SCIENTIFIC AMERICAN

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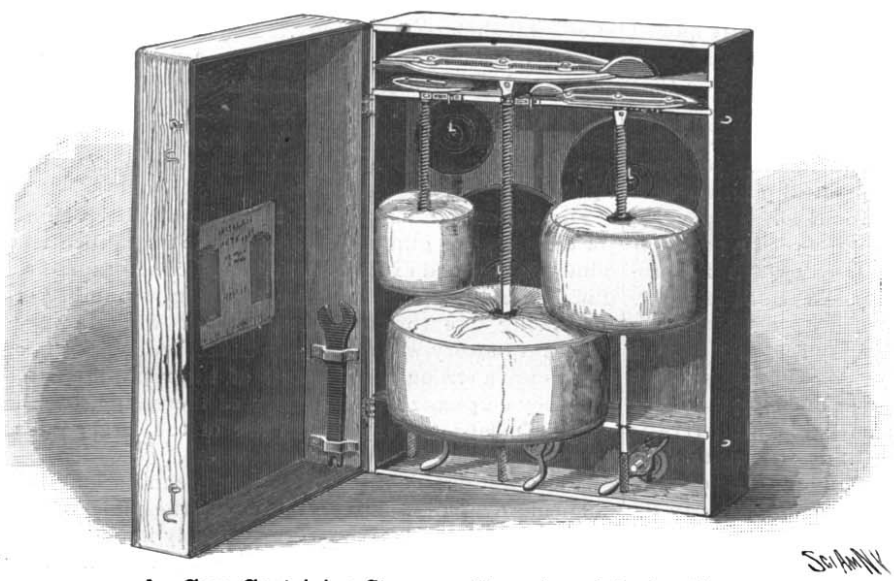
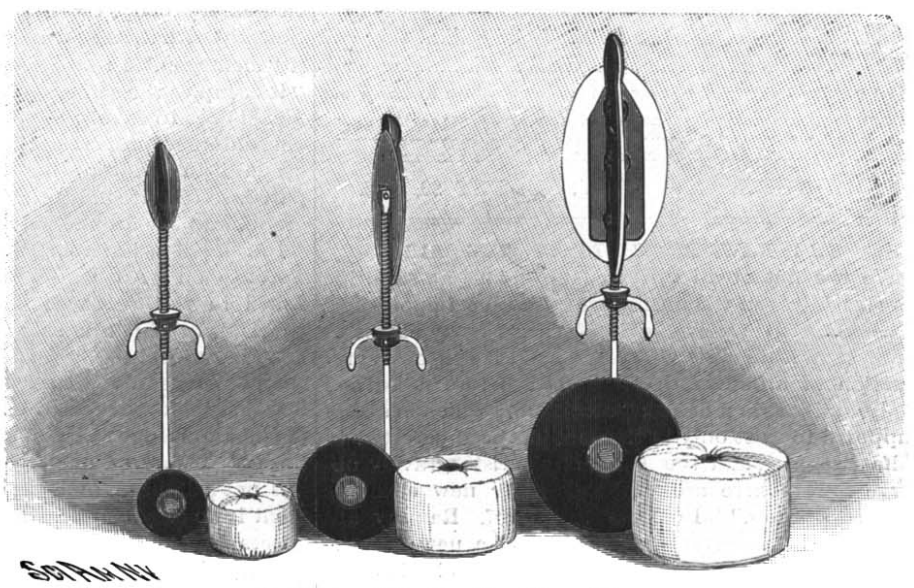
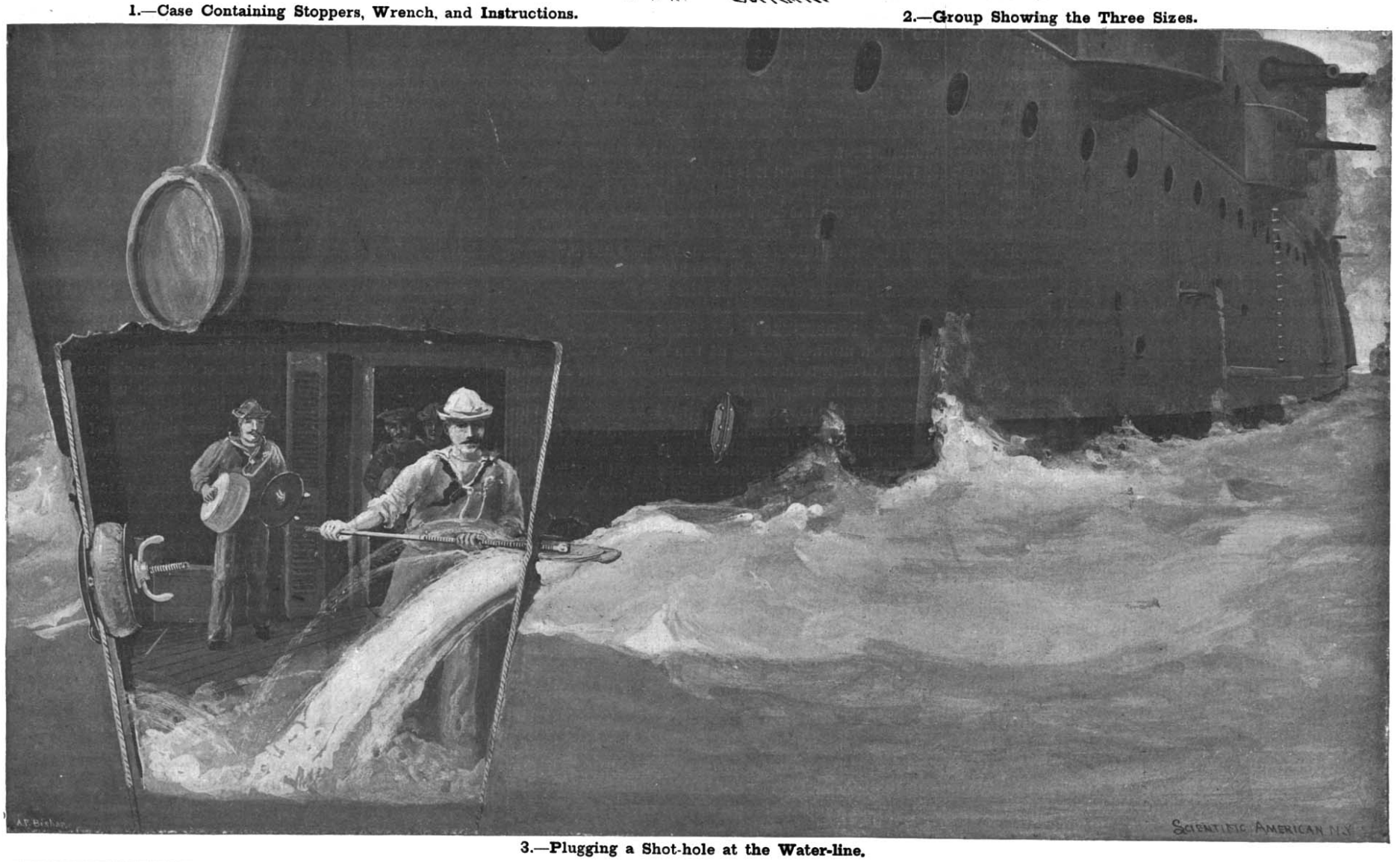


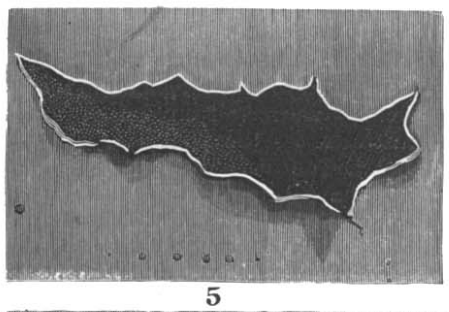
1.—Case Containing Stoppers, Wrench, and Instructions.



2.—Group Showing the Three Sizes.



3.—Plugging a Shot-hole at the Water-line.



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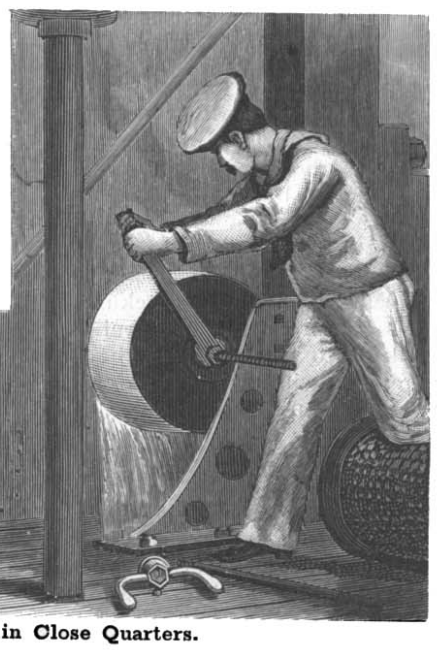
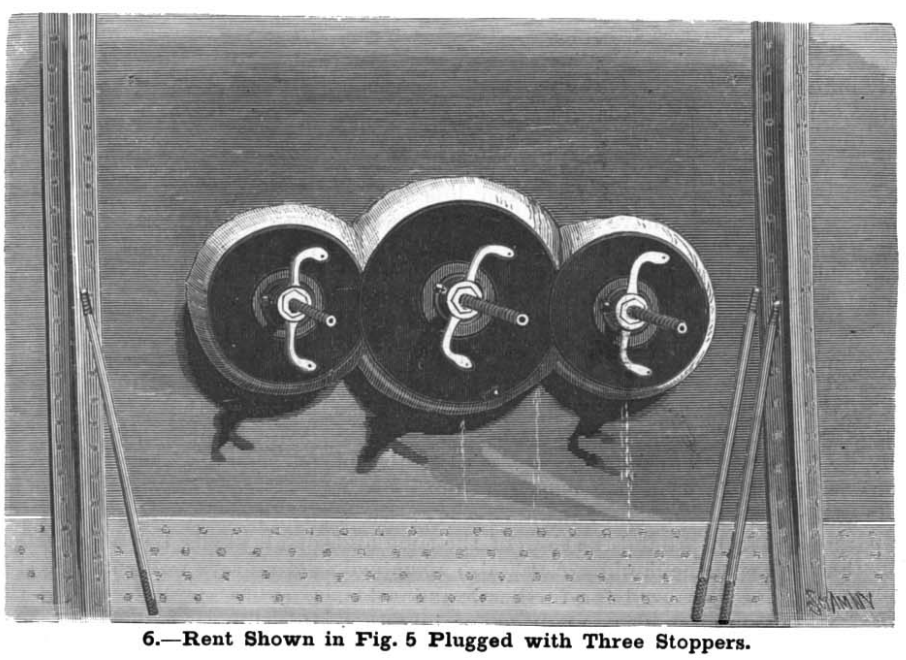


4.—Using the Wrench in Close Quarters.



6.—Rent Shown in Fig. 5 Plugged with Three Stoppers.

THE COLOMÉS STOPPER FOR CHECKING LEAKS AT SEA.—[See page 119.]

Scientific American.

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NEW YORK, SATURDAY, AUGUST 20, 1898.

THE NEW ELEMENTS IN THE AIR.

We are not at all surprised nowadays at scientific discoveries, even when they are of prime importance. We are apt to receive news of them as a matter of course. Within a week we have had the synthetic production of albumen demonstrated before a learned body, and within a month "coronium," which has been supposed to exist only in the sun, has been detected in solfatara gases, and the Italian scientists gravely observe that "there are probably other new elements in these gases." In June last, Prof. Ramsay announced the discovery of "krypton," a new gaseous element existing in the air, and close on its heels come two other elements, also obtained from the atmosphere, which have been named "neon" and "metargon." Krypton was named from the Greek word "krypto," meaning "to hide," and it was well named, for it eluded the vigilance of even the great chemists who have for a long time paid strict attention to the study of gases and the atmosphere, so that Prof. Ramsay scores one more brilliant victory over the unknown, which adds to his triumphs of the discovery of "helium," and jointly with Lord Rayleigh of "argon." For nearly two years, Prof. Ramsay and his assistant Maurice Travers have been searching for gases allied to them. In a brilliant paper read before the Chemical Section of the British Association, he gave his reasons for believing in the existence of an undiscovered gas. This is only another proof of our wonderful advance in science, when the discovery of an element can be predicted with reasonable certainty.

The search for the suspected gas was a long one. It was begun by examining the gases from various minerals and mineral springs and by fractioning helium through porous plates. It was not considered probable that another element would be discovered in the atmosphere, which had so recently furnished argon and helium, but finally mineral gases were discarded and atmospheric air was examined, with the result that "krypton" was discovered in liquid air, which is now fortunately available for physical and chemical purposes. About 750 cubic centimeters of liquid air were reduced by careful evaporation to 10 cubic centimeters, and the residue, if it may be so called, collected. The oxygen was extracted by means of red hot metallic copper, the nitrogen with the electric spark. Finally a mixture of magnesium and pure lime was used to deprive the gas of the oxygen which was left. There then remained a small quantity of gas, which was sealed up for the purpose of experiment in the Pflücker tube. The poles of the tube were now connected with an induction coil, a current was passed through, and the now isolated gas was examined with the spectroscope. It presented a weakly defined spectrum of argon and two strikingly brilliant lines not previously recognized, one corresponding to the yellow of helium and the other to the green line of helium. It has been suggested with some show of reason that the previously accepted lines of helium may have been partly influenced by the slight admixture of this then undiscovered element which we now call "krypton." Prof. Ramsay states that both he and Sir William Huggins are of the opinion that the green line of "krypton" is identical with the green line of the aurora, so that we again have an interesting fact when taken in connection with the finding of terrestrial coronium. The density of the new gas is approximately 22·5. It is an element and is monatomic. It is placed in the periodical table by Sir William Crookes between bromine and rubidium, and has an atomic weight of about 80.

The discovery of "neon" and "metargon" is also very interesting. The experiments were also carried on by Prof. Ramsay and Mr. Travers. A quantity of argon was liquefied, forming a colorless liquid, but a considerable quantity of solid substance was observed to separate and form around the sides of the tube and below the surface of the liquid. A gas also remained, which was at once removed for further examination. The frozen material was also separated for investigation. The gas was found to be the new element "neon" and the frozen substance was the element "metargon," so that in a remarkably short space of time these scientists have succeeded in adding three more to the rapidly lengthening list of elements.

The gas obtained was examined with the spectrum, and it was found to be characterized by a number of bright red lines. The atomic weight was found to be about 22, which would bring it into the neutral position between fluorine and sodium. The spectrum of the frozen substance proved to be very complex. It was totally different from that of argon. It was proved to consist of a single element, and this substance which was separated by freezing out of argon is a distinctly elementary body, though in some cases in close relationship with it, so that its discoverers promptly named it "metargon." In fact, as the investigators observed, "it occupies the same position in regard to argon that nickel does to cobalt, having the same atomic weight, yet different properties;" and Sir William Crookes classes it in an interesting table which he has just prepared, so that it shares the third neutral position with argon, and the atomic weight is about 40.

In the fall of last year Prof. Ramsay read a paper at Toronto on "An Undiscovered Gas," which is published in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1137, in which he said:

"The subject of my remarks to-day is a new gas. I shall describe to you later its curious properties; but it would be unfair not to put you at once in possession of the knowledge of its most remarkable property—it has not yet been discovered. As it is still unborn, it has not yet been named. The naming of a new element is no easy matter. For there are only twenty-six letters in our alphabet, and there are already over seventy elements. To select a name expressible by a symbol which has not already been claimed for one of the known elements is difficult, and the difficulty is enhanced when it is at the same time required to select a name which shall be descriptive of the properties (or want of properties) of the element. It is now my task to bring before you the evidence for the existence of this undiscovered element." After a lapse of several months Prof. Ramsay seems at last to have discovered the missing link and it is highly probable that "neon" will ultimately prove to be the gas which managed to elude them on the first search. It was a delicate attention when the eminent English chemist closed his now historic address at Toronto, when he said: "The history belongs to the old world. I have endeavored to share passing events with the new."

THE PERCENTAGE OF HITS IN WARFARE.

Foreign military critics at the seat of war have all spoken in high terms of the marksmanship of American gunners, and, in view of the special training which they received in the months preceding the outbreak of hostilities and their subsequent practice in the frequent bombardments of Spanish forts, it may safely be said that the work of our gunners in the naval battle of Santiago represented the best results that can be obtained with modern high-powered rifles.

With this fact in view, it is startling, and, to the enthusiastic admirer of the modern weapon, somewhat discouraging, to observe what a very small percentage of the shots that were fired, even on our side, hit the mark—not more, in fact, than about three per cent. This, apparently, is the best result that can be expected in the heat, smoke and confusion of an artillery duel at sea.

Until a more thorough examination of the Spanish ships has been made, and the full returns of ammunition expended have been published, it will be impossible to determine the exact proportion of hits to misses; but sufficient has been made known by official reports and the observation of trustworthy observers on the spot to show that the figure we have quoted is not very far from the mark.

The number of shot holes counted on the four cruisers as they lay upon the beach immediately after the fight was one hundred and thirty-one, distributed as follows: The "Oquendo," sixty-six; the "Teresa," thirty-three; the "Vizcaya," twenty-four; and the "Christobal Colon," eight. As the vessels were submerged somewhat below their normal draught, it is possible that some hits in the neighborhood of the waterline could not be counted. Waterline hits, however, are not likely to be numerous, and if we suppose that about a score of hits were made that could not be counted, we get a total of say one hundred and fifty for all four vessels. The very low freeboard and shorter length of the destroyers would render them difficult to hit, and they were so speedily sunk as to be only a comparatively short time under fire. We will assume, however, that sixty hits were made upon the two boats. This would bring the total number made on one side up to one hundred and eighty.

As regards the number of shells fired, we are informed by an officer who took part in the fight that the total of all shells, big and little, was six thousand. This agrees very well with the statement in the official report of Captain Evans, of the "Iowa," which credits this ship with having fired 1,473 rounds. Accepting the estimates of 180 hits and 6,000 rounds as correct, we find that the proportion of hits was only three per cent.

The disparity is largely explained by the fact that the dense volumes of smoke, both from our own and the Spanish guns, prevented accurate shooting by obscuring the mark during the greater part of the action.

There is an important lesson to be learned, however, from these figures; for if only three per cent of the shots reach the mark, the heavy 12 and 13-inch guns, which fire only once in three or four minutes, are at a great disadvantage as compared with the smaller quick-firing weapons. On the basis of three successful shots in a hundred, these big weapons are likely to be the better part of an hour at work before they land a successful shell on the enemy. This is actually proved by the fact that apparently only two or three of the biggest shells struck the Spanish ships, although the "Iowa" alone fired thirty-one 12-inch shells with full charges, and the "Oregon," "Indiana," and "Texas" were using their 12 and 13-inch guns throughout the fight.

Furthermore, it is noticed that the number of hits for each type of gun is in proportion to its caliber, the 8-inch doing good execution, the 4 and 5-inch rapid-fire guns even better, and by far the largest number of hits being due to the 6-pounders, of which a very powerful battery was carried by the several ships. The results are a strong indorsement of the rapid-fire gun, and they emphasize the necessity of increasing, by all possible means, the rapidity of fire of the larger guns on our battleships.

It is questionable if the 12-inch gun can be handled much more rapidly than it is in some of the navies of the world, and if we wish to secure greatly increased rapidity of fire, it can only be done by reducing the weight of the larger guns. Germany has apparently already grasped this truth, for her new battleships will carry no guns of a caliber greater than 9·45 inches. The small bore is compensated by the high velocity and energy of the projectile, the penetration of the weapon being nearly 26 inches of steel, or about the same as our 12-inch gun. Yet the German gun weighs only about 22 tons, against 45 tons for the 12-inch rifle, and it is a rapid-fire weapon in addition.

The 10-inch, 30-ton wire gun now being tested by the United States government is a more powerful weapon than the 13-inch, 60-ton gun of the navy, and if it is fitted with the most recent rapid-fire devices both in mounting and breech mechanism, it will be a vastly more efficient weapon and would form an ideal gun for our new 18-knot battleships. There are 8-inch rapid-fire guns afloat that fire four shots a minute to the one shot a minute rate of the 8-inch slow-firers of the "Brooklyn" or "Indiana." We should retain the 8-inch gun, but the 3 per cent results at Santiago teach us that we should make it a rapid-firer. Two such guns on each broadside would deliver twice the number of shells that can be thrown from the eight 8-inch guns on the "Indiana."

With four 10-inch, wire, semi-rapid-firers, four 8-inch rapid-firers, and six 6-inch rapid-firers, our new 18-knot battleships would be the most powerfully armed vessels of their day. But whatever may be the armament, Santiago teaches us that rapidity of fire should be made the supreme consideration.

DISCIPLINE AND DISASTERS AT SEA.

When all the phases of the navigation of the deep are studied, the wonder is not that accidents are so many, but that they are so few. Special and general navigation laws obtain in all countries having any pretense to civilization; but owing to the willfulness of owners, the carelessness of shipmasters or the lack of proper understanding, they are often rendered practically null and void. Man is naturally optimistic, sailors are unusually so, and freedom from accident in the past is too often assumed to insure immunity for the future.

Strenuous efforts have everywhere been made to educate the seafaring classes along higher and continually advancing planes; but, for some unknown reason, these efforts have failed to reach the man in the forecastle of the merchant marine. Notoriously, the forecastle is in many instances the final refuge of the illiterate and broken down. In spite of the earnest attempts which have been made to enforce that discipline and obedience that constitute the superiority of the crews of men-of-war over those of merchant vessels, something appears, continually, to be lacking. Perhaps what is needed is the physical and moral qualification which is demanded in the navies of the world. Discipline is recognized in the navy as not only essential, but imperative; but in the merchant marine it is too often enforced only in a half-measured and slipshod way.

The supreme value of naval discipline in emergency has been proved in cases innumerable. When a British troop ship foundered in the Bay of Biscay, a few years since, the soldiers stood in ranks at "attention," and went down to their death as if on parade, realizing that the boats were only sufficient to save the helpless women and children. Again, on board the battleship "Victoria," after she had been rammed by the "Camper-

down," the crew stood quietly at their respective stations until the order to "jump" was given, and thus, while discipline carried many of those below decks to their doom, it also preserved the lives of many above that certainly would have been lost in a general wild and headlong scramble for safety.

Seamanship, *per se*, in its relation to the safety of passengers, it is not our intention to discuss, but there are other and collateral issues that constantly endanger human life. Those who travel upon the high seas certainly have a right to demand of shipowners, shipmasters, and of their own and other governments, that they be safeguarded by every reasonable precaution that it is within human power to provide.

Is the maximum protection accorded?

We think not! Ships are still overloaded, and "Plimsoll's mark" is not operative, except in craft that fly the British flag. Ships of all kinds still put to sea shorthanded; lifeboats are generally too few, and the means of getting them into the water are often clumsy and antiquated, entailing exasperating and fatal delays; and boat drill is in some vessels practically unknown. Finally, while the schooling of the officer is, perhaps, thorough and complete, and ever improving, that of the man forward has practically no existence. "Steam," declared an eminent naval authority, "has killed the real sailor, the old time tar who was the eyes, ears, and fingers of his superior on the bridge or quarterdeck, and in his place we have the landsman, boy, coal passer, fireman, and stevedore."

With properly built, manned, and loaded ships, and the enforcement of discipline, the number of fatalities of the character of that which overtook the passengers on the "Bourgogne" would be greatly lessened. No complaints are heard as to the character or abilities of the officers of the French liner, but the crew exhibited themselves as a maddened, brutish, and mutinous mob. Whose was the fault—the officers, the owners, or the lax laws that permitted the shipping of such a crew and yet failed to provide for their proper handling? To-day all the great railway corporations are at especial pains to secure employes of an approved type of health and manhood—men quick to act in emergency, and of sound physical and mental condition. Were such men selected for the crew of the "Bourgogne," or are such generally found among the masses who "go down to the sea in ships" as a means of livelihood? Are the dangers of railway travel and transportation greater and more imperative than those constantly accruing to navigation of the broad seas, and are the duties devolving upon railway employes generally such as to require higher mental and physical qualifications? Quite the reverse! The practical knowledge demanded of the able seaman is not to be gained in the course of a month or even a year; but the brakeman can master his duties in thirty days.

What was it that specially marked the differences in the two accidents that respectively sunk the "Victoria" and the "Bourgogne"? Discipline and manhood in the case of the warship as against mob rule and brutal selfishness on the Transatlantic liner. Had the "Victoria" carried women and children, it is safe to say that their safety would have been assured before a single attempt was made by the crew to save themselves.

It has already been remarked that, as regards many merchant craft, there is a woeful lack of boat drill and the experience that, in connection therewith, is had only by continual practice. This fact has frequently been pointed out and commented upon by the general press. On most river, harbor, and lake craft the boats are not only too few, but they are deficient in belongings and appurtenances. Especially is this true of "tramp" ships, and of the craft plying on the Great Lakes. To be sure, the boats required by law are there; but too often they rest in cradles; are tightly housed and lashed over by canvas, that requires from ten to twenty minutes to remove; the falls are not hooked on, but are elaborately wrapped and tied in canvas to keep out water, and boat plugs have not been seen since some annual painting. Life rafts, if they are carried, are often useless through age, and so fastened as to require from a quarter to half an hour of labor to launch. Watertight and collision bulkheads were put in by the builder, but the communications are too seldom closed, and in the hour of emergency they are liable to fail of their purpose.

Summing up: The additions to navigation laws should include examination as to the physical, mental, and moral qualifications of crews; frequent and rigid inspections of boats and crews, and definite knowledge as to efficiency; better quarters and food for men; the withholding of part of the wages until the termination of a definite period of shipment or till the close of the season; introduction of rigid discipline; ready methods of placing boats in the water; constant inspection of life preservers as to character and utility; and, finally, self-closing, interlocking communications between adequate watertight and fire bulkheads. As a protection against fire, the employment of fireproof instead of inflammable paints is worthy of serious consideration.

CONCENTRATION OF POWER.

The close of the present century is marked by a tendency in the engineering world toward concentration of energy and material. A quarter of a century since a craft 200 feet long was almost a rarity on the Great Lakes, and when the locks of the Welland Canal were extended 235 feet it was supposed they would fully meet any demand to be made upon them in the succeeding hundred years. To-day there are more large craft on these waters approaching 400 feet in length than those of 300 feet and less, and many exceed the greater figure—running, some of them, even up to 460 feet.

The same increase and concentration is also witnessed among the railroads. Heavier roadbeds and rails, and more capacious rolling stock, are everywhere observable, and the locomotive has reached a degree of development as regards size, weight, power, and economy little dreamed of a generation ago.

A very striking illustration of this concentration of power was afforded recently by a train hauled over the Pennsylvania Railway between Altoona and Columbia, which consisted of 130 cars, was nearly three-quarters of a mile in length, and that weighed 5,330 tons. It was made up as follows: Locomotive 118 tons, other rolling stock 1,519 tons, freight (coal) 3,693 tons.

THE VALUE OF A NAME.

The general press have taken to speculation and discussion regarding names to be attached to such ships of Cervera's fleet as may be saved to the purposes of the United States navy.

But why should these names be changed? Are not the present titles suitable, marking a notable victory; and will they not illustrate and perpetuate history?

The "Macedonian," captured from Great Britain by the man-of-war "United States"—popularly known in the service as "The Old Wagon"—was for over half a century one of the Naval Academy fleet, and a beautiful type of the old time sailing frigate. She remained the "Macedonian" to the last, and it is to be hoped another "Macedonian" will ere long appear in the Naval Register.

In the English service it has long been a rule to perpetuate the names of ships that are of historical interest, either as captors or captured. The sixth "Royal Sovereign" and eighth "Revenge" are now in commission. The "Victory," "Triumph," and "Revenge" recall the three flagships of the fleet that fought and scattered the Spanish Armada; and the first and last named mark two notable victories over the French and their allies in the days of the First Empire. The "Shannon" keeps alive the fact that a ship of that name battled successfully with the U. S. "Chesapeake." What are the meanings of "Barfleur," "Bonaventure," "Foudroyant," "Hermione," "Imperieuse," "Neptune," "Temeraire," "Sans Pareil," and others that still hold a place in the Admiralty list?

By all means let us have naval designations that possess historical significance, as well as those that perpetuate the names of States, cities, and men. Let us have a new "Guerriere" and "Constitution," the old ones having been sold; a "United States," a "Constellation," a "Java," as well as a "Maria Theresa," "Vizcaya," and "Cristobal Colon," provided these latter can be saved. We already have a "Kearsarge," an "Essex," and an "Atlanta." All these and many others have a place in our history, and are far more calculated to appeal to national pride and patriotism than the names of deceased gods and heroes, such as "Ajax," "Jason," and "Amphitrite." Neither national policy nor the size of our navy suggests a "Terror" or a "Dictator." Let foreign countries keep these latter names with others of the kind. Our list of States, cities, and mountains will supply all needs for a century to come, but the demands of historic titles should not be forgotten or ignored.

PORTO RICO'S COMMERCE.

There is now every prospect of Porto Rico becoming annexed to the United States, and the statistics of her foreign trade show that our new island territory is well worth the heavy price which we have had to pay for it. In 1896 Porto Rico's foreign trade amounted to the very considerable sum of $36,624,120, and, for the first time in more than a decade, the value of exports exceeded that of the imports. There is little doubt that American enterprise would, within a very short time, almost double the value of exports, and our ownership of this beautiful island will enable us to have a greatly increased market for our agricultural products and for our manufactured goods; but even now we come second to Spain as regards trade with Porto Rico.

Its foreign trade is conducted chiefly with Spain, the United States, Germany, Great Britain, and France. Of all the merchandise imported and exported by the island during the four years, 1893 to 1896, fully 85 per cent, measured in value, was exchanged with the six countries named. Naturally Spain received the largest share of the trade, having an average of $9,888,074 a year. The United States ranks second, with the yearly average of $6,845,252. Cuba's trade with Porto Rico averaged $4,606,220; Germany's was $3,050,334; and that of the United Kingdom was $2,863,930, and of France $2,201,687.

Agricultural products make up a large part of the island's imports and nearly all her exports. The value of the agricultural imports in 1895 was $7,171,352, and of the non-agricultural imports $9,664,101. The agricultural exports were valued at $14,573,366, and the non-agricultural at only $617,490. Rice, wheat flour, and hog products are the principal imports, comprising nearly two-thirds of the total agricultural imports. The imports of rice in 1895 were valued at $2,271,819. Wheat flour was imported to the extent of 170,460 barrels, worth $1,023,694. The hog products imported were valued at $1,274,618. Vegetable products played the most important part in the agricultural imports. Breadstuff imports had a total value of $1,144,017, and meat products imported were valued at $1,531,986.

Cotton fabrics lead the non-agricultural imports, their value in 1895 being $2,070,667. The imports of fish amounted to $1,918,107; of wood and its manufactures, $840,511; of leather and its manufactures, $711,417. The imports of tobacco in its manufactured forms amounted to $692,333. Iron and steel and their manufactures, not including machinery and apparatus, were imported to the extent of $658,413; and the imports of machinery and apparatus were valued at $344,879. The value of the imports of the manufactures of hemp, flax, jute, manila, etc., was $408,974. Other important non-agricultural imports were: Soap, $248,571; paper and pasteboard and their manufactures, $196,197; mineral oils, crude and refined, $169,629; cotton yarn and thread, $154,964; woolens, $154,947; paraffin, stearine, wax, spermaceti, and their manufactures, $151,995; glass and glassware, $125,688; coal and coke, $124,536.

Coffee and sugar, the leading products of the island, comprise in value fully 85 per cent of all the merchandise sent to foreign ports. The quantity of coffee shipped in 1895 was 40,243,693 pounds and its value was $9,159,985; the exports of sugar amounted to 132,147,277 pounds, valued at $3,905,741. In addition to the sugar, $539,571 worth of molasses was shipped, making the total value of sugar and molasses exported $4,445,312. Leaf tobacco is the next most important export, the amount in 1895 being 3,665,051 pounds, valued at $673,787. Other important exports were: Cattle, $141,816; maize, $69,410; hides, $53,799; fruits and nuts, $10,880; distilled spirits, $9,466. Guano is the only important non-agricultural export. In 1895 the exports amounted to 15,491,476 pounds, valued at $610,921. The value of all the other non-agricultural exports was only $10,000. Porto Rico's export of coffee has more than doubled in ten years.

Porto Rican coffee is shipped principally to Spain, Cuba, Germany, Italy, and Austria-Hungary, Spain receiving 16,405,900 pounds in 1896, and Cuba 15,577,710 pounds, together more than half the total export. France bought 11,306,689 pounds. To the United Kingdom only 334,119 pounds were shipped, and to this country only 322,591 pounds.

The British East Indies sent Porto Rico 28,865,623 pounds of rice in 1896, Germany sent 26,100,840 pounds, and Spain sent 12,977,220. The import of rice from all other countries was only 2,819,566 pounds. The United States shipped $944,418 worth of flour, leaving only $24,129 worth for Spain, the United Kingdom, and France. This country also shipped $1,342,104 worth of hog products to Porto Rico in 1896, all but $13,337 of the total import.

The United States take more than half the export of sugar and molasses. Of the 122,946,335 pounds of sugar shipped from Porto Rico in 1896, 71,875,614 pounds came here, and 43,600,064 pounds went to Spain. The United States received $331,646 worth of the molasses exported in 1896, and the United Kingdom and the British possessions received the rest, which was worth $161,976. No molasses is exported to Spain or Cuba, but these countries get three-fourths the tobacco. Of the 2,219,907 pounds shipped in 1896, Cuba received 2,160,347 pounds and Spain 1,375,751. Shipments of Porto Rican tobacco to the United States are rare.

Spain's trade with Porto Rico increased in value from $4,929,799 in 1887 to $12,644,955 in 1896. The chief gain was in the increase of Spanish exports to the island from $2,411,216 in 1887 to $7,268,498 in 1896. During the same period the value of the imports from Porto Rico advanced from $2,518,563 to $5,376,457. Coffee and sugar constitute in value about nine-tenths of the total imports, excluding coin and bullion. After coffee and sugar the most important agricultural imports from Porto Rico are leaf tobacco, cacao, hides and skins, and fruits. Spain's non-agricultural imports from Porto Rico amount to less than $100,000 a year, and are principally bags and sacks, tobacco manufactures, and guano.

Spain's exports to Porto Rico are three-fourths non-agricultural products. Cotton fabrics constitute nearly a third of all the merchandise shipped during 1892-96, the annual average valuation being $1,581,706.

It will be observed no account is taken of the growths that afford most valuable woods for cabinet and special purposes, such as mahogany, rosewood, satinwood, grenadille and manzanilla, some of which readily command $100 to $150 per ton.

THE HOLLY GRAVITY RETURN SYSTEM.

Among the many recent installations of the Holly Gravity Return System is one worthy of especial notice. It has lately been erected in the Twenty-sixth Street power station of the Edison Electric Illuminating Company, of New York. It deserves mention for the reason that it accomplishes continuously and automatically a duty which ordinarily requires much care and expense. Although the conditions under which the system is working are somewhat unusual, it is operating with complete success. In this station there are engines and electric light machinery aggregating 7,000 horse power on a floor line below Twenty-sixth Street grade, while the boilers which furnish steam to drive the same are located on the fourth floor above, or at an elevation over the engines of about 60 feet.

The accompanying illustration shows a general arrangement of the station in section, and the "gravity" is employed for the purpose of receiving all the condensation and boiler entrainment from the steam mains, separators, headers, and all points of high pressure drainage pertaining to the west side, and returning it continuously to the boilers above without loss of pressure or temperature, taking the place of the traps and pumps formerly used for that purpose. Its simplicity is remarkable, as it consists practically of but two parts in which there are no floats, valves, or mechanical movements of any kind.

The receiver, *A*, Fig. 1, is cylindrical in form, and is located horizontally below all points to be drained. It is 12 inches diameter by 6 feet long, and at one end all the water of condensation, etc., is received through an ejector fitting (or suction tee), *L*. Many of the drip pipes that convey the water of condensation to the receiver are brought from remote points of the station, and there is as a result a slight loss in pressure. These drips are brought to and connected with the side outlet of the suction tee, while the pipes draining the adjacent separators, etc., are connected with the forcing end of the device. The velocity of steam and water through the suction tee, due to the difference in pressure, is sufficient to draw with it all the condensation, etc., from the drips connecting with the side outlet, and all is delivered into the receiver under the initial or boiler pressure. The opposite end of the receiver is provided with a blank head having a series of holes drilled in a vertical line through its center; the combined area of these holes equaling the area of a rising pipe, *C*, which connects with a discharge neck covering the openings, and forming a part of the head. This riser ascends to the top story of the building (the vertical distance being something more than 100 feet), and enters the separator, *B*. At a point near the top it extends into the separator to a central position, and terminates in an open tee arranged vertically. The separator is supported vertically, and its dimensions are 8 inches diameter by 10 feet long. It forms a kind of reservoir to contain or catch the water continually arriving from the receiver 100 feet below.

A small pipe, *P*, usually ½ inch diameter, connects with the top head of the separator, penetrating into the interior about 6 inches, which portion is perforated with small holes and the end sealed, forming a spray pipe. The continuation of this pipe outside of separator includes a small reducing valve, *R*, from which it terminates in the hot water tank. (May be connected with condenser, heater, radiation, or sewer.) Between the reducing valve and the separator there is interposed a three-way cock, *S*, with side branch, *T*, connecting directly with the boiler feed pump. An air vent, *N*, is also attached to top of separator for the free escape of all air that would otherwise accumulate there. The return pipe, *D*, Fig. 1, connects at the bottom the separator and drops down to the boiler room, and is there connected with an auxiliary header which has lateral branches provided with a gate and swing check valve to each boiler. A valved pipe, *G*, connects the lower end of the return pipe, *D*, with sewer, blow-off, or any other convenient discharge, and is called the "starting valve, or pipe."

The operation of the system is as follows: The drips are all opened to the receiver, the starting valve opened, and all air and dirt blown out until boiler pressure (or nearly so) is established throughout the system; then the reducing valve is set to establish a positive circulation from receiver to separator. The operation is then continuous, as the water of condensation and entrainment arriving to the receiver is then taken, or swept up through the riser in sections, or finely divided particles, into the separator, where it falls into the return pipe, *D*, to the boilers. The water is carried through its upward flight with the steam that is required to maintain circulation and will occupy some vertical elevation above the water line of boilers in the pipe, *D*, where the included column will weigh, plus the terminal or separator pressure, more than the pressure carried in the boilers.

The object of the reducing valve is to place the engineer in charge in absolute control of the circulation between receiver and separator. It permits an atmospheric escape of just steam enough to insure this result, and it may be adjusted for varying quantities. The amount is very small, and in nearly all cases it is utilized in the heater, condenser, hot water tank, or in heating radiation. To show how small this quantity is in a heating system including 5,000 square feet of radiation, the steam passing the reducing valve is all used in one radiator containing 100 square feet of surface.

When the three-way cock, *S*, is open to the reducing valve it is closed to the pump, and when open to the pump is closed to the reducing valve: so in cases where there is no convenient way of utilizing the steam passing the reducing valve, this cock is opened to pump, and a small quantity of the feed water is forced through the spray pipe into the upper end of separator, condensing sufficient steam to accomplish the same result. In this way there is no loss of steam whatever, and the circulation is under perfect control by either method.

The system is practically an open circuit from all points of drainage back to boilers, as there are no mechanical movements whatever in its construction; the only obstruction being a check valve at each boiler. It is employed in the most important power station in the United States as a truly reliable adjunct.

The gravity system has proved to be admirably adapted to marine work. Two of the large steamship lines have made the system a matter of very careful experiment, and so far it has proved itself reliable and of great benefit in keeping the water of entrainment and condensation out of the engine cylinder. Rough weather, moreover, has no effect whatever upon its continuous operation.

Cut No. 2 shows the heater and return system combined in one device as in operation in the Suburban Electric Light Companies' power station at Elizabeth, N. J. The object of this combination is to utilize as far as possible the condensation and entrainment about a power station in bringing the temperature of all the feed water supplied to boilers up to the same degree of temperature as the water in the boilers. This is accomplished by the application of the principles governing the operation of the gravity system.

In the cut, the heater, *A*, occupies practically the same relative position to boilers that the gravity separator does, and all the feed water for boilers is by the pump delivered through a spray head, *K*, into top of heater. This heater does not displace the other device employed to utilize exhaust steam or escaping gases, as the feed water is first pumped through either, or both, and from there to the Holly, which takes the water at the temperature obtained from exhaust steam or gases and raises it to the temperature due to the pressure carried in the boilers by the application of direct steam. Upon entering the heater the water falls through nearly its entire distance in a space that is occupied by steam that is continually under boiler pressure, and it is obstructed in its fall by several perforated plates, *O*, which are supported on a central pipe. This pipe is perforated with numerous small holes at its upper end, occupies nearly the entire length of the heater, and, passing outside at the bottom, drops down to a position below all points of high pressure drainage and there is connected to a suction tee, *L*. A direct supply of steam, draining the near-by separators or steam headers, connects with the forcing end of the tee, and all other drips about the plant are brought into the side (or suction) branch of the device.

The velocity (through the suction tee) of the steam necessary to heat the arriving water in heater is great enough to insure that the water of condensation, etc., from the drips connecting at side is drawn with the steam, and all is delivered through the perforations at the upper end of pipe, *H*, into heater. The time occupied by the feed water in falling through the steam-occupied space of heater is sufficient for the water to attain the same temperature due to the pressure carried in heater and boilers. The return pipe, *D*, drops down and connects with the main feed pipe to all boilers.

A regulator, *R*, is provided where necessary, which contains a balanced valve, *S*, through which the feed water passes on its way into heater. The valve is closed and opened by the rising and falling of the water line in the heater. This is not necessary, however, where good elevation can be obtained.

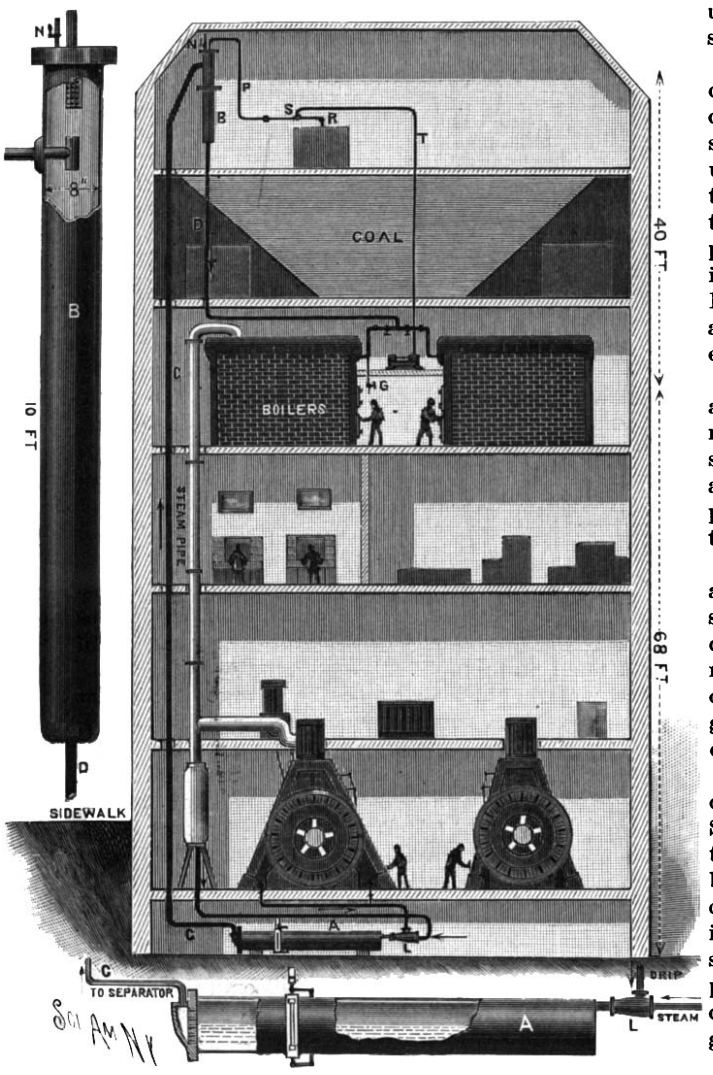


Fig. 1.—HOLLY GRAVITY RETURN SYSTEM.

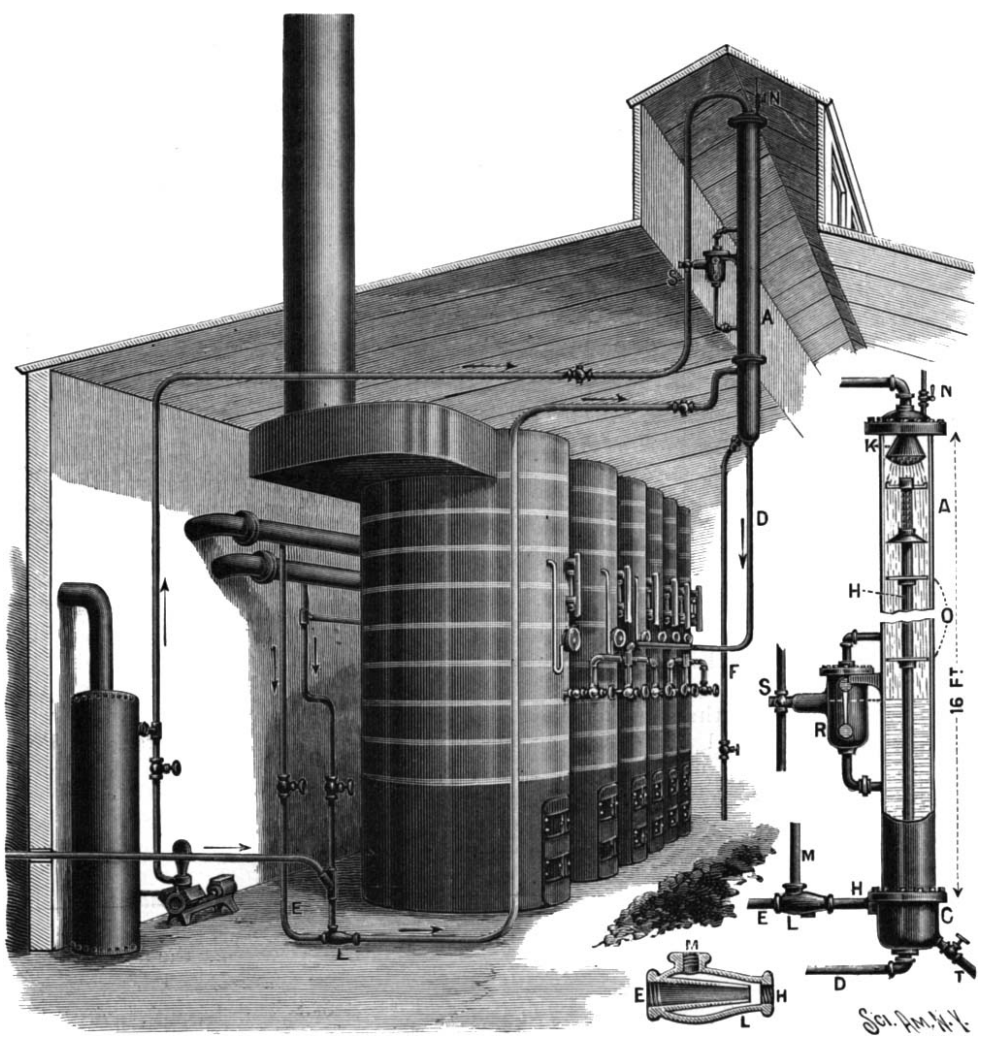
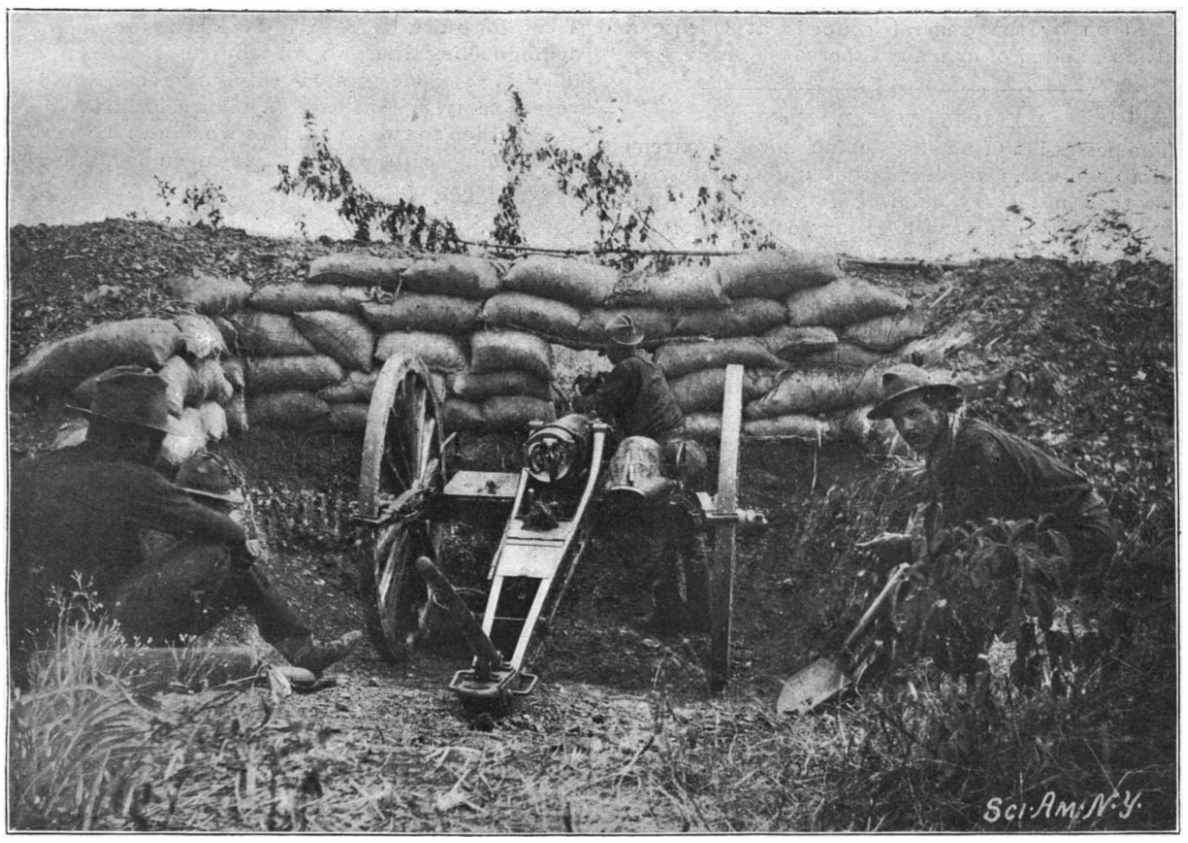


Fig. 2.—HOLLY COMBINED DIRECT HEATER AND RETURN SYSTEM.

GUNS, ANCIENT AND MODERN, AT SANTIAGO.

Peculiar interest attaches to the accompanying illustrations of two guns which did duty, one in the attack and the other in the defense of Santiago. The photograph of the American gun, a 3·2-inch field-piece, was taken when it had been moved up to its last position before Santiago, and made ready to take part in the bombardment of the city. It formed part of Captain Capron's battery to the right of the Santiago-Caney road and on the right wing of General Lawton's division. It was Capron's battery, it will be remembered, that opened the memorable fight which ended in the capture of El Caney and the storming of San Juan hill.



A 3·2-INCH FIELD-PIECE FORMING PART OF CAPTAIN CAPRON'S BATTERY BEFORE SANTIAGO.
(From photograph on the field of battle.)

The 3·2-inch field-gun is a comparatively light weapon and is not designed specifically for bombardment, the 5-inch gun, the 7-inch howitzer, and the 7-inch mortar being intended for this work. The confusion which prevailed at the unloading of the transports and the difficulties of transportation were answerable, we believe, for the failure to get any siege guns into position before Santiago, and, had the bombardment taken place, it would have been carried on with the smaller weapons. The 3·2-inch gun fires a 13·5-pound shell with a velocity of 1,685 feet per second. It can penetrate 3·8 inches of steel at the muzzle and it is an effective piece when firing shrapnel against bodies of troops—though it does not possess sufficient battering power to be very effective for bombarding. The siege gun of 5 inches caliber has a muzzle energy of 1,045 foot-tons, as against 266 foot-tons for the 3·2-inch gun.

The photograph shows very clearly the method adopted for emplacing these guns. This trench and embrasure form only part of the excavations necessary for the gun and its ammunition. A long pit, six feet deep, is dug, at one end of which is the gun and at the other end the main store of ammunition. At a little distance from the gun two cross-pits are dug, in which is kept a smaller supply of ammunition for the immediate use of the gun. A breastwork of sandbags is built up around the piece for the protection of the gun and its gunners.

The other photograph was taken by the same photographer, William Dunwoodie, after the surrender. It represents an obsolete, rifled, muzzle-loading mountain howitzer which was used in the Spanish defense. It formed part of the Ursula battery on the right of the Spanish lines. It is a very old weapon, dating from the time when rifling was beginning to be introduced into muzzle-loading guns. The grooves, as will be seen from the muzzle of the gun, were deep and very few in number. They were engaged by metal studs projecting from the body of the shells—a device which preceded the use of the modern, copper rifling band.

The Spanish method of emplacement was to dig a trench and project the embrasures for the gun forward beyond the line of the trench. In the wings of the trench, to right and left of the gun, were the secondary ammunition pits for immediate supply, and at some distance was the main magazine, which consisted of a bombproof, composed of a circular wall of barrels filled with broken stone. The barrels were three or four deep, and the whole was roofed with timber and covered with earth. The Spaniards had only two modern field guns, but their shrapnel was excellent and exploded with remarkable precision. The stem of the fuse was graduated and could be adjusted with great facility. They used both time and percussion shells and solid shot. The Spaniards used smokeless powder, thereby rendering it difficult for our batteries to locate their position. Both sides made considerable use of brushwood for masking their batteries.

Although, from a comparison of the two guns illustrated, it seems that the Spanish artillery was considerably handicapped, we must remember that matters were largely equalized by the fact that, being entirely on the defensive, they had the choice of position, and abundance of time to strengthen their positions before our hastily improvised emplacements could be constructed.

Electric Protection for Banks.

BY JAMES H. HOWARD.

There are several electric burglar alarm systems in use, of which perhaps the most valuable is that using a mesh of conducting wires interwoven and covered with cloth, forming a curtain with which the safe may be covered or the interior of the vault lined. The cutting of any such curtain breaks the circuit and gives the alarm. The curtain may also be constructed with two solid tinfoil sheets and an insulating medium between them, or a single tinfoil sheet and a mesh of insulated conducting wires spread over it. Any cutting of such a curtain either opens the circuit or short circuits the two sides of the system, between which a resistance should be inserted, so that either effect will make such a change in the circuit resistance that it will sound the alarm. The doors of the safe may be lined with wooden shutters carrying suitable conducting wires attached to metal points of contact, which suitably close the circuit when closed and open it when disturbed. Some curtains of this kind have been made with a tinfoil sheet and wires run in one direction across the other side of the curtain. Such a curtain can with care be cut parallel with the wires and opened out without disturbing the circuit. A more suitable arrangement is that with wires run back and forth vertically on one side and horizontally on the other side, thus crossing each other, making a mesh which cannot be cut in any direction without disturbing the circuit. These wire sheets should be mounted on the two sides of a cloth curtain, the whole covered again with cloth on both sides, painted, and again covered with thin strips of wood grooved and wired together at top and bottom to give suitable mechanical protection. The several breadths of the curtain should also be sewed together with fine insulated wires which may be put into the circuit.

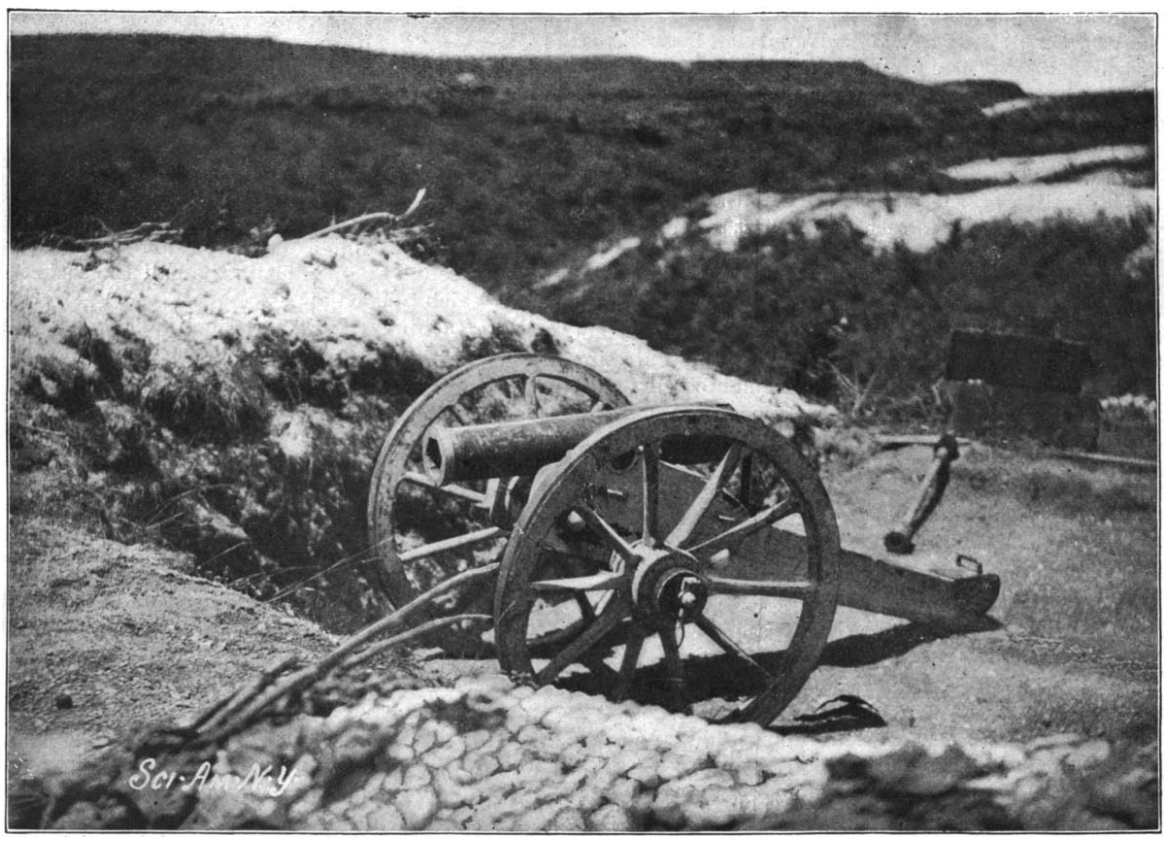
The circuits should preferably be completed by leading the two terminal wires by different routes to the alarm station. The system may be further complicated, so that burglars with a knowledge of electricity cannot tamper with it, by inserting false wires in the conduit. At the station where the alarm is to be given there should be inserted in the circuit a relay or relays to respond to either a marked increase or decrease of the current, with suitable local circuits, annunciator drops, etc., in case several points are under protection. To prevent the insertion of a resistance across the circuit equal to that between the two sides of the protecting curtain and the cutting out of the latter, which could be done gradually without giving an alarm, there may be placed in the vault a variable resistance, changed preferably by clockwork. To prevent this variation acting upon the relay, there may be placed in the same circuit at the central station another variable resistance, also acted upon by clockwork, the two being so arranged that the total resistance of the circuit remains constant. It is useless, of course, to rely on a variable resistance device at the alarm station only, as the resistance in the safe would always remain the same and there would be nothing gained.

Too much confidence is often placed in electrical devices by those who do not understand them, but think that because they are electric they must be very difficult to overcome.—Electrical World.

Efficient Signal Service in Porto Rico.

The Signal Corps of the army has already constructed about 250 miles of telegraph and telephone lines in Porto Rico, and more than half of the island is equipped with means of prompt communication.

Information received on August 11 by Gen. Greely, the Chief Signal Officer, from Lieut.-Col. James Allen is that four distinct lines radiating from Ponce have been completed, and are now in good working order.



SPANISH MUZZLE-LOADING HOWITZER USED IN THE DEFENSE OF SANTIAGO.
(From photograph taken after the surrender.)

The central office is, of course, at Ponce. The first line leads from Ponce to the east, through Guayama to Arroyo to Gen. Brooke's headquarters; the second from Ponce to Coamo to Gen. Wilson's headquarters; the third from Ponce through Adjuntas and Utuado to the advance lines of Gen. Stone; and the fourth from Ponce to Guayabila and Yauco. The lines are being extended as the army advances.

Dr. James Hall.

Dr. James Hall, the geologist and paleontologist, who has also been State Geologist of New York since 1837, died at Echo Hill, Bethlehem, N. H., on August 8. He was born at Hingham, Mass., September, 1811, and was graduated at the Rensselaer School, now the Troy Polytechnic Institute, in 1832, and remained there as Assistant Professor of Chemistry and Natural Science until 1836, when he was made Professor of Geology. On the organization of the Geological Survey of New York, in 1836, he was appointed Assistant Geologist in the second district, and he continued his connection with this scientific bureau of the State until his death.

He began his explorations in the western part of the State in 1837, and from 1838 to 1841 he published annual reports of progress. In 1843 he made his final report on the Survey of the Fourth Geological District, which was published as "Geology of New York, Part IV.," Albany, 1843. Retaining the title of the State Geologist, he was placed in charge of the paleontological work, the results of which have been embodied in "Paleontology of New York." Prof. Hall also extended his investigations west to the Rocky Mountains and his explorations served as the basis of all our knowledge of the geology of the Mississippi basin. In 1855 he was offered a position as paleontologist of the geological survey of Canada, with the promise of directorship of the survey, but he declined the offer. Prof. Hall also held the appointment of State Geologist in Iowa in 1855, and of Wisconsin in 1857. He was one of the original members of the National Academy of Sciences. In 1876 he was one of the founders of the International Congress of Geology, and opened the session at Paris in 1878, and Bologna in 1881, and Berlin in 1885. He was a member of many learned societies and received many degrees and honors. In addition to a number of important works, he published some 250 shorter papers.

Georg Ebers.

Georg Moritz Ebers, the great Egyptologist, died at Tutzing, near Munich, Germany, on August 7. He was born in Berlin, in 1837, in the same house in which lived the brothers Grimm, the great grammarians and treasurers of the wealth of Teutonic folk lore, and it is probable that to their influence the scholarly bent of young Ebers' mind is due.

After the usual course at the gymnasium, Ebers read law at the University of Göttingen. While studying, he had a dangerous illness, which unfitted him for active life, so he decided to devote himself to academic studies in the science which always attracted him, namely, Egyptology. Jacob Grimm introduced him to Lepsius. The first fruits of his study was "A Princess of Egypt," which to the general reader opened up a new world. The scholarship which Ebers displayed in his treatise on "Egypt and the Books of Moses" won the recognition of the learned, and in 1864 he was appointed to a professorship in the university. He made a short journey to Egypt, and then filled the chair of Egyptology at the University of Leipsic. He revisited Egypt in 1872. During his excavations at Thebes, he discovered a papyrus dating from the second century B. C., which is still known by the name of its discoverer. On his return to Leipsic he resumed his round of lectures, which helped to train many Egyptologists of the present day. In 1876, twelve years after the appearance of his first romance, came "Uarda;" "Homo Sum," "The Sisters," and "The Emperor" followed in quick succession. In all, sixteen historical novels have come from his pen, in addition to many treatises, fairy tales, biographies, and two great works of reference on Egpyt and Palestine. Prof. Ebers will also be gratefully remembered for his historical romances, which have done a great deal, not only to popularize Egyptian archæology, but which also interested a vast audience in the history of this strange land. Not often has the scientist and the novelist been combined in the same person in such a remarkable degree.

New Method of Preserving Meat.

A new method of preserving freshly killed meats has been discovered by the Danish zoologist August Fjelstrup, already well known through his method of condensing milk without the use of sugar. The system (according to the printed reports) has stood a remarkably hard three months' test at the Odense (Danish) Company's slaughter houses, in a very satisfactory manner.

The method in itself is extremely simple and might be of great service for the troops in the tropics (the writer having had considerable experience in trying to keep meat fresh in Cuba).

The animal to be used is first shot or stunned by a shot from a revolver (loaded with small slugs) in the forehead, in such a way as not to injure the brain proper. As the animal drops senseless, an assistant cuts down over the heart, opens a ventricle, and allows all the blood to flow out, the theory of this being that the decomposing of the blood is almost entirely responsible for the quick putrefaction of fresh meats. Immediately thereafter a briny solution (made of coarse or fine salt, more or less strong, according to length of time meat is to be kept) is injected by means of a powerful syringe through the other ventricle into the veins of the body.

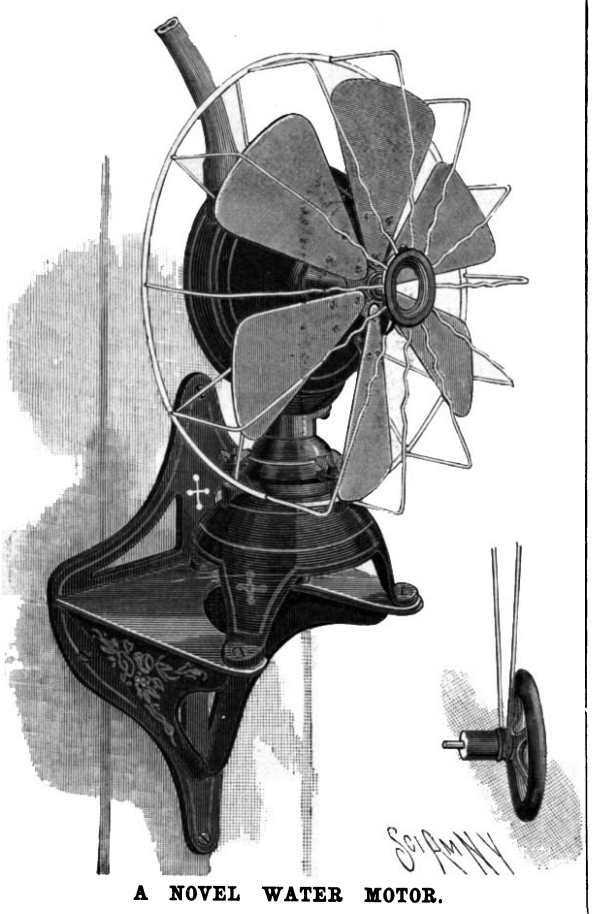
The whole process takes only a few minutes, and the beef is ready for use and can be cut up at once. This method has been examined and very favorably reported on by the general councils at Odense and Aarhaus, and also by many experts.

A NOVEL WATER MOTOR.

The possession of an electric fan-motor is extremely desirable in warm weather, but it unfortunately happens that not every building is provided with the means for obtaining the necessary current. A fan is, however, manufactured by the A. Rosenberg Company, of Baltimore, Md., which requires no electric current, but depends for its motive power wholly upon the water coming from the faucets in every house.

In its construction the motor is exceedingly simple, consisting as it does of a casing in which an impact water-wheel is located and of a spindle rigidly attached to the water-wheel and projecting from the casing. A ball and socket joint at the bottom of the casing enables the motor to be inclined in any direction, even when in motion.

The water enters at the top of the casing by means of a rubber tube having an opening in its lower end varying between $\frac{3}{32}$ inch and $\frac{5}{64}$ inch in diameter. The



A NOVEL WATER MOTOR.

resulting jet strikes the water-wheel at a tangent to the periphery, and after expending its force passes down through an opening in the ball and socket joint, after which it is led away.

By attaching a balance-wheel and pulley, the motor can be made to drive a ceiling or post fan, or a sewing machine, with water working at a pressure of 40 pounds to the square inch. With a pressure of 50 to 60 pounds, a telephone exchange generator can be driven. By attaching a guard to the casing and blades to the spindle the motor can be directly used as a fan, as shown in our illustration. The motor consumes about seven pints of water per minute.

Crystallized Calcium Metal.

Since the memorable researches of Humphry Davy on the decomposition of the alkaline earths, many methods have been suggested for preparing the metal calcium in the pure state. M. Moissan, in the current number of the Comptes Rendus, after showing that none of these yields a pure metal, describes two ways of preparing crystallized calcium containing less than one per cent of impurities. The first of the methods depends upon the property possessed by calcium of dissolving in liquid sodium at a dull red heat, and separating out in crystals on cooling. By treating the mass cautiously with absolute alcohol the sodium is removed, and the calcium is obtained in the form of brilliant white hexagonal crystals. Similar white crystals of calcium can be obtained by the electrolysis of fused calcium iodide. It is noteworthy that calcium has usually been described by previous workers as a yellow metal; doubtless owing to the presence of impurities.—Nature.

Science Notes.

A clever imitation of ivory is extensively manufactured from the fruit of a palm-like shrub called Phytelephas macrocarpa, says The Engineer (London). This fruit grows to about the size of an apple, and has a very hard, white kernel. Worked in the lathe, this ivory can be passed off as the genuine article, the resemblance being so great that it is sold at the same price. It can also be covered just like genuine ivory. To M. Pasquier, of Liége, is due a practical method of distinguishing the two varieties of ivory. It is the following: Concentrated sulphuric acid applied to vegetable ivory will cause a pink coloring to appear in about ten to twelve minutes which can be removed by washing with water. Applied on genuine ivory, this acid does not affect it in any manner.

At Nedunkeni, in the Northern Province of Ceylon, the abnormal rainfall of 31·72 inches in twenty-four hours was experienced. Nedunkeni, 11 miles down the southern road to Mullaittivu, and 122 feet above sea-level, is a small village a little to the east of the dividing ridge of North-Central Ceylon, and though itself in the catchment area of the eastern Per Aru, which flows through Tannir Murippu Tank, it is only a little to the southwest of the point where three separate drainages meet. Forest, containing a thick growth of high trees, extends over the neighborhood, and more especially for many miles from the south to the east. For about three years a rain gage has been established in the grounds of the dispensary in the village, and its records are regularly transmitted to the Public Works Office, and are published among the rainfall returns. Although the mean annual rainfall at Nedunkeni is probably little more than 50 inches, the fall for last December was 67·07 inches, and of this amount 31·72 inches were measured at 9:30 A. M. on December 16 as the rainfall of the preceding twenty-four hours. From an examination of the position of the rain gage, and the testimonies of the observers, Mr. Parker, in The Ceylon Observer, concludes that most probably the actual rainfall was in excess of the recorded amount.

H. N. Toply, of the Department of the Interior, in Ottawa, Canada, who discovered recently a method of developing negatives without the use of a dark room, has discovered that the printing of photographs is not dependent on nitrate of silver. Heretofore the nitrate has had to be used in all prints, but Mr. Toply says that the juices of certain fruits are equally as good, if not better than the nitrate, for photographic printing purposes. By means of this discovery a photograph can be printed upon anything—wood, pulp, and paper—which can absorb these juices. The juice is not used just as it comes from the fruit, but it is subjected to a process which Mr. Toply, of course, desires to keep to himself at present. He has been engaged in the development of the process for five years. His attention was first directed to the possibility of "herbaceous photography," as he calls it, by the withering of the white pine, which becomes a very dark gray under sunlight. A piece of planed pine was placed under the negative and exposed to sunlight without treatment and a permanent print on wood was obtained. Mr. Toply followed up this discovery by a series of experiments with the juices of fruits, which he found could not only turn dark gray, but would become jet black in sunlight. The process is so simple that, were it brought into general use, the price of photographs would be reduced to a minimum.

Walking along the beach on Mobile Bay, a young woman, a relative of the writer, picked up a handful of little shells, left by the tide, and among them several shells of a small marine "snail," the largest of which was probably a half-inch in diameter and the smallest some three-eighths of an inch. She dropped them into her pocket and forgot all about them until several days afterward, when an unpleasant odor in her wardrobe attracted her attention to them. On taking them out of the pocket some fell on the floor, and in recovering them she placed her foot on one. The act was followed by an explosion, quite sharp, and loud enough to be heard all over the floor on which her room is. Astonished, she concluded to try another, and the same result followed. The shells were then brought to the writer, who, on examination, found the mouth of each firmly closed by a membrane of greater or less thickness, formed by the drying of the animal slime. This had probably occurred soon after removal from the moisture of the beach, and, the little inhabitant of the shell dying, the gases of decomposition had quite filled its internal space. On exerting a little pressure by squeezing the shell between two blocks of wood quite a loud explosion was produced, the fragments of the shell being thrown several feet. Subsequently, on trying the experiment, out of a dozen shells, only two failed to explode. The conditions most favorable to success in making the experiment seem to be removal from the beach in very hot, dry weather, which causes the slime to be exuded in greater quantity than usual and dries it up rapidly as it exudes.—National Druggist.

THE COLOMÉS LIFE AND SHIP PROTECTOR.

The Navy Department showed its usual progressiveness and foresight in the readiness with which it adopted the now famous cocoa cellulose for protecting the hulls of its ships in the region of the waterline, and the cellulose plug or stopper for closing shot holes which forms the subject of this article. We were one of the first nations to see the great value of these devices, and they now form an important feature in the protective arrangements of our battleships and cruisers. An improved form of cellulose, manufactured from corn pith, has taken the place of the cocoa product in our latest vessels; but a waterline belt of one or the other of these substances, together with the cellulose stopper, are to be found upon all but the very earliest vessels; that is to say, upon all those which were designed after the new water-excluding material made its appearance.

The Navy Department always stands ready to investigate and adopt any device that will increase the efficiency of its ships, and it is largely as the result of this progressive policy, and the thoroughly efficient and up-to-date character of the ships, that the navy has more than answered every demand that has been made upon it in the present war. In addition to the devices above mentioned, we might suggest the admirable sights in use upon our guns, the range finders, improved ammunition hoists, and a thousand and one other up-to-date conveniences which only come to light during a careful inspection of the ships themselves.

The Colomés stopper illustrated on our front page is a protective device of the cellulose type. It has given good service in the present war, notably at the Santiago engagement, where one of the stoppers was used to close a shot hole made by a large shell from one of the Spanish cruisers in the bow of the battleship "Iowa." The incident is described in a letter from an eye witness on the "Iowa." After particularizing the details of the fight, the writer says: "A shell struck our starboard bow, about one foot above the waterline. It went through the coffer dam, struck a steel hatch, and burst. It started a fire, which was quickly put out. The deck was flooded, but a patent stopper was put in, and we were as good as ever."

The Colomés leak stopper, as will be seen from the engravings, possesses that *sine qua non* of all emergency apparatus: simplicity. It goes without saying that all devices for the swift prevention of disaster and the saving of life in the presence of impending peril must be at all times within easy reach, must be easily understood and capable of rapid manipulation, and must be absolutely certain in their action. It was the possession of these qualities that led to the adoption of the Colomés device by the navy. Our readers will be interested to know that before that admirable and justly popular ship the "Oregon" started on her long and perilous trip from the Pacific, she received a consignment of ten cases of stoppers (see Fig. 1), which were distributed throughout the ship in positions where they could be readily assembled for plugging waterline shot holes.

Both the cellulose and the Colomes leak stopper are French inventions. For the former we are indebted to Admiral Pallu de la Barriére, of the French navy, and the latter is named after the inventor, a Frenchman who is widely known in the French scientific world. Cellulose is prepared from the husks of the cocoanut. It is treated to remove its glutinous portions and any elements which would render it unhealthful, or offensive in odor. It has the property of absorbing water and swelling up rapidly as the result. The corn-pith cellulose is prepared from the pith of cornstalks, and it presents the same obturating qualities, though in a much greater degree, as the cocoa cellulose.

The cellulose was introduced into this country by Ostheimer Brothers, of New York and Philadelphia, who established a plant for its manufacture in the latter city. We are indebted to the courtesy of these gentlemen for assistance in the preparation of the present article on the Colomés stopper; the same firm having been responsible also for the introduction of the latter admirable device into our navy and being now engaged in its manufacture in Philadelphia. Although the Colomés apparatus is best known as an emergency repair for the round shot holes on warships, it has a wide field of usefulness in the merchant marine, where, as we shall show in this article, it is equally efficacious, when several are used together, in closing the narrow, jagged rents in a ship's hull which may be caused by collisions with other vessels or by running upon sunken rocks.

As will be seen by reference to Fig. 2, the device consists of a threaded brass rod, to one end of which a stout cross-piece of malleable iron is hinged at its center. The forward half of the cross-piece is weighted, so that when the rod is held in the horizontal position for thrusting into a hole, as in Fig. 3, the cross piece will lie horizontally, but as soon as the rod is given half a turn, the weighted end will cause the cross piece to swing into a horizontal position, at right angles to the rod, when the whole contrivance will have the appearance of a pickax, as in Fig. 1. A thin sheet of flexible spring brass is riveted to the cross piece. It is elliptical in shape, its longer axis being parallel to the threaded rod. The rest of the apparatus consists of a cylindrical canvas bag, filled with cellulose, a steel washer, slightly less in diameter than the bag, and a nut, provided with two handles for its adjustment. The stoppers are made in three sizes, the cellulose bags being 6, 9, and 13 inches in diameter respectively. They are put up complete, in sets of three, in a hinged case, as shown in Fig. 1, and in the lid of each case is a book of instructions and an illustration showing the method of inserting the stopper in a leak. The cases are placed in convenient positions throughout the ship.

In closing a hole, the operation is as follows: One of the stoppers, corresponding approximately to the size of the hole, is taken from the case, relieved of its cellulose bag, and thrust through the hole, care being taken to hold it so that the weighted end of the "pick" will cause it to lie horizontally along the threaded rod. As soon as it is thrust through the hole, it is given half a turn, when the pick with its attached brass plate falls into the vertical position. It is at once pressed closely up against the outside plating of the hull, by the inrushing water, where the brass plate serves to cover the hole and partially stop the flow of water. The cellulose pad, the steel washer, and the nut are then slipped over the inboard end of the rod, and the nut is screwed home, pressing the bag closely against the hole and effectually sealing the opening. The cellulose bag fits into all the irregularities of a jagged hole, and the powerful pressure of the nut, aided by swelling effect of the water on the cellulose, insures a remarkably tight closing of the hole. For ordinary cases, the hand nut can be used; but when the framing of the ship interferes with this, as shown in Fig. 4, the nut is screwed home by a wrench which is provided with each case.

For the closure of ordinary shot holes, a single stopper proves sufficient; but in cases of collision, such as occur in the merchant marine, it more often than not happens that the hole is long and narrow. This is often the case in the slighter collisions (see Fig. 4), when the plating may be torn by a sharp projecting point of rock, or cleanly cut by the stem of another vessel that is moving slowly at the moment of collision.

Such holes may be readily closed by using several stoppers side by side, as shown in Fig. 5, which represents an experiment carried out by a board of French naval officers at Toulon. The hole was rough and jagged at the edges and lay 4 feet 8 inches below the surface of the water. It was plugged by two No. 3 stoppers with one No. 2 stopper between them, and the inflow of water was arrested in 120 seconds. Other tests by the same board gave the following results: A 2½-inch hole was stopped in 10 seconds, and the flow completely arrested in 30 seconds; a 4-inch hole, 6 feet below the surface, was completely stopped in 25 seconds; and a 7½-inch hole, also under a 6-foot head, was completely closed in 35 seconds.

As may be readily seen from the large engraving on the front page, when the stopper is once in place, securely clamped to the shell plating of the vessel, it cannot be displaced and may be trusted to do its work until the ship has been brought safely into port. Moreover, special value attaches to the system on account of its extreme simplicity, any ordinary seaman being competent to insert the stopper. This fact we consider to be of the highest importance. There is no necessity to send for the expert mechanic.

It is this simplicity, coupled with its small bulk and ease of stowage, that renders the device specially adapted for use in the merchant marine, where it promises to find a field of usefulness as broad or broader than it now occupies in the navy.

Finding the Stars.

A correspondent in St. Louis, who has a two-inch telescope mounted on a tripod stand, writes for information as to how he can find the place of a star with such an instrument when the place is expressed by hours of right ascension and degrees of declination north or south. He also asks what is meant by right ascension and what is the meridian.

In order that a star may be found by means of its right ascension and declination as given in a star catalogue, the telescope should be provided with an equatorial mounting having graduated circles. Without such a mounting the best method of finding a star whose place is given in right ascension and declination is with the aid of a chart of the stars (such, for instance, as Klein's Star Atlas), whereon the position of the object sought can be noted with reference to other conspicuous stars.

Suppose, for instance, that the observer wishes to find a double star, or a telescopic comet, by means of its right ascension and declination. Taking his atlas, he will see along its upper and lower margin the hours and minutes of right ascension indicated. Correspondingly, on the right and left hand margins of the chart he will see indicated the degrees of declination north or south of the equator. With the aid of these indications let him, with a pencil, mark the place which the object he is seeking should occupy upon the chart. If it is a double star, more than likely it will be found there already. In any case, having thus ascertained its position with reference to the bright stars in its neighborhood, he can then turn to the heavens, find those stars, and recognize the particular object he is seeking from its situation with reference to the others.

All this, of course, requires more or less familiarity with the constellations, a kind of knowledge that is not as widespread as it should be, but which is not very difficult to acquire.

By the meridian is meant an imaginary line drawn from the north to the south point, or through the poles of the heavens, and passing directly overhead. Every place on the earth has its own meridian, and the sun is said to be on the meridian at the instant of true noon. Similarly, a star is on the meridian when it is directly north or south, or somewhere on the imaginary line running through the sky from north to south, and passing by the point directly overhead, which is called the zenith.

By right ascension is meant the distance of a star or other celestial object east from a particular meridian of the heavens which has no reference to any special spot on the earth, and which crosses the celestial equator at a point among the stars known to astronomers as the first point of Aries. Right ascension is measured by hours and minutes. There are twenty-four hours in the entire circuit of the sky. Consequently, an object which is precisely at the first point of Aries may be said to be in right ascension 0 hours, or right ascension 24 hours, according as we think of the beginning or the end of the circle. An object diametrically opposite to this would be in right ascension 12 hours. One hour of right ascension is equivalent to 15 degrees.

GARRETT P. SERVISS.

Physical Training in Public Schools.

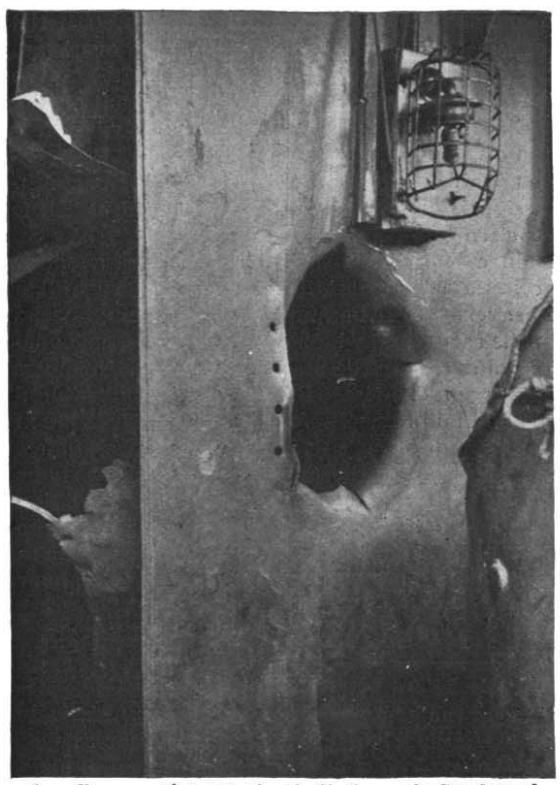
The care of the body has been, up to comparatively recent years, strangely neglected in the public schools of this country. It has been considered a quite sufficient educational training for the young to cram and overload their brains with a quantity of matter difficult to digest, and in too many instances even when assimilated of little use in after life. Numbers of delicate, highly strung children have broken down under the strain, and the dreary daily grind of the monotonous cramming system, undergone in unhealthy surroundings, has developed many of the nervous diseases to which the present generation is so peculiarly susceptible. What does knowledge profit a man, if in the gaining of it he loses the still more precious gift of good health? The nations of the old world, notably Greece and Rome, understood and appreciated much more clearly than do the people of these times the harmfulness of unduly forcing the mind to the lasting hurt of the body. The gymnasiums of ancient Greece probably reached, in their methods of training the young, a higher ideal than have any of the educational systems now in vogue. In the face of this condition of affairs, it is pleasing to note that the people of America are rapidly becoming alive to the pernicious effects of developing the mind at the expense of the body. The more rational mode of educating the young would appear to be that of so training the body and mind that both advance as far as possible at an equal rate. Thus, if a child is of weak constitution but possessed of unusual mental capacity, it should be the aim of his teacher to strengthen his physical powers, and until that object is accomplished to let the mind take care of itself; on the other hand, if the reverse is the case, to adopt contrary methods. The individuals should be studied separately, and children should not be lumped together in a body and put through the same course without regard to their different temperaments, dispositions, and constitutions. It is now about ten years since German gymnastics were introduced into public schools of this country. Since then physical training has held a place in the curriculum of almost all the large cities of the East. The report of the director of physical training in public schools of Washington has lately been published. According to this report, the beneficial results of systematic daily exercise have been marked; but, as the writer of the paper truly remarks, "It is impossible to test the full measure of success or failure of our efforts. It is in the remote future, with school days long past, that the lasting influence of such work will be felt by the individual child." However, one thing seems certain, viz., that the introduction of physical training into the public schools of America is a step in the right direction, and, if intelligently carried out, should result in producing a stronger race mentally and physically. The fact should not be forgotten, though, that physical training may be abused. Gymnastics should not be permitted to take the place of play, but rather the two should go hand in hand.—Medical Record.

A CURIOUS disparity is evident in the authoritative estimation of the heat of the sun. Pouillet places it at 1,400° to 1,800° Celsius (Centigrade), Ste. Claire-Deville at 2,800° Lord Kelvin and Professor Langley at 8,000°, Sir Robert Ball at 18,000°, Sporer at 3,700°, and Pater Leodie at 10,000,000°.—Technische Berichte.

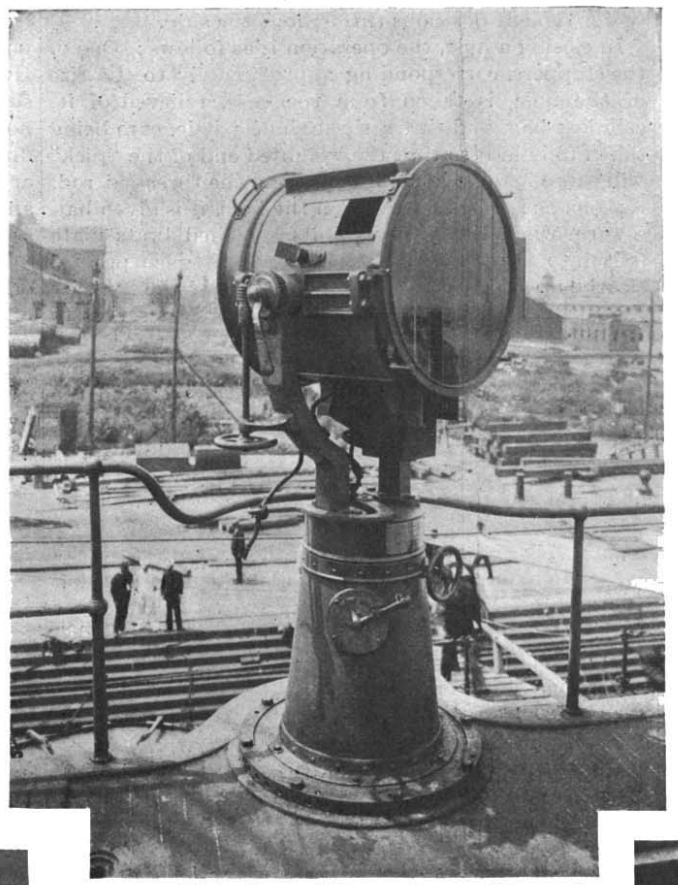
THE "TEXAS" IN ACTION.

The second-class battleship "Texas" as she rests in dry dock at the Brooklyn navy yard is a once maligned but now fully vindicated vessel.

There is, perhaps, no ship in our navy that has been more in the public eye since the day of her launch than the "Texas," and no ship, surely, ever experienced such a continuous run of bad luck as this unfortunate and greatly underrated ship. From the very hour of her conception she has been clouded by the disfavor which descends upon a vessel whose plans are of foreign origin (as were those of many of the earlier ships of the navy), and to this popular dislike has been added the distrust which is born of a frequent succession of accidents. Although she was authorized in 1886, the ship was not laid down until 1889. The work of construction, undertaken at the Norfolk navy yard, was very slow, the launch not taking place until 1892, and she was not commissioned until August 15, 1895, or nine years after the ship had been authorized by Congress. Her plans were drawn up by William John, an English naval architect of considerable reputation, and they were selected by the Navy Department from several designs which had been offered in competition. The delay in commencing construction was due to a lively discussion which ensued as to the merit of the accepted plans, and there is no doubt that the sub-

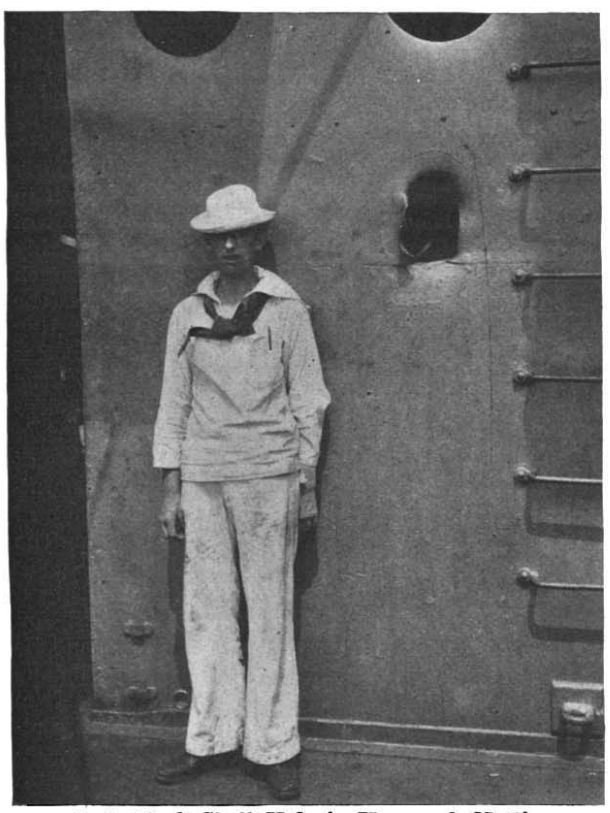


1.—Course of 5·5-inch Shell through Starboard Hammock Butting.

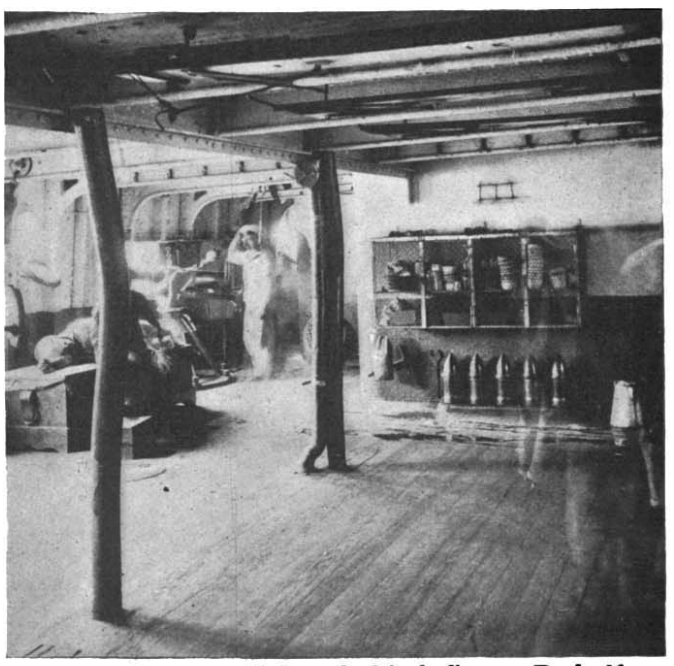


2.—Searchlight from "Vizcaya" now Mounted on "Texas."

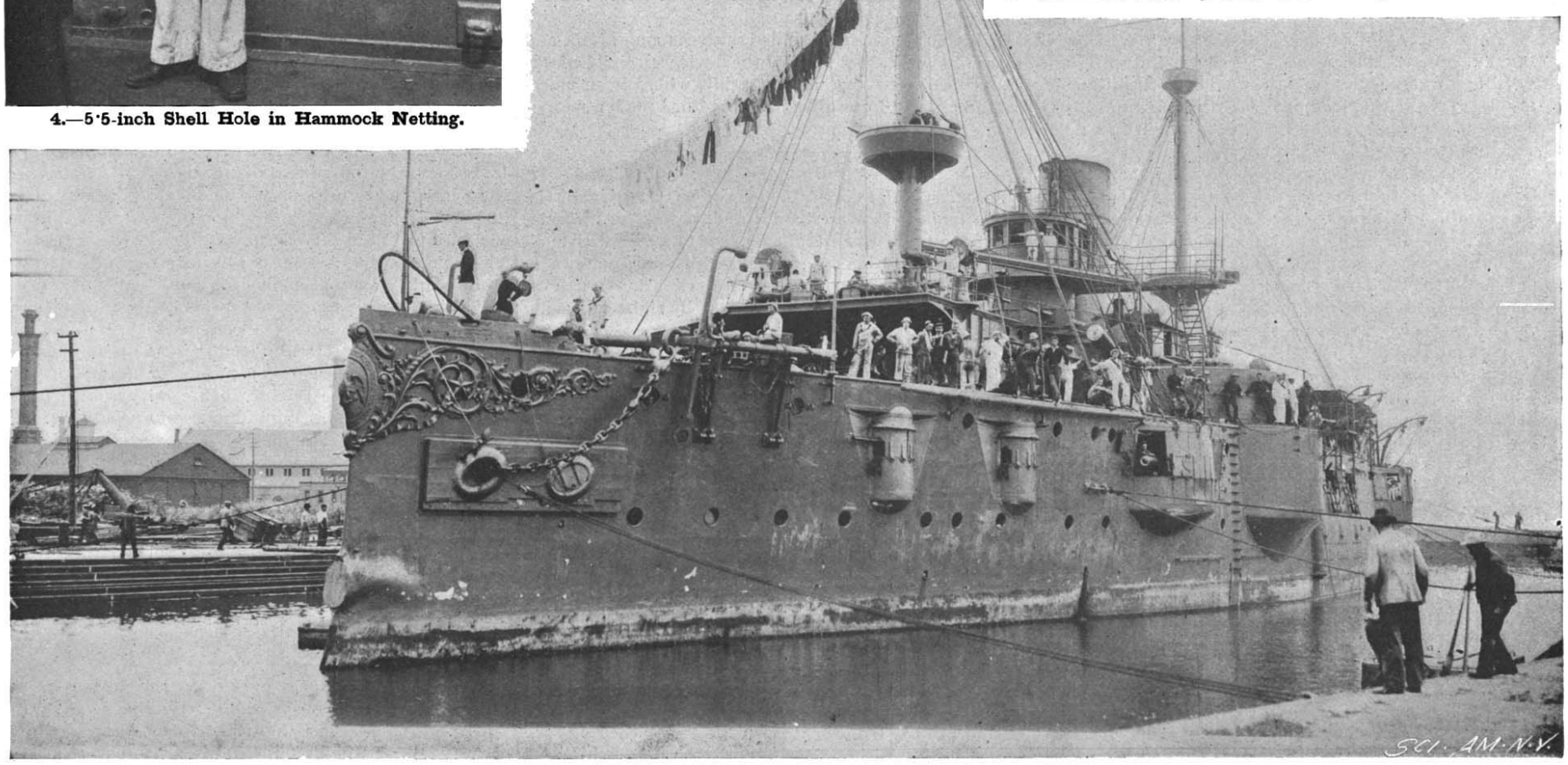
3.—Hole Made by 6-inch Shell in Port Bow on Gun Deck.



4.—5·5-inch Shell Hole in Hammock Netting.



5.—Stanchions Bent by Blast of 12-inch Gun on Deck Above.



6.—"Texas" in Dry Dock for Repairs after Santiago Engagement.

THE "TEXAS" IN ACTION.

sequent popular distrust of the ship was largely due to these hostile criticisms on the part of both official and amateur experts.

The career of the "Texas" was marked by reverses more than ordinarily fall to the lot of the warship in times of peace. She had accidents alow and aloft, from within and from without, at sea and in dock, and climaxed her performance by incontinently foundering one night as she lay at her moorings at the Brooklyn navy yard. On the face of it these mishaps seemed to justify the bad name which was given the ship at the time of her construction. As a matter of fact, however, they were all traceable to carelessness or unpreventable causes outside of the ship itself, and, in the opinion of the various officers who had tested the good qualities of the "Texas," were no reflection upon either her construction or her seagoing qualities.

Vindication, however, came at last, and the various engagements of the Spanish war have proved that the "Texas" is as stout a ship as any in the United States navy, and that she has qualities in which she is the best vessel of her class that we possess. Among the latter we may mention her steadiness as a gun platform—an invaluable quality in a battleship, and one to which no doubt the excellent gunnery displayed by this vessel in the war was largely due.

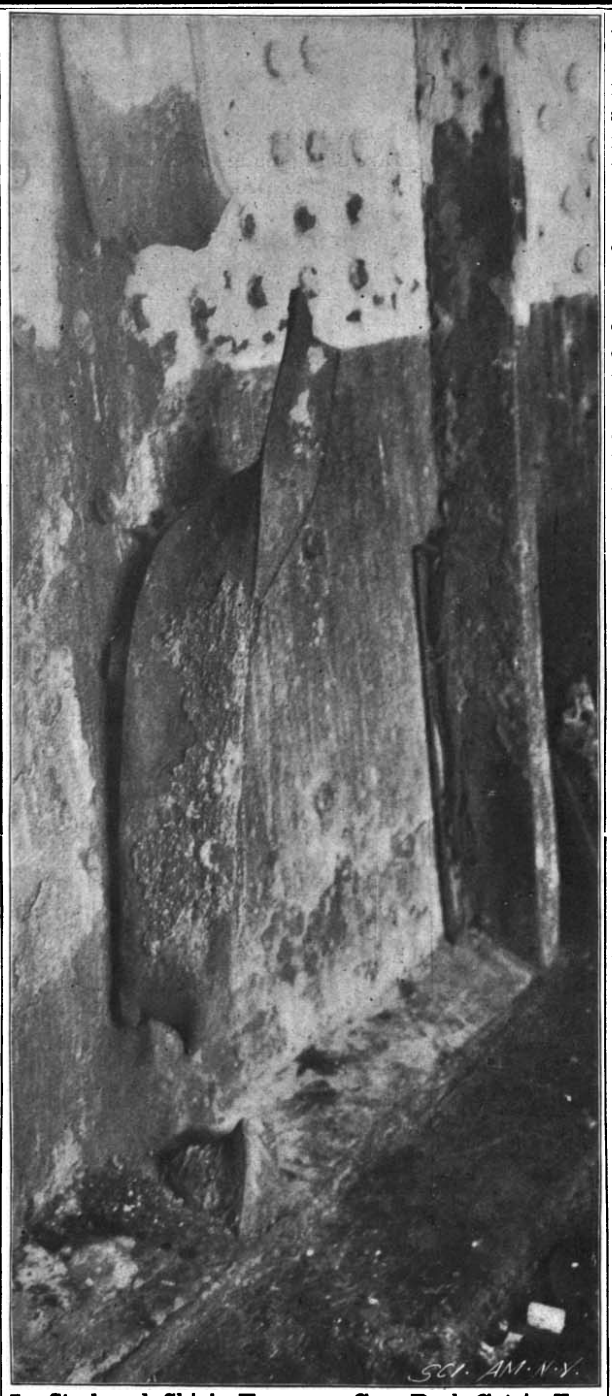
In the various regular and special publications of the SCIENTIFIC AMERICAN our readers have been made familiar with the offensive and defensive material with which a warship is armed and protected. In the present article we are enabled, by the courtesy of Capt. Philip, to present a series of views of the actual destruction wrought by Spanish shells on the hull of a modern warship. Cuts 1 and 7 illustrate the destructive effects of a 6-inch shell fired from La Socapa battery, and the rents shown in Cuts 1 and 4 were made by a 5·5-inch shell, which landed during the running fight at Santiago.

The 6-inch shell came aboard at the close of a duel which took place between the "Texas" and La Socapa battery, which is located at the western side of the entrance to Santiago Harbor. It was the last shot fired by the battery and the only one that reached the ship. The shell entered the port side at a point just below the lower end of the anchor stock (see Cut 6), where the plating is 1¼ inches thick, and tore a jagged circular hole, an inside view of which is shown in Cut 3. It passed diagonally through the compartment and struck a heavy steel stanchion, cutting a piece a foot in length entirely out of it. The shell burst at this point and two of the larger fragments struck the starboard side, bulging the stout plating to the depth of several inches. The fragments swept along the side of the ship and cut entirely through one of the heavy channel irons (massive as a railroad rail) which form the framing of the ship. This effect is shown in Fig. 7. In addition to these larger pieces, the shell burst into a shower of lesser fragments, which landed all over the starboard side of the compartment, cutting off rivet heads, scoring the deck and plating, and wounding the crew.

The fatalities and execution among the crew in this compartment, caused by a single shell, enable us to form a vivid idea of the havoc that would be wrought on unprotected gun positions by a well directed fire in which shells were searching the ship through and through. A man who was standing behind the stanchion, in the path of the shell, was literally blown to pieces, and the flying fragments wounded eight other men, one gunner being struck no fewer than fifteen times. The dense smoke produced by the explosion added to the confusion, and for some minutes the whole battery of four 6-pounder guns was practically out of action. The smoke poured down the ammunition hoists and rolled in dense volumes into the forward compartments of the ship, giving the impression that a fire must have been started.

If this much confusion and destruction can be wrought by a single 6-inch shell, weighing 100 pounds, what, one asks, would be the effect of a 13-inch projectile, weighing over half a ton? Moreover, this was a common shell, filled with brown powder. A shell filled with high explosive would be vastly more destructive, and one sickens at the thought of such diabolical missiles bursting in the thickly crowded between-decks of a modern ship. Nothing but the very highest courage, backed up by perfect discipline, would save a ship's company from panic under such scenes of horror as would ensue.

The damage shown in Figs. 1 and 4 represents only a part of the rending effect of a 5·5-inch shell which struck the "Texas" in the amidship hammock netting during the Santiago fight. The hammock netting forms part of the deck structure which surrounds the smokestack. The shell struck the ship on the starboard side, the first point of contact being at the point shown in Fig. 4. It passed through the steel plating and apparently turned partly over, passing through the next obstruction (the hammock butting, Fig. 1) apparently sidewise, or on end, if we may judge from the shape of the hole. It next struck a heavy steel door, tearing off the upper half of it, and burst in the adjoining ash-hoist. The fragments passed on through another (the fourth) wall of steel plating and tore their way into the smokestack. The larger fragments passed entirely through the stack, and the others, rebounding from the further side of the stack, fell in a shower down the uptake.



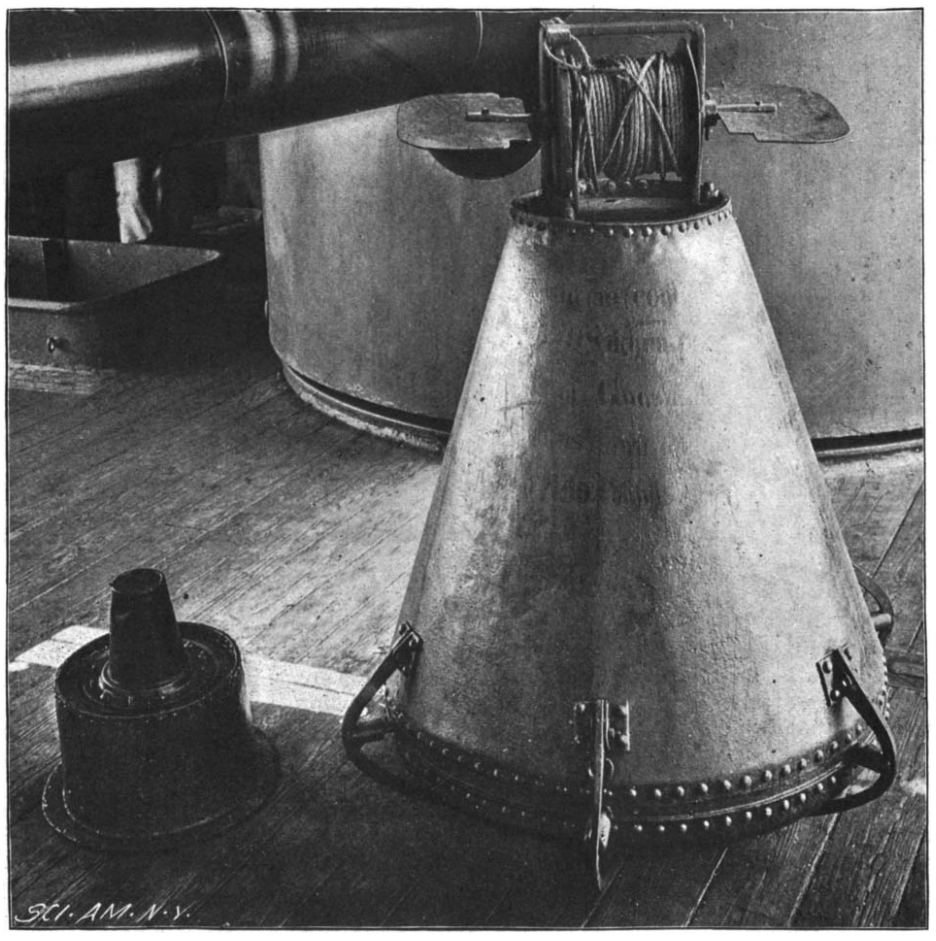
7.—Starboard Ship's Frame on Gun Deck Cut in Two Places by Fragments of 6-inch Shell.

The shock and explosion drove the smoke and fire of the furnaces into the boiler room and caused an enormous cloud of smoke and ashes to ascend from the "Texas." As this occurred early in the action, when the "Texas" was hotly engaged with the leading Spanish ships, it caused much anxiety throughout the fleet lest she had been badly crippled. As it was, not a man was hurt by this shell.

Next to the Spanish shells, the chief damage to the ship came from the blast of her own 12-inch guns. There are two of these, one forward of amidships, sponsoned out on the port beam and the other somewhat aft of amidships on the starboard beam. There are no deck structures abreast of these guns that would interfere with their fire athwartships; so that it is possible to fire the port gun across the deck to starboard and the starboard gun similarly to port. During the action the port gun was swung over and fired at the Spanish fleet. The terrific blast of the gases forced down the main deck, twisting the deck beams, and forcing the heavy stanchions out of line, as shown in Fig. 5. At the same time the rush of gas, aided by grains of unburnt powder, splintered the wood deck and cut deep scores in the planking.

The gravest peril through which the "Texas" passed is commemorated by a 100-pound Spanish mine which now stands, bereft of its guncotton charge, on her quarter deck. The following inscription painted around the shell tells the story: "Spanish submarine mine, broken adrift by the 'Texas' June 15, 1898, when passing through a narrow channel to destroy forts at Guantanamo, Cuba. Providentially, it did not explode. Fourteen of these mines were afterward recovered from this channel. Each contained about 100 pounds of guncotton." That was a close call for the "Texas," and if a material cause for her escape is sought, it is found in the fact that barnacles had grown over the contact fingers, clearly seen in the illustration, and prevented the plungers from closing and striking the fulminate within the case.

The admirable work done by the "Texas" in the battle of Santiago has received ample credit, both official and otherwise. Her shooting, both from the 12 and 6-inch guns and from her 6-pounders, was very effective, and she contributed as much as any other ship to the early disablement of three of the Spanish cruisers and the two destroyers. There is reason to believe that the few large shells of 12 inch caliber that reached the Spanish vessels were fired by this ship. The rapidity of fire of the 12-inch guns is due to the improvements made in them by Lieutenant Haeseler. Originally they were capable of being fired only once in 7½ minutes—a woefully slow rate—but since the improvements they have been fired at an interval of 1 minute 29 seconds between rounds. In the old system the gun could only be loaded in two positions, and it had to be rotated back to these positions to receive the shells. Lieutenant Haeseler placed a circular track on the top of the turret redoubt and designed a little trolley for carrying the projectile around from the ammunition hoist to the breech of the gun, wherever the breech might happen to be. By the new arrangement it is not necessary to take the gun off the target for loading.



8.—100-pound, Contact, Buoyant Mine, Cut Adrift by Propeller of U. S. S. "Texas" in Guantanamo Harbor.

THE "TEXAS" IN ACTION.

The 12-inch guns were in charge of Lieuts. Haeseler and Bristol, and to the latter gentleman we are indebted for some interesting facts regarding the battle. He informs us that the smoke of battle was so dense as to render it impossible at times for the contestants to locate each other. The light breeze that prevailed carried the Spanish smoke (only the "Colon" used smokeless powder) in huge volumes toward the American ships, and the smoke of our own ships was caught by the breeze and rolled back upon them. It is also interesting to learn that the sinking of the two destroyers was accomplished by the concentrated fire of four battleships and the converted yacht "Gloucester." As soon as the destroyers appeared, the ships instinctively turned loose upon them—some with all guns. As seen by Lieutenant Bristol, from his 12-inch gun station, the concentration of fire was as follows: "Indiana," 20 guns, including her 13-

inch, at 4,000 yards; the "Iowa," 14 guns, at 2,500 yards; the "Texas," 13 guns, at 2,700 yards; and the "Oregon," 12 guns, at about the same range. The "Gloucester" was using five light rapid-fire guns. All of these, except the 13-inch guns of the "Indiana," were rapid-fire weapons, and the sea was being churned into a mass of foam about the doomed vessels. This being the case, it is certain that the value of the destroyer is not determined one way or the other by their destruction in the Santiago fight.

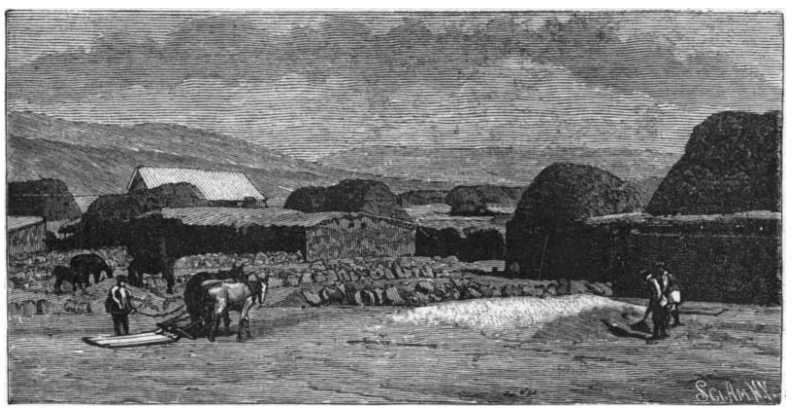
Chained Libraries.

In a paper on the "Libraries of the Middle Ages," recently read by Mr. T. G. Jackson before the Royal Institute of British Architects, the lecturer said that buildings specially to hold their libraries were first erected by the universities and colleges. The oldest structure of the kind in England, perhaps in Europe, is the old library of the University of Oxford, which still retains many features of its original form. This structure, rarely seen by visitors and even unknown to the majority of Oxford men, is a two-storied building situated on the north side of the choir of St. Mary's Church, adjoining the tower at one end, and separated from the body of the church by a narrow courtyard. Having glanced at the way books were kept, used, and lent at Oxford prior to the erection of this building, the lecturer gave a sketch of its foundation by Cobham, Bishop of Worcester, about 1320, and some incidents in its early history, following with a description of the interior, furniture, and general arrangements. Long desks were placed at regular intervals at right angles to the walls, on which the volumes lay on their sides. A bench was fixed in front for the reader, and a window came between each pair of desks to light that pew or cell. Every volume had a metal clip riveted to the front edge of the board forming one cover, to which was attached a light iron chain of the requisite length, having at the other end a ring. This ring ran upon an iron rod which was carried along the top of the desk, and was secured at the end by a hasp and a padlock to prevent the ring being drawn off. The foundation of Bishop Cobham's library was succeeded shortly afterward by that of the library of Durham College, Oxford, by Richard de Bury, Bishop of Durham (1335–45). The books bequeathed by De Bury to the college were kept for many years in chests, under the custody of scholars deputed for the purpose. At the beginning of the fifteenth century a library was built, and regularly furnished with bookcases or settles inclosing pews or studies between them where the books were chained. When Durham College came to an end at the Dissolution, its old buildings were utilized by its successor, the present Trinity, and the old library of Durham College still serves as the library of Trinity College. William of Wykeham's New College at Oxford set the fashion for all future collegiate buildings at either university in provision being made for every department, and thenceforward every college had its library as an essential part of its plan. Though books were few, the rooms devoted to them had to be very large, the chaining of the books to the desks making it possible to have only very few on each desk. Soon, as books increased, shelves were formed behind the desks, tier by tier, until at last, in the seventeenth or eighteenth century, they reached the ceiling. The appearance of the fittings before that time could be well seen in the old library of Merton College. Of chained libraries there were at least three extant in England, that belonging to Hereford Cathedral being the most ancient and perfect. Old chains, hasps, and staples belonging to Hereford — specimens of the actual fittings of a medieval chained library — were exhibited by Mr. Jackson, and the method of fixation explained. All Saints Church, Hereford, and Wimborne Minster also possess chained libraries. But the finest in the world is that of San Lorenzo, Florence, the great hall of which was designed by Michael Angelo in 1524, to contain the collection formed by several generations of the Medici. The lecturer then touched on the difficulties of consulting books in the old chained libraries. Shelves for the ever-increasing number of books had been provided, but desk accommodation remained as before. One student occupied on a volume prevented three or four others getting access to the books. This led to the library rooms being enlarged. Chains were bought for the Bodleian Library as late as 1751; it was not till 1757 that this method of securing the books was abolished.

Bog Iron Ore in Canada.

Bog iron ore is worked in the province of Quebec, and arrangements are being made to extract manganese from bog ore deposits in the province of New Brunswick. The ore is a soft, wet stuff, containing 50 per cent of water, and is covered by a thin coating of vegetable earth. The depth of ore varies from 5 feet to 30 feet. When dried the residuum is a fine black powder, too fine to be treated in the blast furnace, and this has therefore to be made into briquettes, as is done with the fine dust from blast furnaces and the finely divided iron produced from low grade ores by the Edison electrical process. The cementing material used is kept secret. An analysis of the dried ore at 212° F. is given as follows:

Metallic manganese	48·240 per cent.
Metallic iron	5·700 "
Sulphur	0·096 "
Phosphorus, trace.	
Silica	1·88 "



THRASHING AND WINNOWING GRAIN AT JELENOVKA, RUSSIAN ARMENIA.

A Flemish "Smoker."

According to L'Illustration, the nineteenth century citizens of Bruges amuse themselves much after the fashion of the contemporaries of Van Maerlant and Van Artevelde, those great drinkers and smokers of the thirteenth and fourteenth centuries. In this quaint old Flemish city there exists the "Brugsche Rookersclub" or Smoking Club of Bruges, the members of which assemble to enjoy one another's society, to smoke their long clay pipes, and to drink their flagons of beer.

Every evening, it seems, the Rookersclub has a smoking contest, each member endeavoring to consume not the greatest quantity of tobacco in a given time, but to smoke the least quantity in the longest possible time. Before the contest begins, the vice-president and steward of the club seat themselves before a table on which are placed a balance, a tobacco box, and a number of long-stemmed pipes, not forgetting sundry indispensable tankards. The steward carefully weighs out two grammes and a half of tobacco, and methodically the vice-president stuffs each pipe with its allotted quantity. The pipes are then distributed among the contesting members. At a given signal, each contestant lights his pipe and begins to smoke, very slowly and very deliberately, endeavoring to keep alive the fire in his bowl as long as possible and to consume the smallest possible amount of tobacco. A member whose pipe goes out drops out from the contest, and only his more fortunate or more skillful rivals are allowed to continue. When pipe after pipe goes out, or the tobacco is consumed, the contest becomes more and more interesting; and when only two contestants are left, the most intense excitement is aroused.

So expert have the members of the Rookersclub become, that they have been known to keep alive the flame in three grammes of tobacco for a period of an hour and a half.

W. B. K.

A BREAD BAKERY IN RUSSIAN ARMENIA.

PRIMITIVE METHODS OF RAISING WHEAT AND BAKING BREAD IN TRANSCAUCASIA AND ARMENIA.

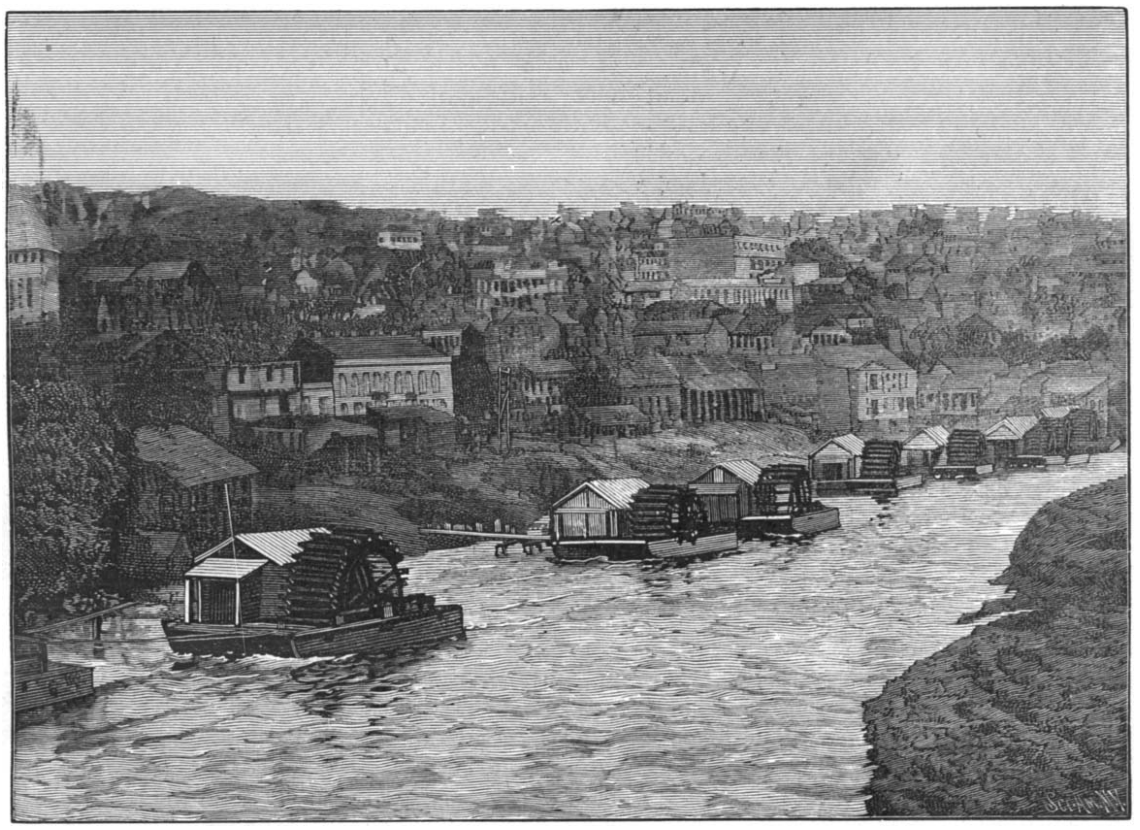
BY E. O. HOVEY.

As soon as the average traveler passes from European Russia over the Caucasus Mountains into the provinces of Georgia and Armenia, which have been parts of the Russian empire for only a comparatively short time, he feels that he has entered a strange part of the world, the manners and customs are so different from those which prevail in western Europe and America. Nowhere is this more clearly brought out than in the methods pertaining to agriculture and bread making. The farmer still uses the implements which his ancestors used and he handles them in the same manner. In the spring the ground is scratched up by means of a clumsy wooden plow drawn by buffaloes or oxen, very rarely by horses, and the grain is scattered over it by hand. The writer was in Transcaucasia and Russian Armenia during the harvest season last year, and had the opportunity of making the photographs accompanying this article, which illustrate the methods of thrashing and drying grain. At the little hamlet of Parakai, near Erivan, the capital of Russian Armenia, we saw the wheat spread out two or three feet deep over a small area of specially prepared ground. Cattle, both oxen and buffaloes, were driven around and around on the grain until the kernels were all broken out of the heads. The biblical injunction is not obeyed here, for the photograph shows that the driver has "muzzled the ox which is treading out the grain."

A more common manner of thrashing is that shown in the picture from Jélénovka, on the shores of beautiful Lake Goktchai. Here there was a very large thrashing floor and an instrument like one of our stone sledges was dragged about over the grain by means of a team of horses. The bottom of the sledge was armed with numerous small pieces of rock, set so as to present a sharp edge for the cutting and mangling of the grain heads and straw as the sledge was driven about. The use of horses for this work, however, is not common, buffaloes and oxen being much more often employed. When the grain has been broken out of the heads, the straw is shaken up with two-tined wooden forks to permit the kernels to fall to the ground. Then the straw is removed, to be mixed with cow dung and dried to form the national fuel, and the winnowing process begins. A day with a gentle breeze is chosen, and the grain and chaff are thrown up into the air by means of long-handled wooden paddles. The wind blows away the chaff, while the wheat falls back to the ground. In Sémenovka, as is shown in our engraving, we saw the grain spread out on skins kept for the purpose, where it is stirred and turned until it is well dried. There seem to be no steam engines in Armenia and windmills are unknown, but the scanty water power is well utilized for the grinding of the grain, and there are numerous mills at Tiflis, Erivan, and elsewhere. Those at Tiflis are an interesting feature of the view from the principal bridge over the swift Koorà. They are worked by means of great undershot wheels, and the whole mill is moored out in the stream at the best place for getting the full effect of the current with safety.

The baking of the bread furnishes another point of wide difference from the methods in use in America. The oven is usually (at least outside of the cities) a hole in the ground three or four feet deep and as many in diameter, narrowing toward the opening in the top. It is lined with pottery or even with nothing but hardened clay, and a wood or charcoal fire is built in the bottom to heat it. The dough is mixed in a trough, formed then into balls with the hands and afterward rolled out on a circular or oval stone or board, until it becomes a sheet about three feet long, fifteen inches wide, and one-eighth of an inch thick. This sheet is carefully spread out over a form like a pillow of the proper shape. The pillow is dexterously seized underneath by the baker, who then bends down into the oven and spats the dough against the wall,

where it sticks and is baked in a very few minutes. The sheet is then pulled out by means of a hook and is hung on the wall of the shop to cool and dry. At several places in the city of Erivan these thin sheets are baked on beds of hot pebbles. This literally "whole wheat" bread contains no salt and resembles pieces of brown paper in appearance, but it tastes better than it looks and is inexpensive, the price in Erivan being only six kopecks (about 3 cents) per kilo (2⅛ pounds). The customer receives it without wrapping paper and carries it off in a roll under his arm or in his hand. Another form of loaf is put into the same kind of an oven as a cake, ten or twelve inches in diameter and two inches thick in the middle. This comes out as a curiously distorted affair, on account of the sagging which takes place before the loaf gets hard and which thickens one side while it thins the other, making it look somewhat like a lady's hand bag. The foreigner will prefer to eat this or any other kind of bread without butter, because that which is indigenous to the country has been churned in a goat skin with the hair turned in, and is anything but attractive in appearance or odor. A peculiar substitute for butter is the cream from buffalo milk. This, too, would never find favor in western eyes, because it is too much like tallow in appearance and consistency.



GRIST MILLS IN THE KOORA RIVER AT TIFLIS, TRANSCAUCASIA.

Mail Service "Mysteries."

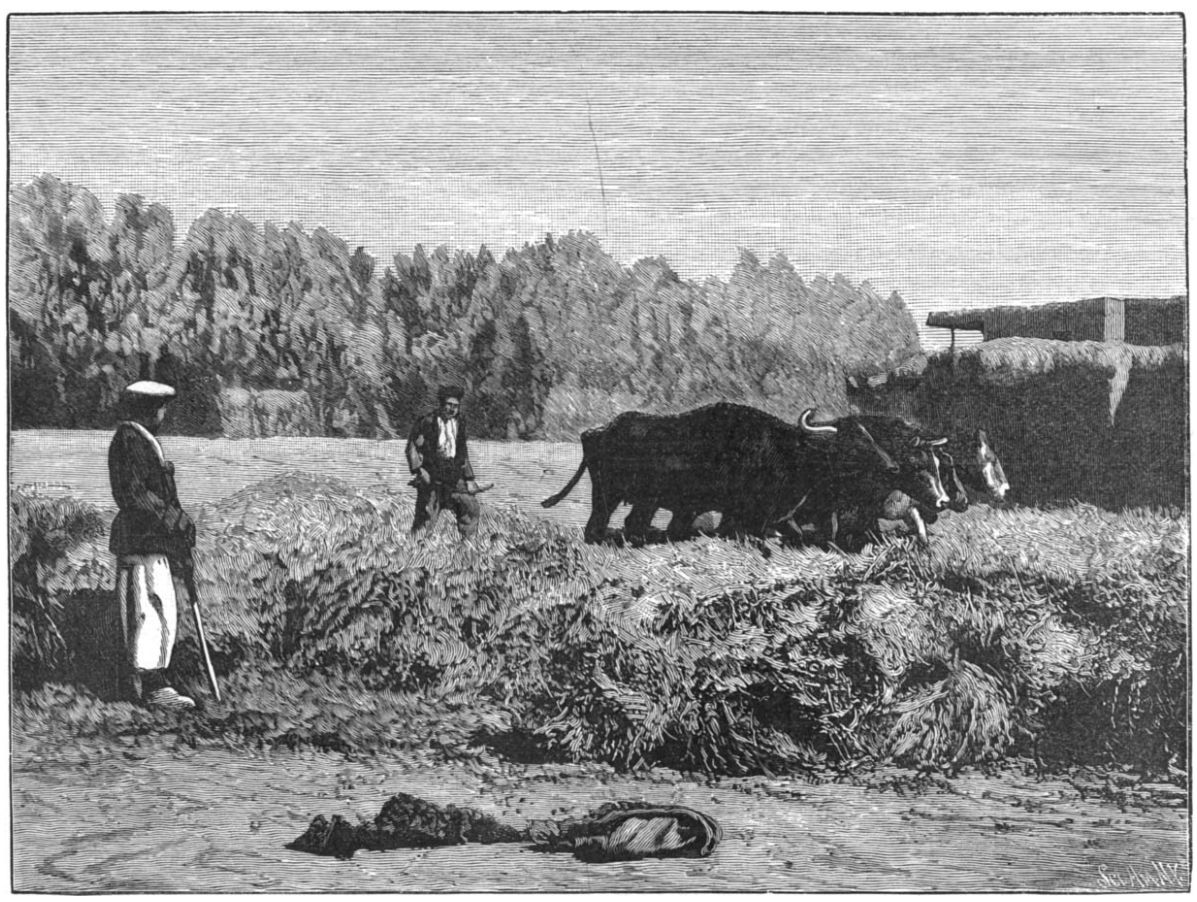
Less care is used by the people in America than by those in European countries in the preparation of mail matter, and as a result the United States government is losing money, while foreign governments get paid for service they do not perform, says The Boston Transcript. Short-paid matter in large quantities is sent abroad every week, and when it arrives at the point of delivery it is rated up to double the deficiency. About two hundred souvenir postal cards, for instance, addressed to people in Germany, were mailed recently, and there was only a two-cent stamp on each card. If they were regular government cards, they would go for two cents each, but since they are printed by a private concern and are written upon, the postage is five cents, the same as for a letter. Had the sender been known to the post office men, he would have been notified, but in this case each card had to be stamped with a "T" to indicate that postage was not fully paid, and then forwarded, because the sender, a Cambridge person, had signed his initials only, and could therefore not be found. When these cards arrived in Germany the equivalent for six cents, just double the deficiency, will be collected for each card. Thus the German government will receive three cents on each card for nothing.

This kind of mail is a good deal larger than is generally supposed, as is shown by the fact that $100 may be collected at the Boston office on one single mail from Europe, and the United States sends about fifty times as much as it receives. Most of the unpaid or short-paid matter comes from Armenia and Turkey, although England and Ireland contribute a fair portion of it. Just before St. Patrick's Day the mails are flooded with packages of shamrocks from Ireland, picked and mailed by people who know little about the postal regulations, and who frequently neglect to find out how much postage is required. Anxious to have the precious twigs well preserved, they even sprinkle them with water before wrapping them up, which not merely increases the weight at the time of mailing, but also serves to spoil the wrappers. Christmas time and Easter, when friends interchange gifts, are equally profitable in this respect; but the United States does not collect as much on foreign mail as the foreign governments collect on United States mail.

There is such a wide difference in the amount collected by the various nations that years ago it led to negotiations for new regulations, resulting in the adoption in this country of the "due stamp," and now each government keeps the money it collects for due postage. Those due stamps serve, in reality, merely to show how much is collected, as they are put on and canceled in the post office, and no person connected with the service can by honorable means obtain one that has not been canceled. In spite of the law, such stamps have come into circulation, probably through burglars who have broken into post offices or through dishonest postmasters; but it matters little to a private citizen how he has obtained such a stamp, whether he has paid for it or not, for the stamp is not acceptable as postage. If an attempt were made to use it, post office inspectors would be at once put on the trail of the offender. It is a matter of principle with some individuals to refuse underpaid matter, says one who is in a position where he sees refused letters when they return. A letter may be sent to some foreign country without any postage on it; the addressee may refuse it, and in that case it must be returned to the sender, who has to pay double rate for it if he accepts it; but he, too, may refuse it, and then its final destination will be the Dead Letter Office, in Washington, if the letter originated in the United States. The United States gets nothing for all this trouble. Occasionally there appears a postal card that is evidently traveling around the world to gather postmarks for its sender. But the United States proposes not to be imposed on to that extent when it can help it, and if it sees the scheme it will put on a mark that ends the postal card's mission.

Counterfeit postage stamps were in circulation in the United States a few years ago, but what has become of them or to what extent they were used is not known. They were such good copies of the two-cent stamps that only an expert could detect the difference. As a guard against them the government secured a large amount of them and sent sample sets to the large post offices in the country to be used for comparison. The set that was sent to the Boston office is still preserved there, but it has never been used, as no counterfeit stamps have been seen passing through that office.

It might be expected that in an office as large as the Boston post office the postal employes have about as varied an experience as it is possible to obtain in the postal service, but when the mail from "La Champagne" arrived at the Union Station the other day the three men that were sent down to receive it saw a sight that had not presented itself before in Boston postal experience—a conglomeration of foreign mail sacks containing mail made up for places that were almost unheard of here, as the general foreign mail for the West and South is not sent to Boston, but goes to New York.



BUFFALOES AND OXEN TREADING OUT GRAIN AT PARAKAI, NEAR ERIVAN, RUSSIAN ARMENIA.

Concerning Giraffes.

The young male giraffe from Senegal lately acquired by the Zoological Society of London, and now domiciled in its garden, is of special interest, says Nature, "as representing the northern form of this animal in contrast to the southern female which arrived in February, 1895; but the differences between them will be much more apparent when both specimens have fully reached adulthood."

Although the northern giraffe has, by various authors, been considered to differ considerably from the southern form, and several technical titles have been proposed for, or given to, each, the subject for the first time has been placed on sound zoological basis by Mr. W. E. De Winton, in a paper read before the Zoological Society, in February of last year, entitled: "On Existing Forms of Giraffe." Mr. Winton conclusively demonstrated that the northern form is distinguished from its southern relative by several characteristics, especially by the great prominence of the third frontal horn, which is barely existent in the latter. He proposes to restrict the title "Giraffa camelopardalis" to the northern giraffe, bestowing upon the southern variety the specific designation of "capiensis." The Cape giraffe seems to be met with in suitable localities all up the east coast into British East Africa, where it also meets the northern form; and the latter appears to range all across the Sahara into Northeastern Africa.

WHEN the planet Mars is nearest the earth, it is 36,000,000 miles away.

An Exhibit of the History of Medicine.

The seventeenth Congress of German Men of Science and Physicians is to be held at Düsseldorf, September 19 to 24. In connection with this congress, there will be several exhibits, one of scientific apparatus, one of scientific photography, and one illustrating the history of medicine and science. The last will be particularly interesting and will comprise the general history of medicine and special exhibits. The former class includes: (1) Ancient Phenician and Egyptian medicine; (2) Assyrio-Babylonian, Medo-Persian and Old Indian medicine; (3) Lydio-Trojan medical antiquities; (4) Greek and "Hellenistic" medicine; (5) Ibero-Etruscan and classical Roman medicine; (6) late Roman medicine, with its Gallo-Roman offshoots in Rhineland and in Gaul; (7) Byzantine medicine; (8) Arabian medicine; (9) Chinese and Japanese medicine; (10) Frankish, Saxon and its Gothic medical antiquities; (11) mediæval medicine of other western countries; (12) the medicine of the Renaissance and modern times up to the end of last century. The medicine of Semitic and other nations will also be represented as far as possible, and an appeal is made to antiquarians and collectors throughout the world to assist in making the exhibition as completely representative as possible. The special class of exhibits will comprise material illustrating the following subjects: (1) Popular medicine, including that of savage peoples and that of civilized peoples. (2) Instruments of all kinds. (3) Geographical exhibits. (4) History of orders and associations for the care of the sick; knights, religious orders, associations of deacons and deaconesses and lay societies. (5) Plague medals, plague masks, and amulets against sickness. (6) Illustrations of hospitals, baths, physicians in the sick chamber, operations, dressers, dissections. (7) Medals and portraits. (8) Poetical scientists and scientific poets in Germany from the oldest times to the present day, with special reference to Goethe and his relations to Düsseldorf and the Rhine country. (9) History of medicine and the Lower Rhine, in the Duchies of Jülich, Cleve, and Berg, subdivided into exhibitions relating to (a) Laurentius Friesius, (b) Paracelsus, (c) Weyer, (d) Kortum. Here again an appeal is made for portraits, medallions, photographs, and illustrated works, among the latter especially such as are of older date than 1580 (receipt books, books about animals, anatomy, distillation, alchemy, astrology, magic, etc.) The exhibitors are not put to any expense, the exhibition committee undertaking to pay all freights and the cost of fire assurance. The exhibition, which is located in the Kunstgewerbe Museum, was opened in July, and exhibits will be received up to September 15. The exhibition closes on September 30.

Duodecaplex Telegraphy.

Experiments are at present being conducted on the Paris-Bordeaux line with some very interesting machines, which the inventor, M. Mercadier, has been working on for many years. With these instruments, called duodecaplex, twelve Morse transmitters can work simultaneously on a single wire, each sending its signals to the proper receiver at the end of the line. This result is brought about by the use of alternating or, at any rate, interrupted currents.

Each transmitter receives its current through a tuning fork having a special note, its vibrations being electrically maintained. These vibrations furnish a current of the proper period to cause resonance at each application in the proper receiving circuit, which has its self-induction and capacity adjusted for this result. This receiver is a telephone (a monotelephone, as it is called by M. Mercadier) so constructed and arranged that the acoustic resonant qualities also help to damp out from the signals received everything not intended for it. These signals are read in the ordinary way by ear, aided by rubber tubes like those used on phonographs. The sifting out of the signals, it seems, is very perfect, each receiver giving no evidence of those signals not intended for it except a slight murmuring very indefinite and not at all bothersome.—Electrical World.

The Current Supplement.

The current SUPPLEMENT, No. 1181, contains a number of articles of interest. "The Town of Tsimo, in Shantung," is the subject of an article profusely illustrated with interesting engravings, taken from photographs which were taken on the spot. "The Koontee, the Seminole Bread Root," is an interesting illustrated paper, by Mr. Charles H. Coe. "Improved Radiographic Apparatus" describes some of the latest forms of apparatus in use in Germany. There are a number of articles devoted to machinery, including shaping and polishing machines, forging presses, and engines, taper hole widening machines, and other devices. "One Hundred Years of Ginning and Baling Cotton" is an article by Mr. G. A. Lowry, describing the old methods of baling cotton, including primitive presses and cotton gins. "Love Jousts Among the Grouse" is the subject of a very interesting article by Dr. G. Archie Stockwell. It is a valuable contribution to the literature of natural history, and is exceedingly readable. "The Decrease of Bird Life in Thirty Years" is illustrated by a graphic table.

Contents.

(Illustrated articles are marked with an asterisk.)

CONTENTS

Of the August Number of the

SCIENTIFIC AMERICAN, BUILDING EDITION.

(Illustrated articles are marked with an asterisk.)

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RECENTLY PATENTED INVENTIONS.

Electrical Appliances.

BATTERY-ELECTRODE.—HENRY E. WILKINSON, Mount Vernon, O. This invention is an improvement in grids or battery electrodes. The improvement provides a main or central plate and a pocket-plate secured thereto, having pockets formed with front sides which slope inwardly toward its bottom, and with ends arranged at angles to these front sides and converging downwardly. The active agent may be applied to the pockets in any suitable manner, and when thus applied is freely exposed to the action of the electrolytic liquid.

TELEPHONE-TRANSMITTER ARM AND ATTACHMENT.—WILLIAM J. BARR, Ashtabula, O. Hitherto, telephone transmitter-arms have been pivoted or hinged to a base adapted to be secured to a wall or other fixed support. In the present improved attachment, a base is provided with one or more integral trunnions. The transmitter-arm is detachably secured to the trunnions by means which insure a firm joint at all times and yet permit easy disconnection of the arm when required. The transmitter cup is integrally constructed with the arm. Economy in manufacture is one of the advantages claimed for this improvement.

Bicycle Improvements.

BICYCLE-SUPPORT.—ABRAHAM W. LEWIS, Asbury Park, N. J. In this improved bicycle-wheel holder a curved bar is provided, vertically arranged and pivoted to a fixed support at the middle of its length, so as to rock and be capable of adjustment. A pair of clamping rings is arranged at the middle. At the end of the bar, bifurcated lugs embrace and hold the wheel rim.

BICYCLE CRANK-SHAFT.—SAMUEL A. DONNELLY, Chicago, Ill. The drive shaft provided by this inventor has integral with it opposite end cranks, and also has seats for the cones and a back-stop between the cones of greater width or thickness than the cone-seats. Cones there are, with one or more recesses or wings, such recesses or wings permitting the cones to pass from their seats over the wide back-stop and all exterior parts. The purpose of the enlarged, flattened ends of the cranks is to reinforce these ends, so that they will not spread by reason of the strains to which the pedal-studs are subjected. Unlike the one-piece cranks commonly in use, the crank-ends in this invention, it is observed, may be enlarged to the size of the widened crank-axle section, because the cone having the recesses to pass over, the widened section on the crank-axle can also pass over the enlarged ends of the crank. By this construction of recessed cone and enlarged crank ends, a strong and durable construction is secured, that permits a ready adjustment of the cones.

BICYCLE STEADYING DEVICE.—FRANK BARTO, New York city. The purpose of this invention is the provision of a new and improved bicycle-steadying device, arranged for convenient attachment to a bicycle and adapted to hold the front or steering wheel normally in proper alinement with the rear or driving wheel. The rider may turn the front wheel in any position and return the wheel to its alined position whenever he releases the pressure on the handle-bars, after steering the bicycle in the proper direction. The invention comprises principally clamps of special construction, which are secured to the members of the front fork, springs connected with the clamps, and a clip held adjustably on the lower brace of the bicycle frame and adapted to receive the rear ends of the springs.

Mechanical Devices.

WINDOW RAISING AND LOCKING DEVICE.—FRANS BRUNO, New York city. The purpose of this invention is the provision of a simple mechanism, comprising a spring-motor that will be automatically wound up or set by a downward movement of the sash. This mechanism dispenses with the usual weights. The device comprises a rack on a window-sash, a spring-operated gear-wheel to engage with this rack, a frame in which the wheel is mounted, and a pivot extended across a mortise in the window casing. This pivot passes through a hole at the upper portion of the casing arranged in the mortise, whereby the lower portion of the frame may be swung wholly out of the mortise. When the wheels are allowed to rotate, the springs will operate the wheels, and the rotary movement thus produced will raise the sash by means of the racks. When the sash is moved downwardly, the wheels rotate to wind the springs, thus placing the springs in proper tension to open the window again.

ILLUSION APPARATUS.—ATTILIO PUSTERLA, New York city. This invention provides an apparatus which produces on spectators the impression of traveling on land or water. In this apparatus, moving scenery is provided which comprises a number of sections or strips, supporting pulleys or disks of different diameters over which the strips pass, intermediate supports for the strips having individual supporting devices for the central portions of the strips, and means for moving the strips. The distance between the strips gradually increases from the center toward the disks, thus obtaining a better effect of objects receding into the distance.

FLOOR-CLAMP.—EDWIN C. INGERSOLL, Philadelphia, Pa. The floor-clamp provided by this inventor is more especially designed for the use of carpenters to force a loose floor board conveniently in engagement with the one already fastened to the joist, so as to facilitate nailing the board in place. The clamp has a frame with a downwardly-extending flange, toothed at one face and adapted to engage one side of a joist or like support. A lever is fulcrumed on the frame and carries a depending jaw at one end adapted to engage the opposite side of the joist, at a point opposite the forward end of the toothed flange. Near the other end, the lever carries a spring pawl. A segment forms an integral lateral extension of the frame, and is provided with teeth on its upper face to engage the pawl. The lever is further provided on its under surface with a guide engaging a segmental recess on the under side of the toothed segment, whereby the lever is held against up-and-down movement. The frame has a guideway and a bar carrying a presser foot, adapted to slide in the guideway. This guideway is located at the outer side of the toothed flange and parallel therewith, whereby the presser-foot engages the board to be nailed at one side of the joist.

CORN HARVESTER AND HUSKER.—JOHN TJOSSEM, Paullina, Ia. The object of this invention is to provide a machine so constructed that it will remove the ears from the standing corn, husk the ears, and convey the ears to an elevator, whence they are delivered to a wagon traveling alongside of the machine. In this machine a supporting frame is connected with inclined snapping and husking rollers mounted in the frame and having spirally grooved forward ends. Converging shields extend over the forward ends of the rollers. Feed-belts travel along the inner faces of the shields and a trough is carried on each side of the feed-rollers. In the bottom of the troughs conveyer belts are located. One of the troughs empties into a hopper from which an elevator leads. In operation the standing corn is received between the shields and by them is directed so as to pass between the snapping and husking rollers, the feed belts assisting the corn in its passage to the rollers and giving the corn a rearward inclination before it meets the rollers. The inclined position of the rollers serves to draw the stalks downwardly and rearwardly, thus snapping the ears from the stalks. The husks being caught between the rollers will be stripped from the ears, and the cleaned ears are delivered by the rollers to either trough and from thence to the elevator, from which the corn may be dropped into a near-by wagon.

PUNCHING MACHINE.—CHARLES SEYMOUR, Defiance, O. In this invention novel means are provided for punching D-shaped openings in handles forshovels, forks, and the like, the arrangement permitting the opening to be formed by one operation in a very simple and effective manner. The punching tool is carried on a frame. On this frame a bracket-shaped slide is mounted to move vertically, and is provided with a horizontal portion having an opening. A chute is attached to the bottom of the horizontal portion of the slide and surrounds the opening to conduct the chips therefrom. A U-shaped projection straddles the chute and is attached to the horizontal portion of the slide. There are means in connection with the projection by which to impart reciprocal movement to the slide. A holder is mounted on the horizontal portion of the slide and has a central opening registering with the slide opening. The holder also has a horizontal guideway in its top face. Plates are mounted to slide toward and from each other in this guideway. Clamping jaws attached to the plates hold the work between them. Means are provided for moving the plates toward and from each other to grasp and release the work.

LOCK FOR FLUSHING-VALVES.—CHARLES H. SHEPHERD, New York city. By means of the lock patented by this inventor, a raised flushing-valve lever may be set to lock in position until the tank is empty and the lever is released by the float-lever unlocking the lock. The lock comprises a lever-arm arranged to connect with a flushing-valve lever, a shaft carrying the arm, a toothed wheel on the shaft, and a spring-pressed lever-pawl to engage the wheel and lock the latter in position against rotation in one direction, the lever-pawl being adapted to be actuated from the float-lever of the tank to unlock the wheel and lever-arm.

BELT-REGULATOR.—OSCAR K. SLETTO, Fergus Falls, Minn. This belt-regulator is adapted for use upon threshing machines and their driving engines, and is so constructed that the guide-pulley or idler may be vertically and laterally adjusted relative to the driver pulley. The device is furthermore designed to prevent the belt vibrating in the wind, thus avoiding side-wear, and causing the belt to run true and without undue friction. The belt-regulator comprises a hanger provided with a tubular section having exterior teeth, a frame mounted to revolve upon the tubular section of the hanger, a pawl carried by the frame and arranged for engagement with the teeth of the hanger, a guide-pulley mounted on the frame and adjusted by means of a latch carried by the guide-pulley support and adapted for engagement with the teeth of the hanger.

APPARATUS FOR DRAWING LIQUIDS.—ALEX. RITTER, Basle, Switzerland. This new and improved apparatus is designed to draw wine, ale, or liquids likely to foam or leave sediments, without disturbing the sediment and rendering the liquid cloudy. The apparatus has a receptacle with a valved inlet for connection with a barrel containing the liquid to be drawn. An air-pressure inlet-pipe opens into the valved inlet to close the valve therein, to interrupt the communication between the barrel and the receptacle and to permit the air to flow into the receptacle and force the liquid to the faucet. This faucet has a connection with an air-pressure supply, with the air-pressure pipe and with the lower end of the receptacle to connect the air-pressure supply with the air-inlet pipe at the time the faucet is open, so that the air-pressure forces the liquid from the receptacle to and through the faucet.

MACHINE FOR WORKING BALLS.—HEINRICH MELTZER, Ratibor, Prussia, Germany. For working roughly-prepared balls, the latter were hitherto kept in circular grooves and in describing always the same circular line, they were worked either upon a flat grinding-disk or this working was effected by the walls of the finely toothed guide-grooves or in such a manner that the balls were ground in oil and emery between the smooth walls of the groove. The result was that the disks grooved themselves or the disks inclosing the grooved guide-plates were moved in opposite directions, rendering it necessary that the grooves corresponded to the size of the ball. In the present invention, a frame is provided with which a bowl is connected. A stamp coacts with the bowl. A spindle attached to the stamp is slidable and revoluble and is connected with a lever engaged by a cam. An arm is pivoted to the lever and is capable of holding the lever raised out of engagement with the cam. The balls introduced into the machine are rapidly and uniformly distributed around the revolving stamp, and it is not necessary to place them as formerly—circularly into the grooves. Not only a single row, but several rows of balls may be worked simultaneously.

Miscellaneous Inventions.

FASTENER.—CHARLES V. WALTER, New York city. This fastener is particularly adapted for use in securing gloves and similar articles, but adapted as well to secure any article having overlapping flaps. The fastener consists of stud and socket members. The socket member comprises a plate having its edges flanged or curved inward and under, and a plate having a series of rectangular apertures disposed along the line of strain and projections on the body at opposite side edges of the apertures. These projections are bent over so as to clasp and hold the stock and the inwardly flanged members of the other plate. The stud member having a side projection adapted to enter the apertures.

FOLDING UMBRELLA.—FRANK G. GROVE and FRANK E. STOVER, Luray, Va. The folding umbrella of these inventors is considerably simplified in its framework. Its telescopic ribs are so constructed that when drawn out to their full length and the runner carried upwardly on the stick, the action of the contracting portions of the two ribs will be such as to hold the ribs immovable and render the telescopic or sectional ribs as strong as a one-piece rib. The folding stick is provided with a spring at its lower section, which is adapted to hold the runner when the umbrella is closed and which may be conveniently placed therein. This spring serves to limit the movement of the lower section of the stick and lock this lower section either when drawn from the upper section of the stick or when carried to an engagement with that section.

COMPUTING SCALE.—CLARK CORBIN, Carbon Cliff, Ill. This computing scale is designed to indicate both

the weight and net price of commodities. The beam of the scale has a weight scale at its lower portion and a value scale at its upper portion. A price-beam is loosely suspended at its ends from the weight and value beam. A weight is mounted to slide on the price beam. An adjustable price weight is also used, comprising a beam and two price weights arranged above the weight and value beam and movable along the top edge thereof. A carriage is movable on a bar supported on the frame of the scale. The adjustable weight is connected with a hanger on the carriage.

MUSIC-HOLDER. — OLAVES I. BYE, Hillsborough, N. D. The purpose of this invention is to provide a simple and cheap music-holder which may be directly attached to the instrument so as to hold the music at all times in clear view of the performer, whether he move about or remain stationary. The music holder consists of a frame constructed of wire or light metal and provided with a spring-held slide adapted to clamp and hold the music, and with a hook which may be placed within the sound-port usually found in guitars and similar instruments.

SUGAR-CRYSTALLIZER.—EDWARD P. EASTWICK, Jr., New Orleans, La. The purpose of the present invention is the provision of an apparatus for crystallizing sugar in motion that will give a more complete movement to the mass than has hitherto been attained. The apparatus is so constructed as to avoid the grinding and breaking of the grains usual in crystallizers commonly employed, by reason of the arms, spirals or paddles scraping against the inner surface of the cylinder. In this improved device, the cylinder and its agitators turn together, thus effecting a thorough mixture of the masse-cuite without any tendency to injure the grain of the sugar.

NECK-YOKE.—SAMUEL J. MCDONALD, Gallatin, Mo. In this invention, the center ring or loop has a swivel connection with the cross-pole of the neck-yoke, thus enabling the center ring or loop to adjust itself to any necessary position. The parts are so assembled as to operate freely with a minimum of wear and means are provided to prevent rattling. The center ring or loop is constructed so that it will not leave the tongue should the traces or tugs of the harness become broken.

MILITARY EQUIPMENT.—HENRY J. ROSE, Hythe, and WILLIAM GILBERT-COOPER, Dover, England. This invention provides an equipment for military and sporting purposes by means of which equipment a knapsack or handbag, great coat, canteen, pouch and the like can be carried with the utmost convenience and least discomfort. The knapsack or bag is carried on a back frame to which braces are fastened, passing over the shoulders down in front of the body and thence to the back, where they are made fast. A stay-strap adjustably connects the braces in front of the body below the chest, serves to keep the braces clear of the armpits, assists in supporting and distributing the weight carried, and maintains the whole equipment in position without the assistance of the usual waist-belt.

SKIRT.—BERTHA E. MARTIN, Asbury Park, N. J. The skirt provided in this invention is a bicycle-skirt, having the appearance of an apron front. The skirt is designed not to blow up over the knees and to be used upon drop frame or diamond frame bicycles, the skirt hanging gracefully whether the rider be mounted or unmounted. The skirt is made so that the front portion may be securely held while the back portion is dropped at the waist. The skirt is particularly adapted to bicycle saddles, since it is prevented from pulling or drawing at any part while the wheel is in motion, at the same time admitting all necessary freedom and elasticity.

PASSAGEWAY FOR BULKHEADS. — DALLAS DU BOIS, Montclair, N. J. In this invention, a device is provided whereby communication may be obtained between one compartment and another, at the same time maintaining a waterproof and fireproof division between the compartments. When the door in one compartment is opened, the door in the other compartment is closed. Both doors, however, may be sealed when desired. The openings of the opposing partitions are out of registry with each other, and between the partitions a car is mounted to travel and provided with opposing openings. A person desiring to pass from one compartment to another, enters the car. The car is then moved by actuating the proper devices, until the opposite door-opening in the car is brought in registry with the door-opening in the opposite partition, whereupon the person may step out into the opposing compartment.

PENCIL HOLDER AND SHARPENER.—CONSTANT E. COUSY, New York city. To provide a holder in which the pencil may be readily advanced as it wears and at the same time permits the sharpening of the point, this inventor employs a spirally grooved case having a longitudinal slot. A socket is provided capable of holding the pencil and of moving in the case. A ring encircles the case and is connected with the socket by a web. A nut works on the groove of the case and bears against the ring to advance the ring and parts connected therewith.

Designs.

WIRE-FENCE.—ALBERT HENLEY, Lawrence, Kans. This design consists of a series of horizontally disposed trapezoidal figures in which the parallel sides are approximately vertical, of the same length throughout the same rows and of gradually increasing length from row to row. The other two sides of each figure are of the same length throughout and converge from one of the parallel sides toward the other, producing meshes of trapezoidal form, uniform in length laterally throughout the fence, but increasing width vertically from edge to edge of the fence.

BOTTLE. — HERMAN TAPPAN, New York city. A circular base is provided for this bottle, from which base rises a cylindrical body slightly tapering inwardly at its upper end, terminating in a neck formed with raised spirals and ending in a reduced cylindrical mouth.

JET FOR LIME LIGHTS.—JOHN A. MANTZ, Jersey City, N. J. The leading feature of this design consists in a boss, from one side of which extends a bend of the base portion and from the top of which boss rises upwardly and forwardly a spout terminating in a contracted mouth.

HOOK.—EUNICE R. MORTON, Revere, Mass. This hook consists of a bar, from the upper end of which rise the spaced side members of a loop, from the middle portion of which extends upwardly the shank of a hook ranging in an opposite direction to a hook-plate depending from the upper edge of the bar first mentioned and from between the side members of the hook.

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Notes & 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.

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(7474) F. W. M. says: I take the liberty of sending you a cutting of an ash tree I have, with a growth which I believe are eggs, and asking you what it is and for a cure. Last year this same tree, later in the season, had numerous small insects on some of the branches which looked like mould or moss, and which I scorched off, and now think perhaps they were a more advanced stage of the same thing I inclose. A. Mr. F. H. Chittenden, acting entomologist of the Department of Agriculture, says: The object sent on a cutting of an ash tree is an egg mass of the orchard tent caterpillar (Clisiocampa americana, Harr.) It is a common species in orchards throughout the northern Atlantic States and Canada, and the peculiar habit of its larvæ of constructing tents or webs on the trees upon which they feed is well known to most fruit growers. These tents are used as shelter, and the larvæ retire into them when not engaged in feeding on the leaves. This habit of tent building furnishes an easy means of destroying the insect over limited areas, as in gardens and orchards, as it is not a difficult matter to cut off and burn these nests with their contained larvæ. The same object can be accomplished by scorching them with a torch, but it is more advisable to cut away the infested portions, as they destroy the good appearance of the trees. This is the simplest and easiest method of controlling the insect. It is also possible to detect most of the egg masses in the winter time and remove and destroy them. Still another method of control consists in the use of arsenical washes. The best time for the application of these washes, or sprays, is when the eggs first hatch, and to determine this point a few egg masses should be collected and kept under observation out of doors. Mr. Chittenden has mailed to our correspondent a copy of Farmers' Bulletin, No. 19, in which he will find full directions for the preparation and application of arsenical sprays.

(7475) F. G. G. asks: Is there any rule by which I can find the strength of an electromagnet, having given the size of the core and wire, the number of coils, and the amount of current? A. A practical formula for this case is

$$\sqrt{lb} = \frac{T\,C\,M}{2661\,L}\sqrt{A}$$

T=number of turns of wire on magnet.

C=current in amperes.

M=magnetic permeability of the iron.

A=area of poles in square inches.

L=mean total length in inches all round the iron circuit.

The value of M varies greatly with the quality of the iron and the degree of saturation. For strong saturation of well annealed wrought iron its value may be as low as 400, and its value may rise as high as 3,000. For a horseshoe magnet the area to be taken is that of both poles. The mean total length is half the sum of the inside and outside distances around the core and armature. The armature should have as large an area of cross section as that of the core of the magnet. No allowance is here made for the leakage of the magnetic lines; so that the actual result in any case will be somewhat less than is given by the formula. Much depends upon the accuracy with which the armature fits upon the poles of the magnet. The full calculations of the lifting power of an electromagnet may be found in S. P. Thompson's "Electromagnet," price $6 by mail. The formula expressed as a rule is: Multiply the number of turns of wire by the number of amperes of current. Multiply this product by 400 for full saturation, and this in turn by the square root of the total area of the poles of the magnet. Divide the final product by 2661, and this quotient by the mean length of the iron circuit. The result is the lifting power in pounds.

(7476) J. H. L. writes: I wish to call your attention to the difference between an eighty gear on a bicycle or a sixty, backpedaling down a hill. Does it require any more strength to hold a large gear down a hill than it does a small one? A. It requires less pressure on the pedals of a low gear bicycle than on those of a high gear, in going down hill.

NEW BOOKS, ETC.

AN ELECTRICAL THEORY EXPLANATORY OF THE SOLAR SYSTEM. By "Delta." Published by the author. 1898. Pp. 12. Cloth. 12mo.

This is a reprint from the Electrical Review of January 21, 1898, and embodies a theory that is at least ingenious.

DIE SCHLEIF-, POLIR-, UND PUTZMITTEL für Metalle aller Art, Glas, Holz, Edelsteine, Horn, Schildpatt, Perlmutter, Steine, u. s. w. Von Victor Wahlburg. Vienna, Budapest and Leipsic: Verlag von A. Hartleben. With 91 illustrations. Pp. 304. Price $1.25.

The second edition of "Die Schleif-, Polir-, und Putzmittel" has given the author an opportunity thoroughly to revise and enlarge his work, and to eliminate all that seemed antiquated when viewed in the light of improved methods. After having exhaustively treated the various polishing substances in the order of their hardness, the author passes to a description of the manufacture of polishing papers and cloths, of emery disks, rings, cylinders, etc. The polishing machines commonly used are illustrated by many engravings which constitute a desirable adjunct to the book. To the cleansing of various objects and to the manufacture of cleansing materials, such as salves, pastes, powders, etc., the author has devoted much care. Taken as a whole, the work will form a desirable acquisition to the libraries of technical schools and of mechanics.

We have received a new catalogue of photographic lenses, shutters, and accessories issued by the Bausch & Lomb Optical Company, of Rochester, N. Y. It is one of the finest catalogues which it has been our good fortune to examine. The lenses themselves are not only described and illustrated in a thoroughly scientific manner, but excellent examples of the work which is done with them are given. The intaglio plates and the half tones scattered through the book give an excellent idea of the range of the various lenses. The views in the factory show what patient care must be exercised in manufacturing high class lenses. The catalogue will be sent to any one who is interested in photographic lenses or shutters.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

AUGUST 9, 1898,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abrading wheel, D. J. Lattimore... 608,877
Advertising device, J. D. Hefley... 608,855
Air brake, F. L. Guillemet... 608,599, 608,600
Air brake, H. S. Park... 608,621
Air compressor, Heston & Harvison... 608,964
Alcohol, manufacturing ethylic, A. M. Villon... 608,652
Angle bars, device for bending, D. Brennan et al 608,829
Assayer's furnace, Lonergan & Calkins... 608,883
Awl, sewing, G. F. Summers... 608,926
Bag fastener, A. H. Propper... 608,909
Bag holder, N. F. Becker... 608,638
Bag holder, W. D. Graves... 608,853
Bag holder and weigher, combined, J. E. Otto... 608,900
Baking pan, compartment, L. A. Tuell... 608,930
Bale tie, F. H. Daniels... 608,840
Ballot box, L. M. Foster... 608,662
Barrel, metal, J. Harmatta... 608,772
Bath apparatus, shower, W. R. Baker... 608,947
Batteries and composition for producing same, plate for secondary galvanic, C. Marschner... 608,614
Battery. See Storage battery.
Bearing, antifriction, E. Rivett... 608,916
Bearing, ball, Harper & Grohmann... 608,854
Bearing, bicycle, W. R. Fox... 608,961
Bearing, roller, R. G. Petway... 608,709
Bearing, vehicle wheel, W. Meeker... 608,698
Bearings, machine for assembling ball retainers for ball, E. Klahn... 608,611
Bed, invalid, A. McKnight... 608,619
Beehive, J. F. Wessel... 608,943
Beer, etc., process of and apparatus for gasing, J. L. Alberger... 608,744
Belt and belt holder, skirt supporting, P. E. Post... 608,907
Belt, waist, J. Pendergast... 608,903
Bicycle, G. G. Bieber... 608,825
Bicycle, F. J. Wadman... 608,936
Bicycle chain brush attachment, F. G. Kinnard... 608,609
Bicycle gear, D. L. Harshner... 608,674
Bicycle gearing, E. H. Godfray... 608,770
Bicycle handle, E. Anderson... 608,566
Bicycle handle bar, G. J. Bungay... 608,572
Bicycle locking or securing device, T. Gilmer... 608,769
Bicycle pedal toe clip, C. O. Nelson... 608,620
Bicycle saddle, L. M. Hildreth... 608,857
Bicycle support, J. Booth... 608,749
Bicycle supporting device, E. Russ... 608,798
Board. See Game board. Plaster board.
Boat, D. Ahern... 608,565
Bolt. See Lock bolt.
Bolt, T. P. Russell... 608,717
Bottle, non-refillable, E. A. Clair... 608,650
Bottle, non-refillable, S. W. Durham... 608,957
Bottle, non-refillable, A. M. Legrand... 608,879
Box. See Ballot box.
Box beam, box girder, and box post, metal, C. M. Horton... 608,861
Box blank making machine, F. P. Rosback... 608,796
Box blank making machine, J. Uhri... 608,809
Box nailing and printing machine, F. P. Rosback... 608,917
Brake. See Air brake. Shoe brake. Vehicle brake. Wagon brake.
Brakes, device for actuating fluid pressure, R. Fitzgerald... 608,661
Bridges, etc., construction of tension members for, G. Lindenthal... 608,690
Bridle, safety, J. Hammond... 608,672
Broom case, G. Hacker... 608,671
Broom clamp, J. Hiett... 608,773
Bubble blower, P. D. Horton... 608,860
Burner. See Hydrocarbon burner.
Button fastening device, J. F. Dunn... 608,588
Button setting machine, S. Upton... 608,933
Buttonhole casing, G. J. Gissing... 608,593
Cable carrier, J. T. Cowley... 608,954
Cakes, etc., device for ornamenting, L. Ferraioli... 608,958
Calk, reversible, K. J. Gaitzsch... 608,665
Can opener, M. F. Connett... 608,575
Cane crusher, A. L. Marshall... 608,885
Car coupling, R. H. Dowling... 608,764
Car coupling, A. L. Humphrey... 608,695
Car coupling, J. P. Paulissen... 608,708
Car coupling, W. Shanklin... 608,719
Car fender, D. Guarino... 608,598
Car safety bridge, H. H. Burkhart... 608,751
Car step lifter, T. Millen... 608,617, 608,618
Carrier. See Cable carrier. Elevated carrier.
Case. See Broom case. Eyeglass case. Refrigerating shipping case.
Cash holder, M. R. Daley... 608,654
Change delivering device, J. S. Johnston... 608,778
Checking device, W. M. Shutt... 608,920
Chuck for woodworking machinery, lathe, C. H. Bartlett... 608,636
Cigar machine, J. Reuse... 608,915
Cigar making machine, J. Reuse... 608,913, 608,914
Clamp. See Broom clamp.
Clasp. See Rein clasp.
Clay products, machine for making, W. W. Wallace... 608,937
Cleaning, apparatus for chemical, A. F. Platt... 608,792
Clip. See Hat clip.
Clock, alarm, Junghans & Hirth... 608,867
Cloth winding machine, J. E. Windle... 608,817
Clothes line prop, extensible, J. W. Wood... 608,629
Clothes pin, duplex, J. R. Hoit... 608,986
Clutch, friction, W. J. Elliott... 608,977
Coat and vest holder, D. W. Axene... 608,633
Cock, draught, B. Krall... 608,874
Coin freed apparatus, A. E. Box... 608,750
Collar and socket machine, C. D. De Forest... 608,584
Collar turning and ironing machine, W. C. Shaw 608,720
Conveying apparatus, J. T. Cowley... 608,576 to 608,581
Cooker, steam, W. J. Thomson... 608,806
Cooking apparatus, electrical, J. B. Cary... 608,952
Cooking utensil, S. Kaufmann... 608,868
Cooking utensil, portable, A. Westheimer... 608,738
Coop and trap, combined folding, W. A. Neal... 608,705
Cornstalks, means for extracting pith or cellulose from, F. T. Wright... 608,630
Cotton gin, M. Swenson... 608,729
Cotton press, J. W. Graves... 608,667 to 608,669, 608,982
Counter, score, H. De Wallace... 608,586
Coupling. See Car coupling. Pole coupling. Rope coupling. Thill coupling.
Crucible furnace, self heating, R. Baumann... 608,747
Crusher. See Cane crusher.
Cultivator, H. Otenhouse... 608,790
Cultivator, disk, A. L. Brock... 608,830
Cushion. See Rocker cushion.
Cutoff for water spouts or other conduits, H. Epple... 608,765
Cutter. See Fruit or flower stem cutter.
Cutting and delivery mechanism, L. C. Crowell... 608,582
Cycle saddle, R. W. Jamieson... 608,682
Damper regulator, E. K. Hutchison... 608,966
Demijohn, G. Beccaro... 608,824
Dental plugger, W. E. Hanson... 608,984
Dovetailing machine, T. J. Ryland... 608,994
Dowel pin pointing machine, C. F. Stewart... 608,924
Draught equalizer, G. S. Hoffman... 608,776
Drill. See Ridge drill.
Drum, heating, C. P. Vernier... 608,935
Dust collector, E. R. Draver... 608,587
Dust receptacle or pouch, W. A. Bartholomew... 608,635
Eaves trough hanger and screen attachment, F. P. Dick... 608,844
Electric cable, H. A. Reed... 608,911
Electric conductors, supporting clip for overhead, W. A. Bartley... 608,637
Electric meter and motor, Davis & Conrad... 608,842
Electric motor, W. H. Powell... 608,711
Electric regulator, automatic, R. Skeen... 608,721
Electrical resistance, switch for varying, E. F. H. H. Lauckert... 608,878
Electrodynamic apparatus for operating clipping, brushing, or other mechanisms, W. P. Freeman... 608,768
Elevated carrier, H. H. Drew... 608,656
Elevator, C. H. Newhall... 608,789
Elevator governor and safety attachment, J. W. Trammell... 608,931
Embroidering machine, R. Loeb... 608,781
End gate lock, N. C. Murray... 608,892
Engine. See Internal combustion engine. Rotary engine.
Engine attachment, gas, J. H. Wiehl... 608,944
Envelop, reversible, E. A. Burlingame... 608,752
Envelop, safety, F. C. Cuckson... 608,583
Eyeglass case, H. E. Bemis... 608,640
Feed water regulator, boiler, A. Blechynden... 608,568
Feed water supply, engine, E. S. Hough... 608,679
Feeding trough, A. A. Innis... 608,863
Fence building appliance, wire, G. Kentch... 608,608
Fence post, W. P. Carr... 608,753
Fender. See Car fender.
Fibrous materials, feeding apparatus for machinery for preparing, J. Good... 608,981
Filter, W. M. Fowler... 608,663
Filtering apparatus, R. Douglas... 608,655
Finger ring exhibitor, M. Adams... 608,946
Fire extinguishers, sprinkler head for automatic, G. E. Hibbard... 608,677
Fireplace back or lining, J. A. Dickson... 608,763
Floor laying machine, J. C. Dukes... 608,847
Flower pot, A. N. Free... 608,664
Flower pot and hanging basket, G. A. Freund... 608,590
Frame. See Spinning frame.
Fruit or flower stem cutter and holding attachment, D. Tilden... 608,807
Furnace. See Assayer's furnace. Crucible furnace. Smelting furnace. Smoke consuming furnace.
Furnace, P. Boimare... 608,826
Furnace, H. E. Wallis... 608,995
Furnaces, rocking fire bar for, A. Pilatt... 608,712
Game board, L. J. Scovell... 608,918
Garment hanger, E. H. Foote... 608,766
Gas generating apparatus, acetylene, J. Boland... 608,643
Gas generating apparatus, acetylene, A. A. Strom... 608,804
Gas generator, acetylene, F. E. Bundy... 608,571
Gas generator, acetylene, C. Kelly... 608,869
Gas heater valve, A. E. Detwiler... 608,974
Gas or oil motor for bicycles, W. Morava... 608,968
Gas producing apparatus, acetylene, T. Hennessy... 608,985
Gate. See Mine gate. Railway crossing gate.
Gate, Flesher & Crisler... 608,959
Gate, E. Grist... 608,670
Gates, opening or closing, W. J. Moore... 608,702
Gear, roller tooth variable, T. Foster... 608,851
Generator. See Gas generator. Steam generator.
Glass and apparatus therefor, production of corrugated sheet, W. L. Pilkington... 608,905
Glass holder, J. Kirby, Jr... 608,610
Glassware articles, apparatus for making, C. N. Brady... 608,828
Glassware manufacturing apparatus, T. Coleman et al... 608,754
Glove fasteners to garments, machine for attaching, E. Flagg... 608,978
Gold separating machine, W. A. Darling... 608,841
Grating machine, A. B. Hostetter... 608,604
Gun lock safety attachment, P. M. Wood... 608,742
Hackling machine, J. Good... 608,979, 608,980
Handle. See Tool handle.
Hanger. See Eaves trough hanger. Garment hanger.
Harvester, cotton, G. S. Lee... 608,689
Hat clip, E. Anderson... 608,821
Hat holding device, R. Piesbergen... 608,710
Hat sweat band, C. Stader... 608,724
Hay stacker, J. Dain, Jr... 608,653
Heat retainer, F. Kahn... 608,684
Heater. See Water heater.
Heating air for therapeutic or other purposes, apparatus for, W. Taylor... 608,928
Heating and evaporating liquids, A. G. Hoffmann... 608,775

(Continued on page 126)

Hog holding device, P. Authier	608,632
Hook. See Slip hook.	
Hose rack, E. Cliff	608,651
Hubs and machinery therefor, manufacture of wheel, Brookes & Davis	608,950
Husking pin, W. H. Tyler	608,808
Hydraulic system for operating reciprocating mechanism, W. B. Cowles	608,838
Hydrocarbon burner, Moon & Marbach	608,785
Ice loader, J. A. Koontz	608,686
Ice tongs, I. L. Edwards	608,848
Igniters, generator for electrical, B. McInnerney	608,895, 608,896
Illuminating apparatus, L. B. Allen	608,745
Inhaling apparatus, V. Koch	608,873
Inking pad, J. H. Melven	608,887
Insulation of electric wires, J. A. Poche	608,906
Internal combustion engine, R. Diesel	608,845
Iron oxide, method of and apparatus for reducing, A. Karyscheff	608,779
Joint. See Pipe joint. Universal joint.	
Kite, W. S. Baker	608,823
Knit fabrics, machine for uniting, J. H. Secor	608,626
Ladder, combined extension and step, L. C. Tiefel	608,929
Lamp chimney, T. Redman	608,910
Lamp chimney holder, L. Mertz	608,615
Lamp, electric arc, T. Spencer	608,723
Lamp for railways, etc., signal, E. S. Manning	608,695
Land bedder and cultivator, M. N. Parker	608,901
Lasts, means for locking or unlocking hinged, D. C. Luce	608,782
Lathing, metallic, R. E. Daniels	608,759, 608,760
Lawn sprinkler, W. F. Brown	608,646
Leg, artificial, H. I. Weller	608,812
Lid support, A. Loewe	608,692
Lightning arrester, J. F. Kelly	608,685
Limb, artificial, J. A. Packer	608,791
Link for poles, traces, etc., A. Wood	608,970
Lixiviation apparatus, H. B. Williams	608,945
Lock, See End gate lock.	
Lock, Girrens & Weitz	608,592
Lock bolt, F. W. Mix	608,784
Locomotive draught device, M. Kelly	608,870
Loom, circular, J. & C. Herold	608,676
Loom shuttle filling carrier or cop skewer, C. A. Littlefield	608,988
Loom swivel batten and shuttle, R. Whitley	608,816
Loom warp stop motion, W. E. Allen	608,971
Mallet, G. A. Weld	608,811
Match safe, W. H. Hooker	608,603
Measuring machine, cloth, J. E. Windle	608,818
Metallic wheel, A. W. Calvert	608,951
Meter. See Electric meter. Water meter.	
Mill. See Rolling mill. Windmill.	
Milling and gear cutting attachment, J. F. Arthur	608,822
Mine gate, N. K. Bowman	608,645
Moistener, stamp and envelop, E. Boggis	608,642
Motion, mechanism for converting continuous rotary motion into intermittent rotary, J. A. Burden	608,573
Motor. See Electric motor. Gas or oil motor.	
Motor, L. W. Carson	608,836
Music holder and turner, A. A. Patterson	608,707
Musical notation, C. C. Guilford	608,771
Net lifting machine, W. F. Ahearn	608,631
Nigger bar cushion stop, H. G. Dittbenner	608,975
Nut lock, W. A. Jackson	608,777
Nut lock, J. O. & C. D. Kafader	608,607
Nut lock, J. Kirkwood	608,872
Nut lock, C. D. Wright	608,743
Ointment base and making same, F. W. Klever	608,612
Ore granulator and pulverizer, J. M. Montgomery	608,700
Organ foot, pipe, F. McCollum	608,704
Packing, gasket, R. Walsh	608,939
Pad. See Inking pad.	
Pad moistener and letter press, combined, W. A. Voncanon	608,733
Pail, dinner, G. Gants	608,591
Paint and varnish, removing, Barnard & Butler	608,948
Painting, H. M. Evans	608,589
Pan. See Baking pan.	
Paper folding machine, T. C. Dexter	608,843
Paper machine, B. Eilers	608,849
Paper vessel, J. J. Lanzit	608,687
Pedestal, folding, J. L. Erwin	608,659
Photographic plate washer, J. Kirkwood	608,871
Photographic shutter, G. C. O. Lange	608,875
Photographs in colors, producing, V. Vaucamps	608,934
Pianoforte, J. H. Ludwig	608,693
Pianoforte action, W. W. Wallace	608,938
Pick, miner's, B. Rubenstein	608,716
Pigeon trap, L. W. Slack	608,801
Pin. See Clothes pin. Husking pin.	
Pipe joint and connection, F. A. Linich	608,613
Planter, automatic seed, G. Von Post	608,793
Planter, corn, W. W. Ellis	608,653
Plaster board, M. G. F. Buckley	608,570
Plasterer's steel angle tie, G. W. Meserve	608,888
Plow, gang, W. C. Matteson	608,696
Pneumatic tool, J. G. Carlinet	608,953
Pole coupling, wagon, L. C. Wilcox	608,815
Poncho holder, J. H. Tabler	608,927
Post. See Fence post.	
Pot. See Flower pot.	
Power. See Tidal power.	
Press. See Cotton press. Printer's proof press.	
Printer's proof press, F. Wesel	608,813
Printing, apparatus for bending form plates for, J. W. Osborne	608,706
Printing, type and type holder for box, J. F. Ames	608,746
Projectiles, appliance for producing case shot like action of explosive, A. Weigner	608,941
Propelling means for vessels, pneumatic, A. J. Culbertson	608,757
Pumping apparatus for water distributing systems, E. Neff	608,991
Punching machine, J. P. Stark	608,725
Pyroxylin compound, J. H. Stevens	608,726, 608,727
Rack. See Hose rack.	
Radiator, J. A. Miller	608,889
Rail and railway track, K. G. A. Uhlig	608,732
Rail bond, G. A. Weber	608,736
Railway crossing gate, C. R. Woodward	608,820
Railway, gravity, J. Murrey	608,787
Railway grips, mechanism for automatically placing cables in cable, L. J. Hirt	608,858
Railway switch, B. L. Bonnell	608,569
Railway switch, automatic, J. L. Calame	608,647
Railway tie, E. G. Carter	608,648
Railway tie distributer, C. C. Gates	608,962
Rake, W. W. Wentworth	608,737
Receptacle, fluid, J. Jaquet	608,864
Recorder. See Time recorder.	
Refrigerator door, A. J. McArthur	608,893
Refrigerator shipping case, F. W. Morse	608,701
Regulator. See Damper regulator. Electric regulator. Feed water regulator.	
Rein clasp, C. S. Watkins	608,940
Resawing machines, feed mechanism for band, F. McDonough	608,894
Ridge drill, V. Bedoret	608,748
Rocker cushion, Fink & Andlauer	608,660
Rolling mill, tube, B. Price et al	608,908
Rope coupling, T. L. Marvel	608,886
Rotary engine, Davidson & Stacey	608,761
Rotary engine, Dean & McCoy	608,762
Roving frame, J. T. Cunneen	608,758
Sack filling and sewing machine, automatic, N. F. Becker	608,567
Sampling machine, O. Byrnes	608,834
Sash fastener, Henneberg & Bergmann	608,601
Sash fastener, R. B. Hugunin	608,606
Sash fastener, E. J. Morgan	608,786
Saw stretching machine roll, G. M. Hinkley	608,774
Seeds, compound for treating, G. Thiele	608,627
Separator and purifier, W. H. Likins	608,880
Sewing machine, sack, N. F. Becker	608,639
Sewing machine thread controlling means, H. P. Richards	608,795
Shoe brake and head, W. H. Phelps	608,623
Shoe vamp stay, J. Walden	608,734
Sign, W. Heeren	608,963
Sign, T. Millen	608,616
Singletree, H. C. Bratton	608,949
Siphon, H. Foulois	608,960
Sleigh roller attachment, J. C. Perkins	608,904
Slip hook, J. Johnson	608,683
Smelting furnace, reverberatory, H. L. Charles	608,837
Smoke consuming furnace, Imhof & Spring	608,862
Smoke consuming furnace, J. Wezel	608,739
Snow removing apparatus, D. Boorman et al	608,827
Solar heat, apparatus for storing and using, H. F. Cottle	608,755
Soldering flux, W. Burnley	608,973
Sounding machine, C. W. Wood	608,741
Spindle and bearing, Nicol & Ayotte	608,992
Spindle bearing, G. O. Draper	608,976
Spinning frame, Tolman & Martin	608,731
Spooling machine, J. Raistrick	608,713
Spoon, medicine, B. F. Morningstar	608,890
Spouts, adjusting means for delivery, W. C. Dentler	608,585
Sprinkler. See Lawn sprinkler.	
Stacker attachment, pneumatic, J. B. McCutcheon	608,990
Stanchion, cattle, H. Taylor	608,730
Staple driving machine, E. H. Michener	608,699
Steam generator, H. Seiffert	608,799
Stirrup, J. T. House	608,605
Stoker, underfeed, W. R. Wood	608,819
Stone, artificial, W. Courtenay	608,756
Stone sawing machine, W. Murphy	608,703

(Continued on page 127)