himself that the fretting out could not have come from the pressure of the water, as might be assumed by reason of the great velocity of the water pressing through the valves. No doubt, a good many engineers will have observed similar instances of corrosion, yet it seems that so far no plausible explanation of the true cause of this phenomenon has been given.

For smaller parts under high pressure, say from 200 to 550 atmospheres, one should resort to forging and turn away from castings altogether, "and"—to quote Falkenau—"I have found that bronze under such a high pressure is not giving satisfaction in so far as its elasticity is slight and uncertain; castings, however, seem to expand gradually and become loose-bodied."

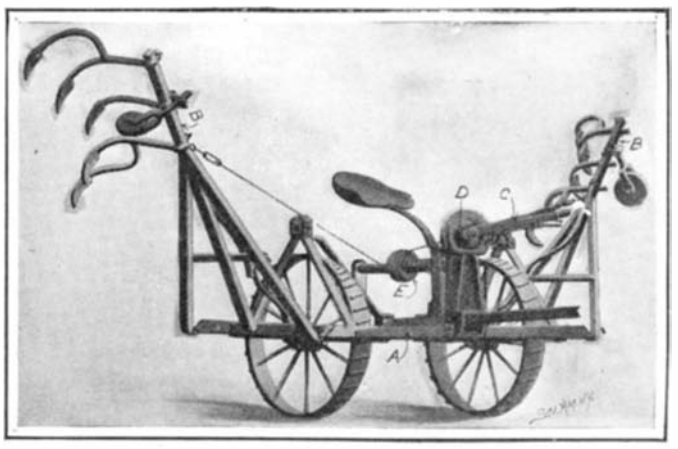
In mining pumps, ammonia pumps, and the like, a selection of material, on account of the direct attack of chemicals such pumps and valves are subject to, is certainly of greatest importance. In many shafts of the anthracite region the water is so strongly sulphureous that in no case can gray castings give satisfaction for any length of time. Falkenau states that he broke a piece out of such a pump a few years ago and examined it. The pump had been used for four years, and the castings originally had a thickness of three-fourths of an inch. But the sample was no longer gray casting, for the iron was all gone and only the graphite remained. It wrote as nicely as any lead pencil.

Experiments With Ties.

An interesting experiment on a large scale is about to be made by the Pennsylvania Lines, using screw spikes with the Thiollier special steel lining or sleeve. The purpose of the experiment is to determine the additional life which may be obtained from ties of inferior wood by the use of improved fastenings.

IMPLEMENT FOR PLOWING OR CULTIVATING AROUND TREES.

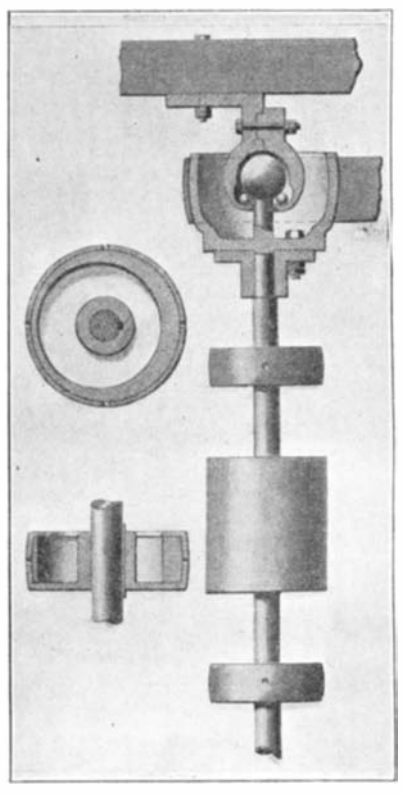
The accompanying engraving illustrates an improved agricultural implement, which can be used either as a plow or as a cultivator, and is especially adapted for operation in an orchard to produce irrigating furrows near the trees, or for cultivating ground around the trees. It will be observed that the beams are hinged to the body of the machine, so that they will fold up in a small space to avoid contact with the trees in turning, and also for convenience in coming and going from the orchard. These beams are spring-balanced, so that the task of elevating them is comparatively easy. The beams are also adjustable to accommodate the machine to different widths between rows of trees. In our illustration the main body of the machine is indicated at *A*, and the hinged beams are shown at *B*. The beams may be lifted to their vertical position by operating the lever *C*, which carries a gear wheel *D*, meshing with a pinion on the shaft of the winding drum, *E*. The latter serves to wind up a pair of cables, whose outer ends are attached to the beams. The counterbalancing spring is wound about the drum shaft. The beams, when in their lowered position, are supported on casters, which are adjustable to regulate the depth to which the cultivator blades may sink into the ground. In addition to this, the tongue or pole of the implement is attached by means of a spring plate, so that by driving a wedge between the pole and the forward crossbeam of the main body, the implement will be tipped downward, causing the cultivator blades to dig deeper into the ground. The inventor of this improved agricultural implement is Mr. W. L. Chase, of Banning, Cal.



IMPLEMENT FOR PLOWING OR CULTIVATING AROUND TREES.

MEANS FOR AUTOMATICALLY BALANCING ROTATING MASSES.

As is well known, all masses in rotation seek to revolve upon their center of gravity. If the body is forced to revolve in fixed journals upon an axis which does not coincide with the center of gravity, shocks, jars, and loss of energy follow. In practice the condition of a perfect balance is seldom accurately reached. Trifling differences become important factors when the number of revolutions is largely increased, and while the distance from the center of revolution is a controlling factor, even an unbalanced key on a shaft cannot be overlooked. In certain turbines which operate at extremely high speeds, it has been found necessary to use flexible shafts which would automatically adjust themselves to make their centers of gravity and revolution coincide. But this expedient is objectionable for many reasons. However, a method for obtaining this same result with a solid shaft has recently been invented by Mr. J. Van V. Booream, of 204 Lincoln Place, Brooklyn, N. Y. The accompanying engraving which illustrates the improved method represents the revolving portion of the machine to be balanced. Secured to the shaft are a couple of counterbalances in the form of hollow drums, one of which is shown in section. Through openings in the top of each drum a semi-fluid plastic material is poured in, preferably a mixture of hydraulic cement, water and sand. The shaft is now rotated at full speed so that the material is subjected to the action of centrifugal force while hardening, and moves against the rims of the drums. If the rotating mass is unbalanced, the material will automatically assume the form of an eccentric ring, bringing the center of gravity into line with the center of rotation. The rotation is continued until the ring hardens, when the rotating member will be perfectly balanced. Screws, lugs, or pockets in the drum may be used to lock the ring in place and prevent displacement.



AN AUTOMATICALLY BALANCED ROTATING BODY.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

BLOUSE.—SARAH OPPENHEIM, New York, N. Y. The invention has reference especially to the type of blouse such as worn by children which is provided with an elastic band or belt which is concealed in the hem provided at the lower edge of the garment. In blouses of this type difficulty is met in washing, due to the presence of the band. The object is to produce a blouse having a concealed waistband or belt which may be readily removed to enable the blouse to be washed and which is at the same time capable of adjustment.

GAUNTLET.—J. M. SALVÉ, JR., New York, N. Y. This invention relates to a peculiar stiffened cuff, specially for gauntlets such as are employed by military officers, carriage and automobile drivers, and for similar uses. The object is to construct the cuff so that it or the gauntlet, if the cuff is attached thereto, may be conveniently folded into a small compass, enabling it to be placed in the pocket when not in use.

GARMENT-FASTENER.—H. BRISACHER, New York, N. Y. This improvement relates to means for removably fastening the parts of garments or other flexible cloth articles. It is adapted especially for use as a cloth-fastener, although applicable for other uses. The aim is to provide a device which may be conveniently manipulated to engage or disengage the garment-sections and which will be of such structure as to securely hold the garment against accidental disconnection.

HAT-FASTENER.—JOHANNA M. BOYLE, New York, N. Y. This fastener is applied to hats for the purpose of securely holding them in position without the use of detachable fastenings, which are always liable to get out of place and even lost. The principal objects of the inventor are to provide a device which will be mounted on the hat at all times and which can be readily manipulated to secure the hat firmly in position.

Electrical Devices.

APPARATUS FOR OZONIZING ATMOSPHERIC AIR.—E. L. JOSEPH, 27 Chancery Lane, London, England. This invention relates to apparatus for ozonizing by the silent discharge of a high-tension electric current, and its object is to provide a compact, self-contained, and portable machine which shall be free from liability to cause annoyance by the transmission of vibration and wherein all the moving parts are so housed as to be inaccessible to unauthorized persons. It may be used with either an alternating or a direct current.

ELECTRIC FAN.—H. D. CESSNA, San Francisco, Cal. The more particular object in this case is to produce a type of fan driven by a motor and capable of shifting bodily from one point to another while in action. The invention relates to certain constructional details for improving the efficiency of the fan and for enabling it to be moved automatically.

Of Interest to Farmers.

CULTIVATING-PLOW.—F. M. RIVERS, Lake Butler, Fla. In this case the invention refers particularly to the construction and form of the foot or standard of the plow or cultivator and to the arrangement of braces in connection with such standard and the beam. By the arrangement of braces and construction of the standard maximum lightness, strength and rigidity are attained.

Of General Interest.

MAGAZINE-FIREARM.—C. G. ANDERSON, Blair, Neb. One purpose here is to provide an arm with a movable magazine divided into two separate chambers, each provided with shells filled with a different kind of ammunition, and to pivot and guide the magazine relative to the frame and barrel in order that either chamber may be brought into vertical alinement with the barrel and in position to deliver a cartridge to the carrier in the frame, which in its turn in conjunction with its breech-bolt deposits the cartridge in the barrel. The gun is a combination target and sporting rifle and is not simply intended for securing greater magazine capacity. Change from one cartridge to another is instantly done, thus securing the advantage of two different guns.

HARNESS-HANGER.—J. A. HAMMER, Elkton, S. D. This improvement refers to devices for supporting harness in a stall or stable and which are therefore usually termed harness "hangers" or "pegs." It is requisite that such device should be so constructed that the harness should be held securely, but may be easily applied to and removed from the support.

APPARATUS FOR USE IN CLEANING BEER-COILS.—C. A. CHANDLER, Carlisle, Pa. This apparatus comprises a cylinder for holding a caustic substance, alined inlet and outlet hot-water pipes, connected with the opposite ends of the cylinder and each provided with a stop-cock, and a supplemental cold-water pipe provided with a stop-cock and connected with the outlet-pipe at point in rear of its stop-cock.

COMBINED FLUE EXPANDING AND BEADING TOOL.—J. V. TERRY, Tucson, Ariz. Ter. In this instance the improvement is adapted to perform the operations of expanding and beading simultaneously and in half the time required by the ordinary method, and the operation may be repeated as often as desired without destroying the flue or defacing it in any manner.

DISPLAY-RACK.—G. H. NORTH, C. S. SMITH, and W. F. BREWSTER, Pocatello, Idaho. This rack or stand is more especially designed for supporting and displaying a pile of garments—such as trousers, coats, vests, and the like—and arranged to permit ready removal of any of the garments without disarrangement and to allow of convenient access to one side of the pile to enable the salesman to quickly read the size and price tickets whenever necessary with a view to keep the stock in good condition.

ORE-ROASTER.—R. E. WICKHAM, University, N. D. The invention relates to improvements in machines for roasting ores containing compounds of sulphur or the like, the object being to provide a device of this character that will be simple in construction and by means of which the separation of sulphur or other matter susceptible to heat may be rapidly carried on.

FLUE-STOPPER.—L. RUSSELL, Carthage, Ill. This device is adapted to be inserted in the mouths of flues after removal of a stove-pipe or other smoke-conductor therefrom for the purpose of excluding dust or dirt and preventing soot from entering the apartment. The invention is an improvement upon the stopper for which Mr. Russell received former Letters Patent of the United States.

BLASTING-CAP.—D. MCEACHERN, Erie, Canada. The invention is an improvement in blasting-caps, and has for an object the provision of a novel construction of cap whereby to prevent the passage of water to the explosive within the cap. In use the plug is fitted in the cap, the latter being properly charged, after which the fuse end is inserted within the plug close to the explosive charge. After this the cap is crimped one, two, or more times, as is usual in this class of devices.

SHAVING-BRUSH.—J. W. HAWKINS, Passaic, N. J. The object of the invention is to provide a brush arranged to collect the drippings, and thus prevent the same from soiling the hand employed for manipulating the brush to apply water and lather to the face and to allow of freshening of the lather by the drip-water gathered whenever it is desired to do so.

HAME-FASTENER.—J. W. GONCE, Kinderhook, Ala. This invention has reference more especially to hame-fasteners of the lever type. It is simple in construction and not expensive to manufacture, besides being adaptable to hames of varying shapes and sizes thoroughly effective and reliable in operation and capable of long service.

BUCKLE.—J. W. GONCE, Kinderhook, Ala. The inventor employs a base-plate associated with certain parts of which is a swing-bar or tongue for effectively engaging the back-band, web, or other device on which the structure may be used. The bar is mounted in special bearings therefor, preferably formed integrally with the plate, and the embodiment is such that the band or web is securely clamped at places and for the full width between the bar and parts of the plate, to derive a more secure fastening for the band, web, and the like.

HORN.—C. R. BREEN, New York, N. Y. The main object of the invention is to produce a superior horn or trumpet to those hitherto devised for use in connection with phonographs or other talking-machines and one which is highly resonant, but devoid of the objectionable metallic sound so often met in devices with a like object in view.

Hardware.

HINGE.—T. E. SPRAGUE, Nashua, N. H. One object of this inventor is to provide a hinge with means for preventing the usual fastening-pin for the joint between the members from working upwardly or out of place during the swinging movements to which they may be subjected in use, thus overcoming any unsightliness in the appearance of the hinge and tending in large measure to prevent separation of the members.

NUT-LOCK.—J. V. BERRY, Shamokin, Pa. The invention is an improvement in nut-locks, and particularly in locks operating in connection with bolts having right and left threads. After the nut has been turned home and the locking device secured down against the end of the nut the shank or handle may be bent down alongside the nut, thus locking the same firmly against any movement.

Heating and Lighting.

FURNACE.—E. E. JONES, Cleveland, Oklahoma Ter. Means in this invention are provided for causing the heavier and lighter bodies of the gases of combustion to take movement along crossing lines, thus bringing about repeated intimate association between colder and hotter gases and causing the combustible in the colder which would otherwise escape through the stack to be ignited and consumed by the hotter gases. As the gases pass from the fire-box all of the combustible in the gases is burned and the best thermal efficiency is attained.

Machines and Mechanical Devices.

TUCKING-GUIDE FOR SEWING-MACHINES.—ELLA SERODINO, New Orleans, La. The objects of the invention are to provide an attachment of easy adjustment to any sewing-machine, having a firm hold on the machine cloth-plate, with a flexibility of the gaging-sections, rendering it easy to place material to be sewed within the same, and so constructed that by the adjustable parts any width of tuck may be sewed and the distance of the tuck from previously-sewed tucks regulated without marking or folding of the material sewed and laces may be sewed upon hems or ruffles or inserted with the accuracy of hand work.

COPYING-PRESS.—J. A. A. D'AYGUESVIVES, 132 Avenue Victor Hugo, Paris, France. This press is so constructed as to require the smallest possible space, giving at the same time a pressure which will be powerful and uniform at all points. It is not necessarily secured to a support and insures a uniform pressure with the same stroke of the operating-lever whatever be the thickness of the copy-book or the parts to be pressed.

LUBRICATING SYSTEM.—W. HIGHT, Newport, Vt. The invention refers to means for lubricating the various portions of a machine, it being especially applicable to the engines of such types of automobiles as the Stanley carriage. Its principal object is to provide a system of this character in which the operator may lubricate all the frictional surfaces of the engine at the desired intervals without leaving his seat.

COLUMN-CLAMP.—J. L. GOSS, Newcastle, Ind. The clamp can be easily and quickly operated both in applying to and removing from columns or other bodies where a flexible clamp is desired. It is especially designed to be operated by the lever mechanism which can be attached and detached after the clamp is applied, thereby lessening the weight of the clamped article and at the same time allowing the lever mechanism to be used in applying other clamps.

ROPE-SHEAVE.—F. SCHULTZ, Tamaqua, Pa. The aim of this inventor is to provide a sheave having separate tread-sections, any one of which when worn out or broken can be quickly and conveniently removed and replaced by a new one without disturbing the position of the rope or removing the spokes and hub from the sheave, the sheave being principally designed for use on the hoisting machinery of mines and the like.

GRINDING-MILL.—W. A. KRAMER, Muncy, Pa. An important object of this invention is to provide means for mounting the grinding members so that they may be readily separated for repair and other purposes. A further object is to provide for the effective lubrication of the running parts and to prevent breakage of the grinding-wheels in the event that a hard substance is passed between the wheels. It is intended particularly for grinding grain.

ADDING AND RECORDING MACHINE.—A. K. ERSLAND, Fruithurst, Ala. This machine is constructed in such a manner that the carriage moves automatically in adding and returns to the initial position without necessitating any setting of the carriage for the order of the left-hand figure, and yet at the same time it provides that the highest figure of any sum shall be struck off first on the registering-keys, each successive figure being struck off in the natural order. Means provide for locking the key-levers to secure rotation of the type-wheels; for carrying from a lower to a higher order, and for correcting errors before the sum is added.

HAND-BORING MACHINE.—J. W. CONE, Barnesboro, Pa. In the present patent the invention has reference to hand-boring machines, and the object of the improvement is the production of a machine of this class which is especially adapted for boring holes in joists for passing wires in electrical construction.

HAT-PRESS.—H. S. BLAKE, Middletown, N. Y. The principal object in this instance is to provide means whereby the die which has the elastic casing can be forced against the companion die with the requisite pressure and simultaneously with the application of pressure to the casing interior. The invention contemplates the movements of the solid die, if desired, into a proper position for commencing the pressure operation; but the compression is obtained by simultaneously expanding the casing and forcing the die which holds it against the other die.

LAND GRADER AND SCRAPER.—A. P. D'ARTENAY, Dixon, Cal. The more particular object in this case is to provide the instrument with a scoop which may be adjusted at will and placed in a large number of positions and thus made to perform a variety of offices. It further relates to means for raising and lowering the frame of the machine.

HOISTING APPARATUS.—W. N. BERGERON, Avoca, La. A vehicle is employed which may be propelled in any desired way, as by one or more horses or other animals hitched thereto, special means being mounted on the vehicle for raising and lowering a grappling device for cane or other material to be hoisted, said means being provided with operating devices for carrying the grappling device to positions by which the same may be operated to take up loads or bundles of cane at different places within a limited radius.

PEANUT-STEMMER.—C. E. NELMS, Smithfield, Va. In carrying out his invention, Mr. Nelms employs a suitable frame comprising side bars, and in this frame journals a series of parallel rollers arranged in sets of four, certain rollers of the several sets being geared together and the intermediate rollers between the last mentioned rollers being idlers and being revolved by friction with each other and with the geared rollers.

Prime Movers and Their Accessories.

FURNACE FOR STEAM-BOILERS.—J. LIVINGSTONE, Montreal, Canada. In principle the invention comprehends disassociation of oxygen and hydrogen of steam in the fire-box and their union with the fuel to produce a water-gas. The steam is so superheated and its contact with heating-surfaces so prolonged as to insure disruption of the elements which elementary gases by their tenuous and expansive character pursue, overtake, and combine with the carbon particles while yet in the box and by quickly forming a water-gas and immediately burning it by the oxygen present reaches the result aimed at.

ROTARY ENGINE.—T. DAVIS, New Haven, Conn. The present improvements relate to the valve mechanism controlling admission of steam or air to the piston-cylinder, to the antifriction bushing or lining for the cylinder, also to the spring-pressed packing for the ends of the piston and to elastic or spring packing for the ends of the blades which are pivoted to and revolve with the piston. It is an improvement upon the engine for which Mr. Davis received a former Letters Patent.

Railways and Their Accessories.

RAILWAY-TICKET.—C. H. MCDERMOTT, Eveleth, Minn. This is an improved round-trip ticket for use on railways. Its form will obviate mistakes in checking passengers, and passengers will not be so frequently missed or overlooked, and the conductor can "work" his train in about half the time now ordinarily required.

RAILWAY SIGNAL SYSTEM.—R. O. TURNER, Barre, Vt. The object of the improvement is to so arrange the circuit-wires for electric signal-lamps at the ends of the block that the circuit may be closed by devices carried by a locomotive or car to give two flashes of the lights when the train is moving in one direction and a single flash when moving in the opposite direction, thus informing the engineer of any train that may be approaching the block as to the direction in which the train in the block is moving, and therefore prevent possible collision.

Pertaining to Recreation.

SKATE.—R. W. SHELMIRE, Roanoke, Va. The body of this skate is of special construction, and comprises cushioning devices, also of special construction, the two said elements being so associated as to give the best results. The cushioning devices may readily answer or take the place of the cushioning-tires employed on the wheels of roller-skates, although their use may still be continued. A specially-constructed brake device is employed for the skate.

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.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 8337.—Wanted, machines for making paper straws.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 8338.—Wanted, apparatus for transmitting mail bags to trains while in motion.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 8339.—Wanted, names and addresses of dealers in talc or mineral clay, and cobalt ores; also all other useful ores.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 8340.—Wanted, a water motor from 2 to 5 h. p. with governor that can be used to run a generator for lighting purposes, or a direct connected motor to dynamo.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 8341.—For parties engaged in twisting or making wires, screws, etc., into different shapes.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 8342.—Wanted, a machine for cutting several folds of cloth into different shapes, etc.

Metal Novelty Works Co., manufacturers of all kinds of light Metal Goods. Dies and Metal Stampings our Specialty. 43-47 S. Canal Street, Chicago.

Inquiry No. 8343.—For parties engaged in canning eggs for commercial use.

The celebrated "Hornsby-Akroyd" safety oil engine. Koerting gas engine and producer. Ice machines. Built by De La Vergne Mch. Co., Ft. E. 138th St., N. Y. C.

Inquiry No. 8344.—Wanted, makers of a gas and lighting machine, in which the air brought to the burner is charged with the volatile hydrocarbons of the gasoline.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machine work and special size washers. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8345.—Wanted, makers of electroplating apparatus.

Inquiry No. 8346.—Wanted, an apparatus for burning alcohol in gaseous form.

Inquiry No. 8347.—Wanted, to buy black skunks' tails which are brought on the market by furriers as a waste product.

Inquiry No. 8348.—For manufacturers of illuminating lamps that would burn denatured alcohol.

Inquiry No. 8349.—Wanted, parties who could manufacture pressed metal coat hangers.

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.

(10121) S. S. asks: Please tell me whether there is any such thing as an absolute vacuum, and if so, how is it produced? A. It is claimed that an absolute vacuum has been made by chemical means. The gas remaining after exhaustion had been carried as far as possible by means of pumps, was absorbed by chemicals and the space was then empty of gas, a vacuum. Another method has been described. Fill a hard glass tube closed at one end with soft glass. This on solidifying presents the appearance of a glass rod, solid throughout. When this is connected to an air pump and heated so that the soft glass melts, the melted glass will drop from the top of the tube, just as the mercury does in the barometer and Torricellian experiment. Upon cooling the soft glass solidifies again, leaving a complete vacuum in the upper part of the tube.

(10122) C. W. N. asks: 1. Approximately how large a spark coil is needed in wireless telegraphy to transmit through a distance of one mile, and how large for a distance of five miles? A. A coil giving a spark one inch long will transmit one mile over water. Over land the spark length varies with the character of the surface. A coil giving a ten-inch spark will answer for a variety of distances and circumstances. 2. In winding a large spark coil in which the greatest amount of wire is placed on the middle part of the coil, I have learned that it is customary to leave a space between the core and the wire at the ends. Is there any disadvantage in winding so that the wire lies directly on the main insulating tube? A. The space is left because of the greater tendency of the spark to jump from the secondary into the primary as the ends of the coil are approached. See Hare's "Construction of Large Induction Coils," price $2.50 by mail. 3. Is there any better insulator than paraffine for use in the construction of coils? A. Paraffine or a heavy oil is employed. 4. What is the best material to use in separating the sections of the secondary? A. Hard rubber disks. 5. Are there any means by which the voltage of the secondary wire of a coil may be determined? A. Widely different estimates are to be found of the voltage necessary to force a spark through various lengths of dry air. There is no rule giving a certain result for lengths beyond a few centimeters.

(10123) J. G. M. asks if cast iron balls and cones can be cast so as to wear, and if they cannot, kindly state what other material can be used besides steel. A. Cast-iron balls and cones are not suitable for bearings for vehicles or machines. Nothing is better than truly finished steel balls and bearings, hardened.

(10124) D. L. O. asks whether or not it was ever the general practice to build locomotives with inside cranks in this country. Kindly give the date at which inside cranks were most generally used, and state roughly the extent to which the practice of building this type of locomotive was carried. A. Locomotives with inside cranks were the prevailing type with American builders commencing about 1831, and their building continued until about 1845. They were in use mostly for switching engines as late as 1860 and possibly later. The outside crank type was also built and in use during the early period of locomotive service in the United States, and began to displace the center crank type for passenger service about 1842.

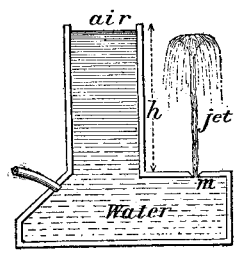
(10125) C. B. H. asks: 1. I have a good knowledge of the rudiments of electrical engineering and am desirous of completing the study as far as possible without the aid of an instructor. Will you kindly inform me what books you would recommend, also the prices and the order in which they should be taken up? A. Starting from a thorough knowledge of elementary electricity, embracing all that is contained in a book of the scope of Thompson's "Elements of Electricity," price $1.40 by mail, you should then proceed to the study of the dynamo, lighting systems, distribution systems, power systems, etc., in the direction of practical work. At the same time a study of currents, theoretically, should be carried on. Thorough work should be done upon the mathematics of the alternating current and the machines used in its distribution. You would do well to begin with Hawkins and Wallis' "Dynamo," and take next Crocker's "Electric Lighting," two vols., price $3 each. Steinmetz's "Alternating Currents," price $2.50, is the standard book on the theory of this subject. Kapp's "Transformers," $4, might follow this. For the electric railway there are many valuable books. Crosby and Bell, price $2.50; Dawson, $12.50; Bell, $3, may be named. The work thus laid out as a beginning only ought not to be carried on "by the book" alone. It ought to be taken in a laboratory where the article which is the subject of study at the time can be before the student and be handled, tested and investigated. Even a night course at one of the excellent institutions offering such courses in New York city would be far better than a book course taken without an instructor. 2. I should also like to know the method employed in figuring charges for light and power and how the wattmeter is read. If different manufacturers' instruments require a different formula—preferably those in use by the Edison Company in this city. A. The rotary wattmeter is a dial instrument and is read like the gas meter. A constant for the instrument must be used in computing the value from the reading, and each sort of instrument would of course have its own constant.

(10126) J. C. H. asks: Will you please inform me whether there is any book treating on electric resistance and its principles? If so, can you furnish it, and at what price? I am aware that this is treated of in various works but I want the most complete treatise I can find. A. There is no separate treatise upon electric resistance. It is fully treated as to theory in such a textbook as Thompson's "Elementary Lessons," price $1.40 by mail. The various data of metals, methods of measurement, etc., are given fully in Foster's "Electrical Engineers' Pocket Book," just issued at $5.

(10127) C. G. W. says: Will you kindly inform me through your Notes and Queries column how I can artificially color a meerschaum pipe? A. Ordinarily the pipe is boiled for coloring in a preparation of wax which is absorbed, and a thin coating of wax is held on the surface of the pipe, and made to take a high polish. Under the wax is retained the oil of tobacco, which is absorbed by the pipe, and its hue grows darker in proportion to the tobacco used. A meerschaum pipe at first should be smoked very slowly, and before a second bowlful is lighted the pipe should cool off. This is to keep the wax as far up on the bowl as possible, and rapid smoking will overheat, driving the wax off and leaving the pipe dry and raw. A new pipe should never be smoked outdoors in extremely cold weather. Fill the pipe and smoke down about one-third, or to the height to which you wish to color. Leave the remainder of the tobacco in the pipe and do not empty or disturb it for several weeks, or until the desired color is obtained. When smoking, put fresh tobacco on the top and smoke to the same level. When once burnt the pipe cannot be satisfactorily colored, unless the burnt portion is removed and the surface again treated by the process by which meerschaum is prepared. The coloring is produced by action of the smoke upon the oils and wax which are superficially on the exterior of the pipe, and are applied in the process of manufacture.

(10128) F. B. C. asks for rules for calculating speed of pulleys. A. The diameter of the driver being given, to find the R. P. M. of the driven: Rule.—Multiply the diameter of the driver by its number of revolutions, and divide the product by the diameter of the driven; the quotient will be the number of revolutions of the driven. Ex.—24 inches diameter of driver × 150, number of revolutions, = 3,600 ÷ 12 inches diameter of driven = 300. The diameter and revolutions of the driver being given, to find the diameter of the driven, that shall make any given number of revolutions in the same time. Rule.—Multiply the diameter of the driver by its number of revolutions, and divide the product by the number of required revolutions of the driven; the quotient will be its diameter. Ex.—Diameter of driver (as before) 24 inches × revolutions 150 = 3,600. Number of revolutions of driven required = 300. Then 3,600 ÷ 300 = 12 inches. The rules following are but changes of the same, and will be readily understood from the foregoing examples. To ascertain the size of the driver: Rule.—Multiply the diameter of the driven by the number of revolutions you wish to make and divide the product by the required revolutions of the driver; the quotient will be the size of the driver. To ascertain the size of pulleys for given speed. Rule.—Multiply all the diameters of the drivers together and all the diameters of the driven together; divide the drivers by the driven; the answer multiply by the known revolutions of main shaft.

(10129) L. P. says: Will you give me a rule for finding the power a stream of water is capable of developing, when the size and drop of stream are known? A. The gross power of a fall of water is the product of the weight of water discharged in a unit of time into the total head, i. e., the difference of vertical elevation of the upper surface of the water at the points where the fall in question begins and ends. The term "head" used in connection with waterwheels is the difference in height from the surface of the water in the wheelpit to the surface in the penstock when the wheel is running. If Q = cubic feet of water discharged per second, D = weight of a cubic foot of water = 62.36 pounds, A = total head in feet, then $D \times Q \times H$ = gross power in foot pounds per second, and $D \times Q \times H \div 550$ = gross horse-power. A waterwheel or motor of any kind cannot utilize the total head H due to losses at the entrance and discharge from



the wheel. There are also losses due to friction, etc., which place the average efficiency of waterwheels at about 75 per cent. Thus net

$$\text{horse-power} = 0.75 \times \frac{Q \times H \times D}{550}.$$

A head of water can be made use of in one or more of the following ways, namely: 1. By its weight, as in the water balance and overshot wheel. 2. By its pressure, as in turbines and in the hydraulic engines. 3. By its impulse, as in the Pelton waterwheel. 4. By a combination of the above. Referring to your question, we might say that it would be impossible to compute the horse-power of a stream of water when the size and head are known only. It would be necessary to measure the quantity of water which flows in a certain time. From this value Q could be determined in the formula, H could be measured, and the horse-power calculated. 2. A dynamo of what lighting capacity will a 3-horse-power gasoline engine run? A. A 3-horse-power gasoline engine would run a dynamo which could be operated on a lighting system carrying safely thirty 110-volt 16-candle-power Edison incandescent lamps on a parallel circuit.

(10130) W. S. asks: Is it possible to consume all the oxygen in a confined quantity of air, viz., in a sealed iron pipe? A. Yes; by placing copper scraps in the pipe and heating the air in the pipe. The oxygen combines with the copper, forming a solid substance, and leaving the nitrogen uncombined.

(10131) M. J. M. asks: 1. I have a folding camera 4 x 5, with lens 1 5-16 inches in diameter. Can I use it for a 5 x 7 camera? A. To cover a 5 x 7 plate a lens with a focal length of about 8 inches is used. 2. How can I remedy a ground glass which has become blurred and spotted by water and breathing on it? A. Wash it with soap and water, and afterward do not handle it. 3. Is there any paste made that can be used on squeegeed prints that has but little water or moisture in it, for it will spoil the print? A. There are many formulas in the photographic books for pastes or mountants made of gelatine. These do not penetrate the paper very much. 4. Can you give me the formula for flash-light powder? A. Flash-light powder is finely powdered magnesium. You should buy it from photographic dealers. 5. Will you please tell me what is the matter with my intensifying solution. I made it as per directions, but after it had stood several days it became crystallized at the bottom and shaking would not dissolve it. A. The water is saturated with the substances employed in the formula. Filter the solution. It is not injured by the crystals. 6. I have a lot of trouble with my exposure. I cannot always time it just right. Which would be the best for me to do—to get an exposure meter or an exposure book in which I would have to register every exposure? A. Nothing but experience and a careful study of the light can enable you to expose properly. You cannot become a photographer by the use of a meter or a book. It is, however, well to record the conditions of our exposures, so that we may study them and improve by our experience. Keep an exposure book by all means. 7. I wish to become proficient in the art of photography. What book or books would you advise me to procure to advance in that direction? A. We recommend and can supply you with the following books relating to photography: "The Amateur Photographer," by Wallace, price $1; "A Manual of Photography," by Brothers, price $6, post free. 8. Is there any way to burnish my prints and keep the card from curling without a burnisher? A. We do not know of any way of burnishing without a burnisher. Most amateurs use paper which has no gloss, such as velox, platinotype, bromide, etc. 9. Is it necessary to have a license to sell pictures? A. Some cities may require a license for selling anything. We do not think a license is required to sell a photograph any more than to sell a penny whistle you may have made. 10. Can you give me the address of some firm that has good lenses? A. See our advertising columns for addresses.

(10132) C. M. writes: 1. I want to use a call bell in kitchen, battery to be in second story, from which run two wires. I want one push button in one room, one in second room, one in parlor, one in room down stairs, also one in dining room—five push buttons; how could I connect all buttons to work properly with only one bell? A. Carry one wire from one post of the battery to the bell, and from the other side of the bell a wire which shall branch through each push button to the other side of the battery. There will then be a complete and separate circuit through battery, bell and a push button. 2. I have one lamp, 8 candle power, 26 volts; could I light it with 14 cells improved standard Fuller battery? If so, how about the amperes it will use with 26 volts? A. You can light the lamp with 26 volts and 1 ampere of current. 3. How old is Mr. Edison? Also, who was the first that invented the electric light? I mean both the arc and incandescent lamp? A. Mr. Edison was born February 11, 1847. The first man who ever saw a spark from artificially excited electricity is said to have been Otto von Guericke in 1660. This was the first electric light. Sir Humphry Davy is credited with first producing an electric arc light in 1801. He had a battery of 3,000 plates, each four inches square, and used charcoal points made of wood, which he immersed in a mercury bath to increase the conductivity. With this he melted many refractory substances such as lime, platinum, sapphire, and diamond. The incandescent lamp was invented and perfected by Edison.

(10133) H. E. G. asks: 1. What causes the humming sound heard at the receiver of a 'phone during a long-distance connection (New York to Philadelphia)? A. The running of the dynamo at central by which the system is worked. 2. Would not an alternating current (high tension) circuit parallel to 'phone wire have a tendency to cause such effect? A. Yes. The transposing of the line wires on the poles destroys the induction effect from currents upon parallel lines. 3. What is the object of transposing telegraph circuits? Are they affected by induction? A. The effect of transposing a line wire is as given above, in answer to question 2. 4. Why did such a long time elapse between the discovery of electro-magnetic induction (1831) and the invention of the dynamo (1867)? A. The world was not ready for it. 5. Are single-phase alternating current circuits ever operated on the three-wire system of distribution? A. We do not know whether this has ever been tried.

(10134) J. H. L. asks: I have a long-distance telephone in my office. A portion of the day the office is locked and I am engaged in another room about one hundred feet distant, where I cannot hear the bell ring. How can I arrange to hear the signal in the latter room without having a second long-distance 'phone installed? Can I fix up a separate two-battery call telephone that will transmit the sound from one room to the other, thus notifying me that the bell is ringing? A. You can have a second bell put in so that the call shall ring in both places all the time. Or you can switch out the second bell when you do not wish it to ring. Many physicians have such an arrangement for night calls, placing the extension bell in their sleeping room.

(10135) J. T. H. asks: 1. If you rub with flannel a stick of sealing-wax held in the hand, it becomes electrified. If similarly you rub a rod of brass it does not become electrified. Explain the differences. A. The wax is an insulator, the brass is a conductor, and its electricity flows off as fast as it is generated. Insulate the brass and it can then be charged. 2. Is it possible to obtain a magnet with a single pole? A. No. 3. Can you magnetize a steel ball, 3 inches in diameter, and where is the equator? A. Yes. If symmetrically magnetized, the equator will be at the largest place between the two poles and equidistant from them.

(10136) W. F. R. writes: Is it not a fact that wireless telegraphy was known and practiced (experimentally) as much as fifteen to twenty-five years ago? I remember reading (I think in Scientific American) of some one who succeeded in sending a message a distance of eleven miles between mountain peaks in Virginia. A. Wireless telegraphy has been known much more than twenty-five years. Between 1840 and 1850, Prof. Joseph Henry made this record in a published paper: "A single spark from the prime conductor of a machine of about an inch long, thrown onto the end of a circuit of wire in an upper room, produced an induction sufficiently powerful to magnetize needles in a parallel circuit of iron placed in a cellar beneath, at a perpendicular distance of 30 feet, with two floors and ceilings, each 14 inches thick, intervening." This was not the sending of a message, but the man who did this was not far from sending messages in the same way. He also placed a coil 5½ feet in diameter against a door and at a distance of 7 feet from another coil of 4 feet diameter. Shocks were felt in the tongue from the terminals of the second coil when the circuit of a battery of eight cells was broken in the first coil. This was sending signals with the tongue as a receiver. In 1885 Mr. L. J. Phelps installed a system of telegraphing to trains on the railway between Mott Haven and New Rochelle, N. Y. The message was sent along a wire between the rails and received in the baggage car of the moving train, wherever it happened to be along the line. This was soon replaced by the Edison system, and this was employed by the Lehigh Valley Railroad in running its trains. A man who was connected with this system has recently stated in print that he had received messages by it at a distance of 10 miles

from the line, using a wire fence to receive with. In subsequent experiments the same writer states: "A large induction coil similar to that used by Marconi was used, and 10 to 20-mile messages were of common occurrence."

(10137) A. B. asks: 1. Why are magneto calls used on telephones instead of the common make and break bells? A. The magneto machine generates a current well adapted to ringing the bell. No battery is required. It is less liable to get out of order than if a battery were employed to ring the bell. 2. Is the armature of a magneto bell a permanent magnet? If not, please state what causes it to vibrate. A. The bell has a polarized armature. This is a permanent magnet, which moves the instant the current varies the magnetism around it. It works more easily than a bell with a battery could do. All such matters are fully explained in Webb's "Telephone Handbook," price $1 by mail.

(10138) H. L. B. asks: How much No. 36 wire will it take for the secondary of a coil giving a one-inch spark, and how much and what size wire for the primary coil to be used for wireless telegraphy? A. It is a very good coil which gives an inch of spark for a pound of secondary. For primary coils from 12 to 16 wire may be used.

(10139) J. R. F. asks: 1. What amount of weight can be lifted with a pound of metal charged with lodestone as heavily as it can be charged? A. There is a great difference in the weight lifted by permanent magnets. You will do well if you lift a pound with a magnet weighing as much as a pound. Nor can you magnetize a bar magnet well with lodestone. It should be magnetized with an electric current, if you would produce a strong magnet. 2. Does the metal charged lose its power to lift in time by using it? A. No; a magnet is not injured by working. If left with a keeper on its poles and handled with care, no loss of strength need take place. 3. Can cast iron be charged as well as any other metal? A. Steel is the only metal of which a permanent magnet can be made. The best tool steel should be used.

(10140) K. S. A. asks: Is there any method known by which a picture or outline can be thrown on a screen in daylight, on the principle of the magic lantern, without making the room dark? For instance, could the outline be thrown on as a shadow? A. A lantern slide can be thrown upon a screen in a room by daylight if an electric arc lamp is used for an illuminant. It will not be as distinct as if the room were darkened, but still it can be distinctly seen.

(10141) W. E. F. asks: What would be the apparatus necessary to charge a storage battery from a trolley wire of an electric railway, and what size battery for 5 horse-power motor to run say 10 hours; and about what would the outfit cost, and how long would it take to charge it? A. You will require half as many storage cells to run your motor as the volts taken by the motor, since each cell will give 2 volts. To obtain the number of amperes you will need, divide 746 by the voltage of the motor. This gives the amperes for one horse-power hour. Multiply this by 5 and by 10, and you will have the ampere hours required for 5 horse-power for 10 hours.

(10142) L. E. A. K. asks: 1. Is the current that leaves a telephone in talking the battery or an induced current? A. An induced current. The induction coil is to be seen in the box of the transmitter in many forms of apparatus. 2. Are telephone generators alternating or direct current? A. The magneto generator by which the call bell is rung is an alternating current machine. 3. Can a direct current be transformed from a higher to lower or lower to higher without going through a rotary transformer? A. Yes; by an induction coil it is transformed to a pulsatory current in one direction.

(10143) C. C. McC. asks: Do you publish a work on the construction of voltmeters and ammeters that would enable one to construct one for use on an isolated plant? A. SUPPLEMENT No. 1215, price ten cents, will give information for the construction of a voltmeter and ammeter which may answer your purpose.

(10144) S. C. asks: 1. A party of us visited an electric plant. The electrician attached to the end of the poles of the dynamo two large pieces of iron, then inserted them into a saline solution, saying he would boil water, but I thought what he called boiled was only the decomposition of the water to H_2+O. Am I correct? A. Both decomposition and heating of water takes place, and the water is soon heated to boiling. 2. The electrician said if the two pieces of iron at the end of the poles were to touch one another, it would blow up the dynamo. In that case what would cause it to blow up? A. If the plates were brought to touch each other, the resistance would be brought so low that an enormous flow of current would take place (Ohm's law), and this would heat the dynamo so that the wire would soon melt, unless there were a fuse which would blow and cut off the current. It would not be an explosion in any ordinary sense of the term, but a burn-out.

(10145) S. B. S. asks: 1. Will a 4-ohm telegraph work on a line one mile in length? A. Yes, if all else is in good shape. 2. If so, how many gravity batteries will be required to work the instruments if No. 12 galvanized iron wire is used with ground circuit? A. The number depends upon the joints and insulation. We should put 4 to 6 cells and try it. Then add others if necessary. 3. How many gravity batteries will be required to work two 4-ohm telegraphs on a line 265 feet in length, where No. 18 uninsulated wire is used with ground circuit? A. Probably two will do the work.

(10146) D. H. asks: 1. Is there any way that a number of open-circuit sal-ammoniac cells (say twelve) can be connected together so as to produce a continuous current for an incandescent light? Is there any apparatus made for such cells to make them produce a more continuous current? A. No. It is impossible to use a sal-ammoniac cell on a closed circuit for any length of time. 2. Will dry cells recuperate as quickly and as well as wet open-circuit cells? A. No.

(10147) M. B. T. asks if putting the antennæ of a wireless telegraph system in an iron or other pipe will prevent the emission of the Hertzian waves? A. Anything which disturbes the free outflow of the waves from the vertical wires will disturb the transmission.

(10148) E. H. S. asks: 1. I should like to know something about the mathematics of an induction coil; how to calculate its probable output and what vital points tend to increase or diminish its efficiency. A. You will find in our SUPPLEMENT No. 1124, price ten cents, the description of a coil which gives a 6-inch spark. This will do X-ray work upon the thinner portions of the human body. For the thickest parts, a coil is employed which will give a spark of 14 inches or more. Such a coil is described in Hare's "Large Induction Coils," price $2.50 by mail. 2. Something about the Wehnelt electrolytic interrupter. A. We can send you five numbers of the SUPPLEMENT containing illustrated articles upon the Wehnelt interrupter, at ten cents each. SUPPLEMENT, pages 19602, 19811, 20871, 20982, 21500. 3. How to build an induction coil suitable for X-ray work, etc.? A. Faraday's laws of the induced current cover the action of a coil. The correct designing of a coil is the result of experience extending over many years, as well as the application of law to the case.

(10149) A. E. W. writes: 1. I would like to know if there is any advantage in using plate rather than ordinary glass regardless of difference in price? The plate will run oppositely 1-16 inch apart (20 inch D.), while some window-glass may run seldom less than ¾ inch apart. A. It is an advantage to bring the plates of any static machine as near to each other as possible. If they will not run nearer than ¾ inch apart, the machine will not be very efficient. 2. The plate is usually about 3-16 inch thick. Does this thickness of glass take away from the efficiency of the machine? A. It is not advisable to use glass of a greater thickness than will stand the strain of the running. 3. Could you also tell me as to how I can obtain drawings or descriptions of the arrangement of conductors or carriers for a two-plate Wimshurst? A. A good design of a Wimshurst machine can be found in Bottone's "Electrical Instrument Making," price 50 cents, by mail.

(10150) J. F. McG. asks: 1. What is the temperature of a 30-candle-power incandescent electric light? A. The temperature of incandescence is not directly connected with the candle power of a lamp. Ganot gives the temperature as 2,350 deg. Foster's Pocketbook gives it at about 2,500 deg. 2. What is rare earth and where can it be obtained? A. Certain minerals have been known among chemists as earths. The rarer ones are zirconia, glucinia, yttria and thoria. They are oxides of elements of similar names. 3. What candle-power would a 220-volt lamp give? A. It may be of any candle-power, depending upon the resistance of its filament.

(10151) R. B. asks: 1. Will a watch become magnetized by a motor? A. Yes; if there is much external magnetism in the space around the motor. 2. How can you tell if it is? A. By its irregular motion, or failure to keep time as well as it has been doing, often even stopping entirely. 3. How can it be demagnetized thoroughly? A. The quickest way is to take it to a jeweler, who is nowadays quite accustomed to this disease of watches. We can send you two valuable articles on the subject for 20 cents.

(10152) D. S. asks: Will you please answer through the columns of your valuable paper, if a small motor or dynamo, say 1-16 to 1-8 horse-power, can be designed the same as larger machine of 1 horse-power or over, that is in regard to the magnetic flux in the different parts? A. All dynamos are designed by the same rules.

(10153) F. M. C. asks: 1. In winding the primary and secondary coils for a medical battery (faradic current) should both be wound right or left hand, looking from the same end of the coil, or should one be wound right hand and the other left hand? A. We do not see how it can make any difference in which direction the turns of a coil are wound. The electrical induction will find that out for itself. 2. In using a galvanic battery, for medical purposes, of say ten carbon and ten zinc plates arranged zinc to carbon through the entire number, is it absolutely necessary to have each element, that is, a carbon and zinc plate, in a separate cup or cell with the fluid, or will the battery work as well, and the current last as long, if *one* large cup is used containing *all* the elements and fluid? A. If all the plates are in one cell, you will have one cell with the electromotive force of one cell, but with the amperes due to the large surface of your single plate. The same state of the current results if you connect all the positive plates together, and all the negative plates together from a larger number of smaller sized cells. This is *connecting in multiple.* If, on the other hand, you join the zinc of one cell to the carbon of the next in series, you will have an electromotive force equal to that of one cell multiplied by the whole number of cells, and a less number of amperes because of the greater resistance of the arrangement. This is a battery *connected for intensity.*

(10154) W. H. G. asks: 1. Please give acid used in pole indicator and ground detector and state what size and kind of wire is used. A. Make a solution of alcohol, 10 cubic centimeters, phenolphthalein, 1 gramme. Add to this distilled water, 110 cubic centimeters. Make a second solution of sodium sulphate, 20 grammes, in 100 cubic centimeters of water. Soak blotting paper in the first solution, and drain off the superfluous liquid. Then soak the paper in the second solution and dry the paper. To test the poles of an open circuit, moisten a strip of the paper, and place the ends of the wires about two inches apart upon it. A red spot will appear around the end of the negative wire. 2. Is there any way in which a bipolar dynamo can be made to give a steady current and not an alternating current? I cannot run a Ruhmkorff coil because of this, and would like to know if there is any instrument or battery that I can connect in circuit to stop this alternation? A. A dynamo gives a direct or continuous current when its armature is provided with a commutator. The same machine gives an alternating current when its armature is fitted with rings connected to the windings. Either form of dynamo will work a Ruhmkorff coil equally well. If the alternating current is to be used, screw down the vibrator so that it will not vibrate. 3. Do I understand that in the system of wireless telegraphy explained in SCIENTIFIC AMERICAN of January 4, 1902, there is no Ruhmkorff coil used in the transmitting part, but just the batteries connected to the earth? A. Yes; but Hertzian waves are not used in this system. 4. What are inductance coils, and please give idea of how made? What is a choke coil, and how made? A. An inductance or a choking coil is a coil to reduce the current by its induction upon the current as it pases through it. A second current is set up in the inductance coil, which flows in the opposite direction to the main current and thus chokes it off, so to speak. 5. Please give number of SUPPLEMENT, if you have same, that has plans and working drawings for constructing small gasoline motor. A. See SUPPLEMENTS Nos. 715 and 716, for construction of gas engines, 23 figures, 10 cents by mail. Also a book on "Gas Engine Construction" by Parsell and Weed, $2.50 by mail.

(10155) L. P. L. writes: We have an angle iron tower 100 feet high on which is a 50,000-gallon tank. Miscreants annoy us by climbing to tank. Electric light and trolley lines are near; how best connect them to tower to give a good stiff shock, and what size wire should we use? A. You can connect your tank to the electric lines you mention, but you will render yourself liable for the injury or death of anyone who may be connected to the circuit through your act. A man does not render himself liable to be murdered by climbing a neighbor's tower. It is simply a trespass, which has not so severe a penalty in the law. There are other ways of meeting the case.

(10156) M. P. C. asks: 1. What metal is next in quality to platinum for contact pieces in a bell, induction coil and a telegraph key? A. There is no metal which can take the place of platinum for this use. There are several which have higher melting points, but they cost from five to ten times as much as platinum and the price prohibits their use. Most metals oxidize too easily to enable them to be used for contact points. 2. Does carbon or graphite make a good contact? A. No. They are too brittle, and would soon be broken in pieces. 3. How many pounds of wire should be wound on the armature and field magnet of the hand-power dynamos described in SUPPLEMENT No. 161? A. The winding calls for so many turns, not so many pounds. 4. Is this dynamo suitable for running a motor? A. Yes, a small one.

(10157) L. A. G. asks: We have a small motor wound for 25 to 30 volts, which we would like to utilize in running a small job press which we are at present running by foot. Would it be advisable to use a battery of the Grenet cells; or would the cost of maintaining them be too high? A. The voltage is only one element in determining the output of a battery, and in rating the power required to run a motor. To furnish the voltage for your motor will require 16 bichromate cells. The type described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 792, price ten cents, is best adapted to this purpose. The size of cell therein described will doubtless be large enough to run motor. One charge will last six hours. You can determine the cost from the price of bichromate of soda or potash and sulphuric acid at your place.

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Ink, writing, Y. Tamaki	56,265
Knives, certain named, Harrington Cutlery Co.	56,275
Lamps and lanterns and parts thereof, tubular, R. E. Dietz Co.	56,291
Lard, S. Ewart & Co.	56,299
Lead, oxids of, National Lead Co.	56,252
Leather made from sheep and goat skins, kid, A. B. Clark Co.	56,220
Lime, Rock Plaster Company of New York and New Jersey	56,257
Liniment, T. Eccles	56,235
Magazine, periodically issued, A. D. Porter Co.	56,221
Magazines, periodical, Doubleday, Page & Co.	56,206
Malt tonic or extract, Dubuque Brewing & Malting Co.	56,234
Meats, certain named, Schwarzschild & Sulzberger Co.	56,261
Medicinal and adhesive plasters, J. Ellwood Lee Co.	56,213
Medicinal tablets, F. H. Putnam	56,255
Medicine for certan named diseases, Lung Germine Co. 56,245 to	56,247
Medicines, certain named, L. Ashworth	56,201
Medicines, laxative, F. A. Luyties	56,248
Metal, antifriction, Eureka Brass Co.	56,272
Milk, condensed, Borden's Condensed Milk Co.	56,204
Milk, condensed, Michigan Condensed Milk Co. 56,249,	56,250
Milk for rearing young animals, artificial, J. A. Panchaud	56,297
Mower and reaper knives, Whitman & Barnes Manufacturing Co.	56,282
Oil for external and internal use, Foster-Milburn Co.	56,208
Paints, carbon, Nashville Carbon & Oil Co.	56,251
Paints, mixed, Hurley Manufacturing and Supply Co.	56,240
Paper and cloth coated with abrasive material, H. Behr & Co. 56,226,	56,227
Paper lined bags and paper linings, Arkell Safety Bag Co.	56,224
Pea hullers, J. M. Sanders	56,281
Pianos, B. H. Janssen	56,243
Polish, A. L. Prescott	56,254
Razors, H. Clauss	56,269
Refrigerators, Cooper & McKee	56,232
Remedy for certain named diseases, Laxo Co.	56,214
Remedy for liver and blood troubles, R. M. Carlisle	56,268
Revolvers, pistols, rifles, and shotguns, Harrington & Richardson Arms Co. 56,276,	56,277
Roofing slate, particular brand of, R. F. Schaeffer	56,260
Rubber, boots and shoes made wholly or in part of, Haynes, Sparrell & Co.	56,239
Safes, Herring-Hall-Marvin Safe Co., 56,278, 56,279,	56,287
Sewing machines, covers, stands, tables, and attachments, A. G. Mason	56,289
Sewing machines, covers, tables, stands, and attachments, White Sewing Machine Co., 56,294,	56,295
Sherry, S. Streit & Co.	56,218
Shoes, leather, Peters Shoe Co.	56,253
Soap, shaving, J. B. Williams Co.	56,242
Surgical dressings, Johnson & Johnson	56,288
Talking machines and parts thereof, E. Desgrandchamps et Cie	56,233
Telephone signaling apparatus, Dean Electric Co.	56,270
Tobacco, chewing and smoking, Bloch Brothers Tobacco Co.	56,203
Tobacco, smoking and chewing, Western Tobacco Works	56,219
Tonic, reconstructive histogenetic, T. W. Stemmler	56,263
Valves and faucets, H. Mueller Manufacturing Co.	56,274
Water, carbonated, American Specialty Co.	56,202
Whisky, J. W. Flood	56,207
Whisky, Frankfort Distillery	56,209
Whisky, J. Merkel & Sons	56,215
Whisky, Casey-Swasey Co.	56,229
Whisky, Frankfort Distillery	56,237
Whisky, E. M. Gerstel & Co.	56,238
Whisky, H. F. Corbin & Co.	56,286
Whisky, rye, Allmens Distilling Co.	56,222

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"Hacker's," for kidney pills, W. A. Hacker	13,074
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"Phenix Carbon," for carbon paper, United Carbon & Ribbon Co.	13,077

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"Sour Grapes," for ornamental buttons, M. Breidenbach	1,779

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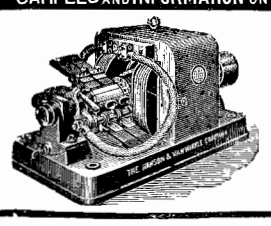

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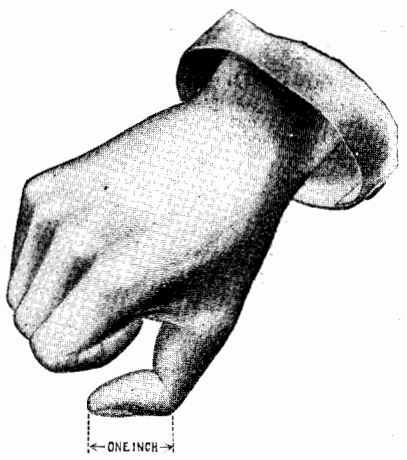
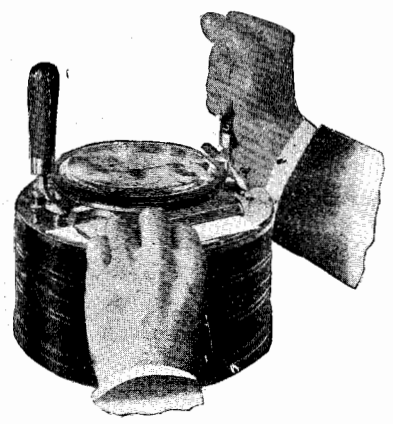


is a poor rule for measurement in a machine shop

It is also a poor rule to figure the labor cost of factory products on the estimates or guesses the workmen make of the time they spend on each job. Not one in a hundred can guess accurately.



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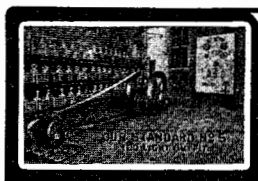

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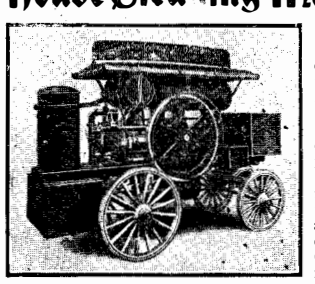

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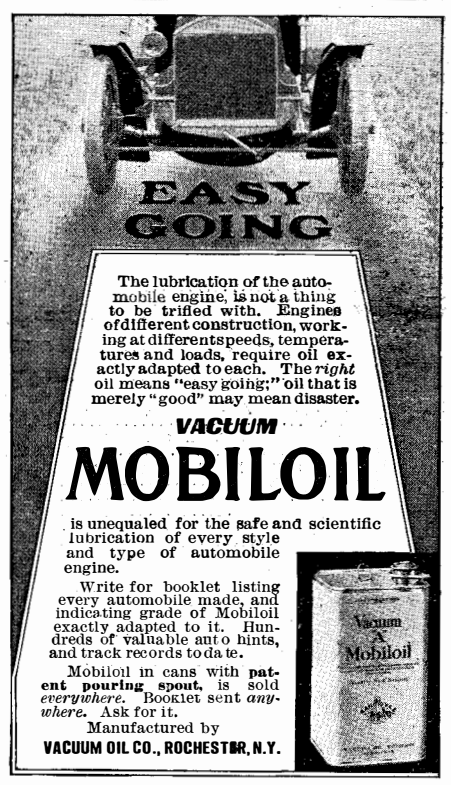

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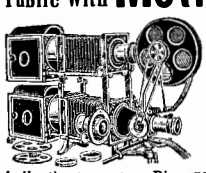

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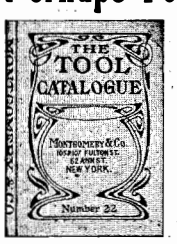

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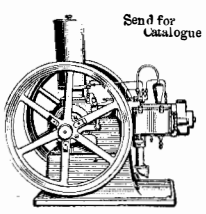

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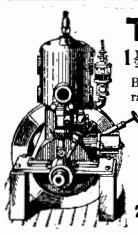

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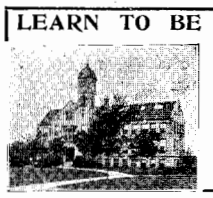

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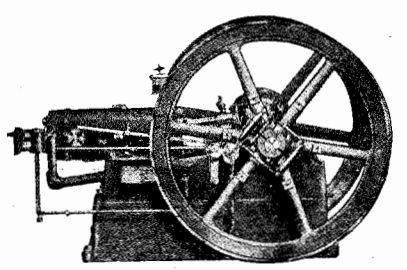

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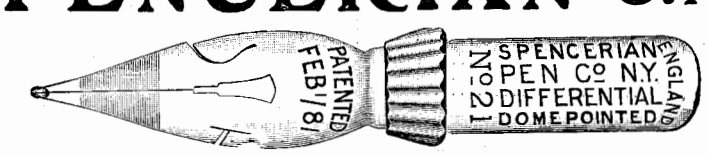

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