

speed. At the time of the Santiago engagement, these ships were good for from 15 to 15½ knots with clean bottoms, and the total horse-power of the fleet was about 50,000. When we come to consider the Atlantic fleet, there is a marked increase in speed and power. The five ships of the "Connecticut" class, designed for 16,500 horse-power and 18 knots, developed, on trial, from 19,000 to 20,000 horse-power, and speeds of from 18.3 to 18.8 knots. The five ships of the "Virginia" class developed from 20,000 to 24,500 horse-power, and all steamed at over 19 knots on trial. The "Maine" and "Missouri" made over 18½ knots for 16,000 horse-power; the "Illinois" and "Wisconsin," 16.2 and 17.2 knots for 11,000 and 12,300 horse-power; and the "Kearsarge" and "Kentucky" made 16.8 and 16.9 knots with 11,788 and 12,179 horse-power. The total horse-power of the whole fleet, as developed on trial, was 258,000, as against 50,000 developed on trial by the Santiago fleet. This is an increase of 500 per cent in power. There is no corresponding increase in the cruising speed of the fleet as a whole, since it is governed by the speed of the slower ships of the "Alabama" and "Kearsarge" class, whose sea speed is probably not much better than that of the Santiago fleet. The ten ships of the "Connecticut" and "Virginia" class, however, have a sea speed two to three knots greater.

In a comparison of the crews of the two fleets, there is the same increase of from 450 to 500 per cent. The total number of officers and men in the Santiago fleet, if they contained the regular complement, was 2,276, and in the battleships of the Atlantic fleet, it is about 10,237. It is probable, however, that the crews were temporarily increased during the Spanish-American war, and we know that large numbers of extra men were carried on the cruise around the world.

Equally impressive are the two diagrams in the accompanying drawing, showing the relative power in the number of heavy armor-piercing guns of 12- and 13-inch bore. In the Santiago fleet there were mounted twelve 13-inch guns and six 12-inch. The Atlantic fleet mounted altogether sixty-four 12-inch guns. It should be noted, however, that the above comparison is based merely upon numbers, and takes no account of the enormous increase, both in the rapidity of fire, and in the striking energy of each projectile as it left the gun. To get an accurate idea of the comparative weight of metal thrown by the two fleets in a given time, we must turn to the diagram showing, by the outlines of the two projectiles, the comparative amount of metal which could be thrown from the broadsides of the two fleets, during five minutes of an engagement. The enormous difference is explained by the fact that improved methods of mounting the guns, improved ammunition hoists, breech mechanism, rammers, etc., have increased the rapidity of fire about five times, so that for every single shot delivered from a 12-inch gun in 1898, the crew of a 12-inch gun on the Atlantic fleet can deliver five shots. There has been a similar increase in the rapidity of the smaller guns, and the result is shown in the total metal delivered, which in five minutes' firing by the Santiago fleet would amount to only 69,140 pounds, as against 1,401,680 pounds, which could be delivered in the same time from the broadsides of the Atlantic fleet, an increase of 2,000 per cent.

But this is not all; for not only has there been an increase in the rapidity of fire, but the energy of a given weight of metal thrown has also been greatly increased. In the intervening ten years there has been a great improvement both in the powder and the guns. The old brown powder has given way to smokeless powder, and the length of the guns has been increased from 30 and 35 calibers to 40 and 45. The smokeless powder, giving off greater volumes of gas, exerts its accelerating pressure upon the base of the projectile through a greater length of bore, and the energy imparted, which varies as the square of the velocity, has risen, in the case of the 12-inch gun, from 25,985 foot-tons to 44,000 foot-tons. Applying these results to the two fleets, we find that in five minutes' firing with all guns on one broadside, the metal delivered by the

Santiago fleet would have a total energy of 2,146,738 foot-tons, whereas the total energy of five minutes' broadside from the Atlantic fleet would be over thirty times as great, or 66,328,910 foot-tons.

But it is not the amount of metal that leaves the muzzles of the guns that determines the issue of a sea fight, but rather the amount of it that lands on the enemy—"it is the hits that count." Therefore, we will now substitute two individual ships for the two fleets, and compare the actual ability to inflict damage on the enemy of the "Oregon" of 1898 and the flagship "Connecticut" of 1908. The "Oregon" in five minutes' firing from all the guns which she could train on one broadside was capable of hurling at the enemy 15,800 pounds of metal. In the same time the "Connecticut," from her 12-, 8-, 7-, and 3-inch guns could deliver 89,200 pounds of metal. After the battle of Santiago our ordnance officers made a count of the number of hits on the sunken Spanish ships. Com-

paring this with the number of shots fired, which, of course, was known for each of our vessels, it was found that only two per cent got home on the enemy. It is generally believed, however, that more hits than this were made. Many of the shot holes being below water could not be counted; many shots must have entered previous shot holes; and additional hits were probably made upon portions of the vessel which were subsequently blown bodily away. Let us then assume that the average of hits at Santiago was five per cent, as shown in the accompanying left-hand diagram representing a modern battleship. In our latest target practice, conducted as nearly as possible under battle

conditions, the average efficiency of the ships of the Atlantic fleet is sixty per cent of hits. But in an actual engagement the shells of the enemy would be getting home upon our own ships, and therefore, to a certain extent, disturbing the aim of our gunners. On the other hand, there would be no smoke, as at Santiago, to hide the enemy. We have therefore cut down the average to forty, and represented in the right-hand drawing the same modern battleship as she would appear after the first five minutes of an engagement with the "Connecticut." Applying this comparison of accuracy to the diagram showing by the size of the ships the relative amount of metal thrown, we find that the "Connecticut" from being over five and a half times as large must be represented, as in the lowest diagram, by a ship forty-five times as large as the "Oregon"; or, to put it in other words, the "Connecticut," during a five minutes' engagement with the "Oregon," would land forty-five times as much metal on

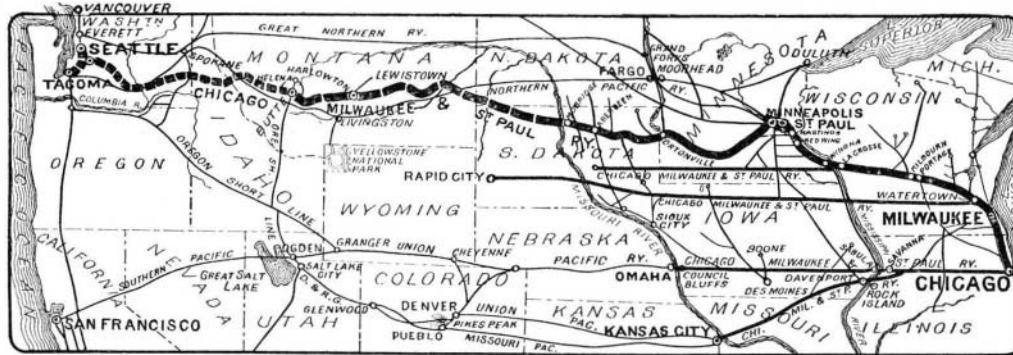
THE EXTENSION OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY TO THE PACIFIC COAST.

With the completion to the Pacific coast in the near future of the extension of the Chicago, Milwaukee & St. Paul Railway (now known as the Chicago, Milwaukee & Puget Sound Railway) one more of the great railroad systems of the West will be entitled to rank as a transcontinental line. For the beginnings of this great railway system we must go back to the year 1865, when the Minnesota Central, now known as the Iowa and Minnesota Division of the Chicago, Milwaukee & St. Paul Railway, was completed to Faribault, Minn. This road reached the Iowa line in 1866, and was completed to St. Paul in 1867. Since that time the growth of the system has been rapid, the

total mileage reaching 4,721 miles in 1884, 6,065 miles in 1892, 6,382 miles in 1903, 7,264 miles in 1907, and 7,451 miles in 1908. The total length of the extension now being completed from the Missouri River to the coast is 1,400 miles, and by the time it is opened the total mileage of the whole system will have reached 9,000 miles.

It is probable that by the time of its completion the new line will have created a record for rapidity of construction. Work was begun in April, 1906, and if the expectations of the engineers and contractors are fulfilled, the last main line rail will be laid by April 1, 1909, and the whole stretch of 1,400 miles will have been built in the remarkably short time of three years. During this period 60,000,000 cubic yards of material will have been excavated, 360,000 yards of tunnel driven, 20 miles of bridges erected, and 200,000 tons of 85-pound rails laid, at a total cost of \$85,000,000.

The new line being the latest of the transcontinental roads to be built, has all the advantages which come from accumulated experience in the construction of similar roads that have already been built. From the standpoint of operation, the most important question is that of grades, and particularly what is known as the "ruling grade," this last being the maximum degree of grade occurring on any given stretch of the line. No matter how short its extent may be, the ruling grade determines the total weight of train which can be hauled over the division upon which the ruling grade obtains. If a short stretch of only a quarter of a mile of two per cent grade occurs on a division of say 100 miles, where there is no stretch of grade exceeding say 0.5 per cent, the maximum train-load must be reduced on that division to the maximum which an engine can haul unassisted over the short stretch of two per cent grade, or additional pusher engines must be maintained at the ruling grade to assist the trains over this quarter of a mile of track. The new line, however, is characterized by favorable gradients and easy curvature. Between the Missouri River and Marmarth, N. D., the ruling grade east-bound is 0.5 per cent, and between Marmarth, N. D., and Melstone, Mont., a distance of 235 miles, it is 0.4 per cent. From Melstone, Mont., to Harlowton, Mont., 104 miles, there is no adverse east-bound grade; the entire distance being a very gradual descent conforming to the valley of the Musselshell River. The maximum grade of the Montana Railroad, when revised, will be one per cent. Between Lombard, Mont., and Piedmont, Mont., the maximum east-bound grade is 0.3 per cent, and between Piedmont and Butte, crossing the continental divide, the ruling grade is 1.66 per



Map showing the extension of the Chicago, Milwaukee & St. Paul Railway from the Missouri to the Pacific coast.



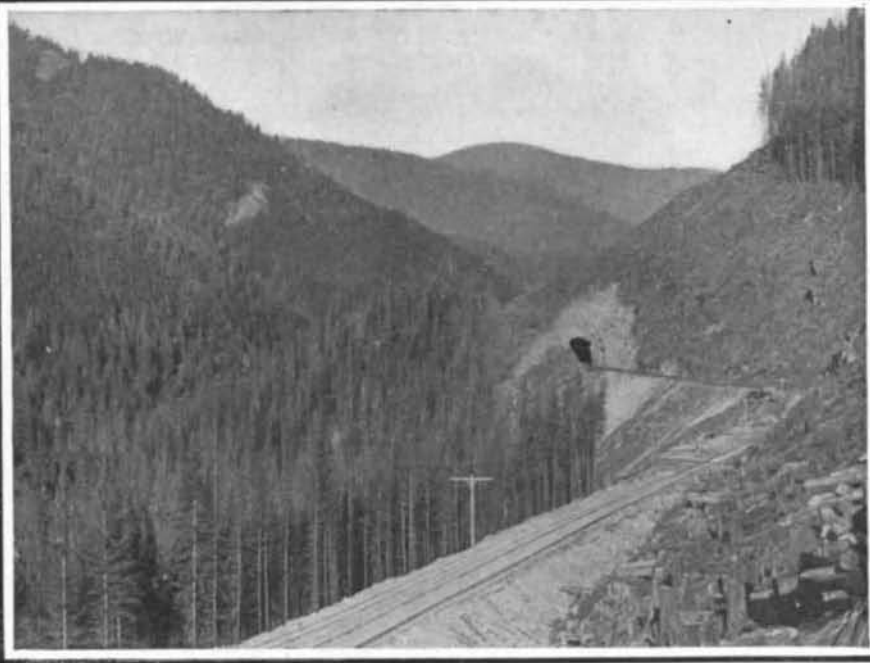
Steam shovel work at Lock Bluffs, Montana.

THE EXTENSION OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY TO THE PACIFIC COAST.

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Laying track on the Chicago, Milwaukee & Puget Sound Railway.



Tunnel near the summit of one of the mountain passes.

cent, compensated, as in all other instances, for curvature.

Between Butte and the Bitter Root Mountains the line follows the Deer Lodge, Hell Gate, and Missoula rivers, and the ruling east-bound grade is 0.4 per cent, except between Deer Lodge and Butte, where it is 0.6 per cent. The Bitter Root Mountains are crossed with a maximum grade of 1.7 per cent, and from there to the Columbia River the maximum of 0.4 per cent is maintained. Johnson Creek summit, about 20 miles west of the Columbia River, is crossed with a maximum east-bound grade of 1.5 per cent, and the Cascades will be crossed with a maximum of 1.7. On the approach to the Cascades from Puget Sound the maximum grade is 0.8 per cent.

The new line begins at the town of Moberidge in South Dakota, and crosses the Missouri at a point about 100 miles due west of Aberdeen by a handsome steel bridge, which forms the subject of one of our illustrations. It is carried upon four concrete and stone piers, the foundations for three of which were put in by the pneumatic caisson process. Pier No. 3 was sunk to a depth of 90 feet 6 inches below low water. The bridge consists of a steel through-truss span of 128 feet on the east approach, followed by three steel through-truss spans each 423 feet 4 inches

in length, which form the main bridge. The west approach consists of 281 feet of steel viaduct and 1,289 feet of timber trestle. The filling of the timber trestle will be completed this season. After crossing the Missouri the line parallels the State line through the Standing Rock Indian Reservation, and swings into North Dakota, touching several small towns, including Marmarthon on the Little Missouri River, where one of the division points will be established. Thence, it proceeds to Terry, Mont., on the Yellowstone River, and 4 miles to the west of Terry it crosses the Northern Pacific by an overhead bridge, and follows the line of the Yellowstone River to Miles City, Mont., where large division terminals are being built. The road passes through the valley of the Musselshell River, and at Harlowton joins the Montana Railroad, on which a large amount of work has

At an elevation of 6,350 feet, the road pierces the mountains at the head of Pipestone Pass. The summit work includes two tunnels respectively 2,268 and 1,148 feet in length, and three steel trestles over ravines from 100 to 160 feet deep and from 400 to 600 feet wide.

From Butte the road will pass by way of the broad and fertile Deer Lodge valley to Garrison and Mis-



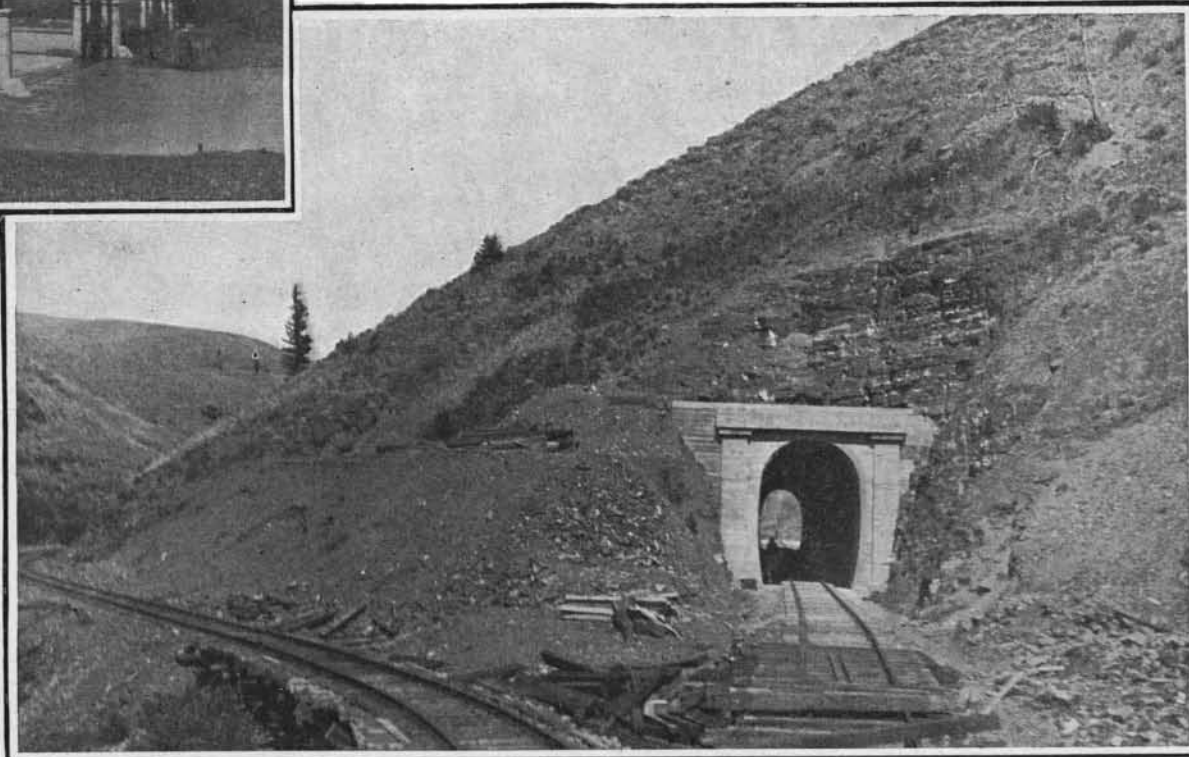
View showing the remarkable development of the grades through the mountains west of the St. Paul Pass tunnel.



The three 423-foot spans of the Missouri River bridge.



A 200-pound keg blast at the Lock Buttes.



Relocation; the new line through the tunnel takes the place of the longer line around the hill.
THE EXTENSION OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY TO THE PACIFIC COAST.

been done in the way of reducing grades and curvature to accommodate the expected heavy traffic. At Lombard the new line again crosses the Northern Pacific Railway, and then climbs the great continental divide between Piedmont on the eastern side of the Rockies and the city of Butte on the west.

soula, Mont., and at Hangan, Mont., will commence the long climb over the Bitter Root Mountain range. At the summit it will pass through a tunnel 8,751 feet in length, and after crossing St. Paul Pass at an elevation of 4,160 feet it will pass through the famous

(Continued on page 156.)

COMPOSITION OF THE FLEET WHICH SAILED AROUND THE WORLD.

Whether by design or accident, the fleet of battleships which was selected for the 42,000-mile cruise around the world, contained two or more representatives of every class of battleship which has been built for our navy from the close of the Spanish war to the present time. Moreover, it does not include a single ship that was in commission during that war, or took any part in its active operations. So that to any student of naval affairs (and there must have been many a score of such at the various ports of call) the visit of the fleet presented an unrivaled opportunity to trace the development of the United States navy, at least as far as its capital ships are concerned, during this, the most active decade of construction in the history of our navy.

During the progress of the war, when we had but four first-class and one second-class battleships in commission, frantic efforts were being made to rush to completion two sister ships, which, about the time of the outbreak of hostilities, had been launched from adjoining slips in the Newport News yard. These were the two battleships "Kentucky" and "Kearsarge," vessels of 11,520 tons displacement and a little less than 17 knots speed. They are characterized by a low freeboard of 13 feet, and by the fact that they mount their main battery of four 13-inch and four 8-inch guns in superposed, or two-deck, turrets, a device which has the distinction of having been installed against the bitter opposition of the naval constructors, and of being to-day cordially disliked by the line officers to whom its design and installation was originally due. Designed with the object of securing a maximum all-round fire for a maximum number of guns, it is open to the objections that too many guns are carried upon a single turntable, preventing independence of training; that there is an undesirable concentration of heavy weights; that the matter of ammunition supply is complicated; and that a single high-explosive, heavy armor-piercing shell might at one blow put half of the main armament out of commission. However, the superposed turret makes a brave show, and it cannot be denied that excellent target results have been achieved by guns mounted in this way.

The next two ships in point of importance in the fleet are the "Illinois" and "Wisconsin," of the "Alabama" class, vessels of about the same displacement and speed as the foregoing, and carrying four 13-inch guns in two 2-gun turrets, fore and aft, and a broadside of fourteen 6-inch rapid-fire guns disposed behind the armor of a central box battery. Ships of this class are easily recognized by their two elliptical smokestacks, placed abreast of each other, in the English fashion of the period when the "Alabama" class was designed. Their seagoing qualities, as compared with the "Kentucky" and "Kearsarge," are improved by the addition of a forecabin deck, giving a freeboard forward of between 19 and 20 feet on normal displacement.

Next in importance are the "Ohio" and "Missouri" of the "Maine" class. Originally, the three ships of this class were designed to be of the same size as the preceding "Alabama" class; but they were subsequently lengthened 20 feet, the displacement being raised to 12,500 tons, and the speed from 17 to 18 knots. The 13-inch gun gives place to a 40-caliber, 12-inch piece, of higher velocity and greater power. Four of these guns are carried in two turrets, and there is a powerful secondary battery of sixteen 50-caliber 6-inch guns. In the five ships of the "Virginia" class, a great advance was made both in size and power over the "Maine" class. The superposed turret was reintroduced, as was also the 8-inch gun. The ships are of slightly under 15,000 tons displacement, and all of them, on trial, made over 19 knots an hour. The armament is unusually powerful. It consists of four 40-caliber 12-inch guns, eight 40-caliber 8-inch, twelve 50-caliber 6-inch, and twelve 50-caliber 3-inch guns. The four 12-inch and four of the 8-inch are carried in two superposed turrets forward and aft, and the other four 8-inch are mounted in two turrets, one on each beam. The twelve 6-inch pieces are mounted behind casemates on the main deck. These five ships were the first battleships in our navy to have a continuous, unbroken upper deck from stem to stern, with a freeboard of 19 feet or over. Because of the superposed turret mounting, the "Virginias" possess a heavier broadside, even, than the "Connecticut" class which followed them, the total amount of metal that can be thrown from one broadside in five minutes being 98,800 pounds, as against 89,200 pounds for the "Connecticut" class.

In the "Connecticut" class our designers have turned out one of the most successful battleships designed for any navy. They are about 1,000 tons larger, though about one knot slower than the "Virginia" class. The main battery consists of four 45-caliber 12-inch guns mounted in two turrets; four 45-caliber 8-inch in four turrets; twelve 50-caliber 7-inch guns mounted in casemates on the main deck; and twenty 50-caliber 3-inch guns. The "Connecticut"

represents the highest development of what might be called the mixed-caliber battleship, as distinct from the all-big-gun type, which was introduced by the "Dreadnought." As such, she is comparable with the "King Edward" of the British navy, which carries four 9.2-inch guns in her intermediate battery, as against the eight 8-inch guns of the "Connecticut."

All the ships of the fleet are heavily armored, the older vessels carrying from 16½ to 13 inches of Harvey armor, and the latest ships from 11 to 6 inches of Krupp armor on the waterline and upon the principal gun positions. There has been a steady increase in coal-carrying capacity and, therefore, in the steaming radius, the bunker capacity being as follows: "Kearsarge," 1,500 tons; "Illinois," 1,275 tons; "Missouri," 1,825 tons; "Virginia," 1,900 tons; and "Connecticut," 2,275 tons. The complement has grown from 586 men in the "Kearsarge" to 916 in the "Connecticut."

It is interesting also to compare the steady increase in the amount of metal which can be thrown from a single broadside in the successive ships, the figures for five minutes continuous firing of all guns being as follows: "Kearsarge," 70,720 pounds; the "Illinois," 74,970 pounds; the "Missouri," 85,150 pounds; the "Virginia," 98,800 pounds; and the "Connecticut," 89,200 pounds. The great improvement in rates of fire and energies of projectiles, in the later guns, shows clearly in a comparison of the relative energy, the total energy of discharge for one broadside for the ships of each class in the Atlantic fleet being as follows: "Kearsarge," 2,035,520 foot-tons; "Illinois," 2,354,490 foot-tons; "Missouri," 4,490,670 foot-tons; "Virginia," 5,191,370 foot-tons; and "Connecticut," 4,522,140 foot-tons. It might be supposed that the "Connecticut," with her 45-caliber 8's and 12's and her 50-caliber 7's, would show a more powerful total muzzle energy than the "Virginia," with her 40-caliber 8's and 12's and 50-caliber 6's. But the "Virginia" can concentrate two more 8's upon the broadside, and the greater rapidity of fire of her 6-inch guns more than offsets the greater energy of the slower-firing 7-inch piece; the total energy for five minutes of the 7-inch battery being 1,508,810 foot-tons, and of the 6-inch battery, 2,057,040 foot-tons. In the same way, the eight 6-inch guns of the "Maine" account for 2,742,720 foot-tons of her total energy.

If, however, we take account of the "remaining energies," which determine the punishing power of the guns at the fighting ranges of from 6,000 to 8,000 yards, the "Connecticut" heads the list by a good margin, and the "Maine" drops far behind.

The total muzzle energy of the whole fleet's broadsides during five minutes engagement would be 66,328,910 foot-tons. This would be sufficient to raise the battleship "Kentucky" over one mile into the air.

THE EXTENSION OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY TO THE PACIFIC COAST.

(Continued from page 152.)

Coeur d'Alene district. At Beverly, Wash., the line reaches the Columbia River. The last stretch of the new road passes through the virgin timber lands of Snoqualmie Pass in the Cascade Mountains, which are probably the richest timber lands in the State of Washington; and then after following the Cedar River valley to Maple valley, it runs into the populous and thriving cities of Seattle and Tacoma on the Pacific coast. The line to Tacoma runs through Kent and Auburn, passes through Sumner and North Puyallup, crossing the river of that name, and then entering the famous seaport of Tacoma.

Although for a considerable portion of its distance the new line traverses approximately the same country as the Northern Pacific, for the greater part of the distance it will open entirely new sections, in which are included some large areas of fertile agricultural country, and extensive districts that are rich in mineral and forest wealth. The new line will have an advantage over the present lines to North Pacific coast points in lower grades and shorter mileage. The development of the country through which it passes, and the carriage of freight and passengers to and from the large areas which will be tributaries to the line, are not by any means the sole objects for which it has been built. Its promoters are looking beyond the broad Pacific, in the expectation of sharing that large and ever-accumulating trade, which has already assumed considerable proportions, between the Orient and the leading ports of the Northwest. Traffic arrangements have already been made with certain lines of steamers to operate in connection with the new transcontinental route.

According to a consular report, Sir Oliver Lodge has recently demonstrated the efficiency of his fog-clearing apparatus in Liverpool. He succeeded in clearing a thick fog over a radius of 60 feet. The Lodge system consists in discharging electricity at high voltage from a series of disks, with the result that the fog is condensed and falls to the ground. The apparatus will soon be tested in London.

Correspondence.

A SUGGESTION FOR INVENTORS.

To the Editor of the SCIENTIFIC AMERICAN:

Regarding all of the information that has been published about the collision in the sinking of the steamship "Republic," there is one comment from a passenger of the "Florida" which is, I believe, of particular interest. It is as follows:

"As I got to the deck," said Roberto, "I saw the big hull of the 'Republic' a faint blur in the darkness, and immediately there came over the water the boom of a rocket, and the darkness was for a second illuminated. The bow of the 'Florida' was in bad condition, and there was a running and scurrying of men down there, investigating the nature of the damage and repairing it as best they could."

The question arises that if as soon as the distress rockets were sent off they illumined the ocean sufficiently to make out the whereabouts of the "Republic," why would it not have been a good plan to send off rockets before the collision? This, of course, brings up the entire question of what kind of lights, if any, will penetrate or illuminate in a fog.

PALMER H. LANGDON.

New York, February 6, 1909.

A YACHT DESIGNER'S OPINION OF THE NAVY SITUATION

To the Editor of the SCIENTIFIC AMERICAN:

To your editorial in the SCIENTIFIC AMERICAN of December 19, 1908, commenting on President Roosevelt's recommendations in regard to the reorganization of the navy's bureaus, kindly accept, from one who has helped a little to make his country's navy the "best ever," a modest but sincere and hearty "encore."

Only by frequently repeating such clear and effective statements of the problems involved, can those who are entirely unfamiliar with them be shown the technical difficulties to overcome in the building of our naval vessels.

Your excellent illustration of the troubles that would result from an application of the general principle in the President's proposal to the question of a design for the defender of the "America's" cup, appeals strongly to one who has wrestled with the problems many years as a yacht designer.

As one who was moreover intimately connected with the design work on the ships under Lewis Nixon and the late J. J. Woodward, and more recently in constructing them under the eminent ex-Chief Constructor F. T. Bowles, allow me to second the expression of your hopes that our ships may continue to be designed by the technically expert.

Marblehead, Mass., December 21, 1908. J. R. P.

ALCOLINE.

To the Editor of the SCIENTIFIC AMERICAN:

Surely he who finds a short cut between an idea and its expression in this day, when railroads are spending millions in shortening and leveling their lines, is worthy of as much honor as Swift thought due the man who made two ears of corn grow where only one grew before. Now, it is patent to all that the appellation "denatured alcohol" cannot pass into current use. It is too long, clumsy, and contradictory for our monosyllabic age, and in its place I suggest the caption of this letter, *Alcoline*, and submit the following points in its favor:

First, it puts it into articulation with the other well-known fluid fuels: gasoline, kerosene, benzine, etc. The popular mind will very readily grasp the analogy, even if it should be etymologically incongruous.

Second, it would obviate or at least minimize the danger of such mistakes as have strewn the path of "wood alcohol" with twisted corpses. Possibly the world may not lose much by the departure of any chance boneheads who cannot understand that some kinds of alcohol kill more quickly than others, but some otherwise good and useful men might be tempted to try the new brand, "denatured alcohol," just as otherwise sensible people will dab at a freshly-painted surface, just to see if it is drying, so this point has some weight.

Third, it gives this substance, which is plainly destined to occupy an increasingly important place in our industries, a single, unconfusable name. "Denatured alcohol" is too long, confusing, and misleading. If it is "denatured," it no longer has a right to the name alcohol. To follow the analogy, the SCIENTIFIC AMERICAN is printed upon "denatured spruce" by type made of "denatured ore." The presses are operated by "denatured" lightning, which is generated by "denatured water" power, denatured by "denatured" forests of the Carboniferous era! Let us have a name as well as a place for everything, without qualifying words to trip us up!

WARD MORSE.

Genoa, Nance County, Neb., January 6, 1909.

The Current Supplement.

The current SUPPLEMENT, No. 1729, contains a large number of interesting contributions. Among these may be selected William H. Booth's paper on "Coal, Its Composition and Combustion," Friedrich Hartmann's instructive article on "Amalgams," a succinct statement of steam engine efficiency in the light of modern thermo-dynamic conceptions, an illustrated article on the government's efforts to stop the appalling loss of life in mines, a picturesque description of the wonderful cavern of Proumeyssac in France, an enumeration of recent earthquakes that preceded the great Italian cataclysm, a summary of the scientific attempts to stop bodily decay and prevent death, a review of some recent processes of making artificial unwoven cloth, an account of the surgical instruments of antiquity, a popular statement of the sewage problem, and a continuation of the treatise on aeronautic motors begun in the last number of the SUPPLEMENT.