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INCREASE IN OUR ARTILLERY URGENTLY NEEDED.

It was only a few years ago that the country awoke to the fact that it was absolutely without modern sea coast defenses. To-day it finds itself in possession of a growing number of forts and guns, but has not sufficient trained gunners to man them. The successful agitation for the building of forts and guns may be said to date more particularly from the time of our trouble with Chile, when it was realized that the Pacific coast ports were defenseless against the cruisers of a fifth rate power. It resulted in the adoption of a system for the construction of modern defenses which provided for over 500 high power rifled guns of from 8 inches to 13 inches caliber, 1,000 twelve-inch mortars and 360 rapid fire guns, all of which were to be distributed among twenty-five of our most impor ant harbors. The defenses were also to include the placing of 6,000 submarine mines. By June of next year one-half of these guns and mortars, or over 900 separate pieces, are expected to be in place.

It now appears that although the work of reconstruction has been carried on with commendable zeal, no provision whatever has been made for manning the guns, and we are now at a stage where the question of an immediate increase in the artillery must be faced without delay. The problem is clearly set forth by Gen. George W. Wingate, president of the National Guard Association, in the current number of The Journal of the Military Service Institution of the United States.

Gen. Wingate insists that modern guns without gunners are as useless as guns without gun carriages, and that the calmness with which the present critical condition of affairs is borne by the nation is nothing less than wonderful. Our press and members of Congress are "fierce to resent the slightest infringement upon American rights," and we have "apparently cast off the restraint which diplomacy has imposed upon official communication between the representatives of civilized countries;" nevertheless, we leave our new defenses and high power guns without men enough to man them. as if they were a sort of "military scarecrows which would in themselves keep away an enemy as a farmer's old clothes frighten birds away from his grain."

There is a danger lest the present generation, in look ing at the final triumphs of the civil war, should lose sight of the difficulties experienced at the outset in securing arms, officers or discipline. Hasty levies of patriotic citizens are at the first little better than armed mobs, and the necessity for preliminary training which was made clear in that war is trebly strong in these days of complicated long range ordnance. In working the modern gun, with its long range and high velocity, the gunner, during the heat of an action, when shells are bursting overhead. has to work out a problem which has to include the distance of the ship, the angle of approach, the speed, the strength of the wind and its direction, the temperature and the barometer. If he makes a mistake in any one factor of the equation, or, having solved it correctly, lays the gun with a variation of sight greater than one-fiftieth of an inch, his shot is wasted.

Good work of this kind can only be obtained from carefully trained men. It is granted that in time of war a proportion of the detachment of a heavy gun may consist of new enlistments, but the proportion of these cannot safely exceed three-quarters. All the gunners must be experienced and disciplined at the outset. When the new system of forts is completed 29,000 artillerists will be required to provide one relief for the guns. Three reliefs are required in war. The pres- and 4,684,210 ton miles. Scientific American Supplement ent fortifications around New York alone require 7,000 men to man them, and when all are completed the artillery force of the United States at present numbers only 3,890 men, including ten batteries of light artillery, it would not provide even half the number of men necessary to man the present fortifications of New York. As the system of defenses when completed will conartillerists would not provide two men to a gun. It is would call for 4,000 skilled men. Army officers agree lery is capable of becoming efficient gunners; so that to clared. secure the 4,000 gunners would require an enlistment of at least 7,500 men.

from the National Guard of the States. What is shape" the additional artillerists enlisted in time of emergency. This force of 7,500 should be composed of \mid mile of line. men of a high grade of intelligence. If it is understood that this branch of the service is to be a select

training of this force should include a large amount of practice in target firing, and this could be carried out at moderate cost by fitting the large guns with auxiliary barrels of small caliber.

Although Gen. Wingate does not think it practicable to utilize our civilian soldiers in manning our heavy guns, he thinks that the government should encourage the National Guard to form field batteries, as the service of a light battery is acquired with much less difficulty than that of heavy artillery. The theory and practice can be obtained in the various armories. Government aid in the formation of such batteries has hitherto been absurdly inadequate: but if it would adopt the policy of lending to the States the guns and equipments, charging only for the perishable parts, the number of light batteries would be largely increased. One or more army officers should be detailed to each State to assist the National Guard officers in learning their duties, and a general invitation should be extended to the latter to undertake a brief course of practical instruction at the different army posts at which a regular battery is established.

The risks of war are as certain as any other risks to which a nation is exposed, and for New York the risk of bombardment, on account of the vast concentration of wealth and property, is doubly great. The Fire Department costs \$1,500,000 a year and the city pays anually \$6,000,000 in premiums against fire risk. Contrast this with the fact that the amount which the States are authorized to draw from the government for the militia is less than half a million, and it will be seen that the provision is absurdly inadequate. The estimate that \$2,000,000 per annum represents the proper amount to be appropriated for military purposes is conservative and fully justified by the facts. Of this, one million should go to increase the sea coast artillery, one-half million for the benefit of the regular infantry force, and another half million for the benefit of the National Guard, particularly in increasing the field artillery and supplying it with ammunition for the regular practice, without which it would be of doubtful value.

REPORT OF THE INTERSTATE COMMERCE COMMISSION.

The Ninth Statistical Report of the Interstate Commerce Commission for the year ending June 30, 1896. has just been submitted. It is stated in the beginning of the report that there were 151 roads in the hands of receivers, a decrease of 18 on the previous year. The length of operated mileage represented was 30,475, a decrease of 7,380 on the total of the year before. The capital stock represented by these bankrupt roads was \$742.597.698 and the funded debt was \$999.733.766.

The total mileage was 182,776, an increase of 2,119 for the year. The largest increase, 233 miles, was in Georgia and the next largest, 202 miles, in California. The aggregate length, including all tracks, was 240,129 miles. The length of second track was 10,685 miles; of third track, 990 miles; of fourth track, 764 miles. The mileage of vard track and sidings alone was 44.912 miles.

The total number of locomotives in service was 35,950, an increase of 251 over the preceding year. The number of cars was 1,297,649, an increase of 27,088. The United States employ 20 locomotives and 713 cars per 100 miles of track, and each locomotive hauled on an average 51,471 passengers, the passenger miles accomplished per locomotive being 1,312,381. The work of each freight locomotive is represented by 37,634 tons

This vast system employed 826,620 men, an increase of 41.586. Of these, 31.792 were employed in the general force necessary at this port will be 13,000. As the entire administration; 243,627 in maintenance of track and structures; 167,850 in the locomotive and car shops; and 373,747 in conducting transportation. The total amount paid out in wages and salaries was \$468.824.531.

The amount of railway capital at the close of the year was \$10,566,865,771, or \$59,610 per mile. The tain nearly 2,000 guns and mortars, the present force of | funded debt was \$5,340,338,502. The amount of stock paying no dividend was \$3,667,503,194. The amount of idle to think of having less than two skilled gunners to | funded debt which paid no interest was \$860,559,442. a gun to make it effective in time of war, and this The total amount of dividends was \$87,603,371, which would be produced by an average of 5.62 per that not one-half of the present enlisted force of artil- the amount of stock on which some dividend was de-

The number of passengers carried during the year was 511,772,737, an increase of 4,351,375 on the preceding It is not at present practicable to provide these forces 'year. The year was remarkable as witnessing the largest total of freight carried in the history of railroads in needed, and needed at once, is a sufficient force of this country. It amounted to 765,891,385 tons, an intrained gunners, men who devote their entire time to crease of 69,130,214 tons over the previous year. The their duties and are always in a state of high effici- density of the freight traffic is shown by the number ency. It will be their duty to aid in "licking into of tons of freight carried one mile per mile of line, which was 523,831, an increase of 44,342 ton miles per

The gross earnings for the year were \$1,150,169,376, an increase of \$74,797,914. This was made up mainly as one, with good pay and comfortable quarters, there follows: Passenger revenue, \$266,562,533; carriage of should be no difficulty in securing the enlistment of mails, \$32,379,819; express matter, \$24,880,383; freight good mechanics, with sufficient technical training to revenue, \$786,615,837. The passenger revenue showed render them competent to hold the position of officers an increase of over 14 millions and the freight revenue and non-commissioned officers who would control the of over 56 millions. The operation expenses were \$772,artillery force when expanded to a war footing. The 989,044, an increase of over 47 millions on the year. These expenses were assigned as follows: Maintenance of way and structures, 160 millions; conducting transportation, 440 millions; maintenance of equipment, 133 millions; general expenses, 36 millions.

The income from operation, that is, the gross earnings, after deducting operating expenses, was over 377 millions, an increase of over 27 millions. The income from other sources, chiefly leases and investments, was 129 millions, making a total income of 506 million dollars for the year. The total deductions from income were \$416,573,137, so that the net income out of which dividends and surplus were declared was \$89,631,926. This amount is 33 millions of dollars larger than the corresponding one for the previous year. The dividends declared were \$87,603,371.

The statistics show that the slaughter of railway employes continues with ghastly activity, the number of killed being 1,861, an increase of 50, and the number of wounded being 29,969, an increase of 4,273-and yet forsooth the railways are asking to be excused from equipping their trains with safety appliances. The number of passengers killed was 181, and 2,873 were injured, an increase of 11 killed and 498 injured. The number of persons other than employes and passengers killed was 4,406, and the number injured was 5,845; these figures include casualties to persons reported as trespassers, of whom 3,811 were killed and 4,468 were injured. The number of passengers carried for one passenger killed was 2,827,473, and one passenger out of 178,132 was injured. The immunity of passengers from accident is coal lying in the middle section and the lower part of shown by the ratios based upon the number of miles the upper section, the best being in the upper part of traveled, from which it appears that 72,093,963 passenger-miles were traveled for every passenger killed, and 4,541,945 passenger-miles for every passenger injured. This is a satisfactory showing, and contrasts sharply areas of western Europe, according to the Russian with the terrible fatalities among employes, where one man out of every 444 was killed, and one man out of every 28 was injured. The figures for trainmen are! Permian into beds of indubitable Jurassic age, and in still more shocking, for of these, 1 man out of every 152 was killed, and 1 out of every 10 was injured! If the commission will merely quote these shocking figures to the wealthy corporations that are just now pestering them to extend the time set for equipping the cars with couplers and train brakes, they will surely have given a sufficient answer and rebuke.

THE SEVENTH INTERNATIONAL GEOLOGICAL CONGRESS - THE CAUCASUS EXCURSION.

BY E. O. HOVEY, PH.D.

In the minds of most of the members of the congress the geological excursion to the Ural Mountains before the sessions at St. Petersburg and to the Caucasus region afterward formed an integral and very important part of the whole, for by means of these excursions geologists from all over the world have been enabled to the sessions of the congress in St. Petersburg closed some two hundred of those who had been in attendance went to Moscow to take part in the excursion to the southern part of the empire. Three days were devoted which Napoleon watched the entrance of his army into Moscow) and Miatchkowo, a place noted for its Carboniferous fossils, being the localities visited.

From Moscow the geologists went southward in three parties by routes offering different points of attraction. One section went by way of Nijni Novgorod, and down the Volga River by steamer to Tzaritsyn or Astrakhan and Petrovsk and thence by rail to Wladikavkaz. This party had an interesting view of the geological section from Carboniferous to lower Tertiary along the right bank of the river, as well as of the phenomena of Auerbach & Company, who took the property a few the great river itself and of the ethnological features shown by settlements along it. Another party went to Kiew and through the Dnieper valley to Kherson, traversing a region of special interest to students of Tertiary strata. The third and largest section visited great salt mine at Dekonskaïa, near Bakhmout. The the existence of a summit crater on Great Ararat, but of the others and will therefore receive the most de- rock salt. The series corresponds, in part at least, ance, and proper preparation. tailed description in this account.

After leaving Moscow the first stop was made September 10, at Podolsk, to examine the great quarries of the cement works located there. The strata worked are of upper Carboniferous age, covered by about ten feet of morainic clay, and are put to various uses. The clay furnishes the red bricks which are the principal material of construction used in Moscow, and a heavy bed of fossiliferous yellow lime, capable of high polish, is used for stairways and ornamental purposes.

Some of the horizons consist of almost pure carbonate of lime, which, mixed in certain proportions with the clay, produces a Portland cement, while the dolomitic (magnesian) marly layers are mixed with the clay for the production of a Roman cement.

After leaving Podolsk, a few hours were spent in the important manufacturing city of Toula, and the party went, on the same afternoon, to the Petrovskoïe coal mines, about ten miles from Alexsine.

the lower Carboniferous series, are exploited here, and some beds of pure quartz sand, also of lower Carbonif- ing mother liquor. The salt is extracted by blasting, erous age, are about to be used in a glass factory, now in process of construction near by.

This was the last place in the Moscow basin visited by the party, which then proceeded to Kharkow, where the study of the Donetz basin was begun in the geological museum of the university. Magnificent banquets were tendered the excursionists by the university and the city, which were but two of the series of fifteen banquets given this group of geologists while on their way from Moscow to the mountains. these banquets were an expression of the unbounded welcome given the foreigners by all classes of Russians, they did not greatly assist in the study of the geology of the region. Between forty and fifty general banquets were tendered the geologists during their stay in

Kharkow is one of the most important cities of southwestern or "Little" Russia, and contains a university, a technological institute and two high

Two days were spent in studying the coal fields of the Donetz basin and a mercury and a salt mine located in the same region. The Carboniferous rocks of this basin are divided provisionally by Messrs. Tschernychew and Loutougin, of the Geological Survey, into a lower, a middle and an upper section, the workable beds of the middle series. The basin of the Donetz bears much closer analogy to the coal-bearing area of our central west (Iowa, Missouri and Illinois) than it does to the geologists. The Paleozoic section of the Donetz presents a complete series from the Devonian through the addition to the mines of coal, mercury and salt already mentioned, the rocks contain deposits of gold, silver, zinc, lead and iron which are being exploited.

The coal industry is by far the most important, there being about 10,000 square miles of exposed coal-bearing strata and a still larger area which is covered by later deposits. The geologists examined the Carboniferous section near the stations of Wolyntsewo, Gorlovka, Almaznaia and Warwaropol and the upper works of some of the coal companies. Gas and coke coals and some anthracite are produced. The best beds of gas and coke coals are in highly inclined strata, but those which are nearest the axis of the main anticlinal contain the lowest percentage of volatile constituents and grade into anthracite.

The veins of cinnabar (sulphide of mercury) were discovered in 1879 by A. Minenkow, a mining engineer. They are situated near Nikitovka and are in the zone obtain a very good general idea of a great region which of the main anticlinal just mentioned. Those which is usually very difficult of access for travelers. When are actually exploited occur in three minor folds. The most important is known as the "Sophia." The belt extends in an east-west direction and the veins end within the tract of land owned by the company. The ore occurs in the joints and crevices of a gray quartzite and to studying the geology in and near Moscow; the hill impregnating a sandstone. Where the rock has been on which the Kremlin stands, the Sparrow Hills (from slickensided the cinnabar also is often seen to have been polished by the friction. A noteworthy association is the occurrence of irregularly disposed seams of coal or carbonaceous material together with and even inclosing cinnabar. The Russian geologists hold that the carbon has acted as a concentrator of the mineral. The cinnabar occurs in crystals and in massive form. The chief associated mineral is stibnite (sulphide of antimony), but pyrite occurs in some of the nearby strata. The present prosperous condition of the mine is due to the skill of Mr. A. Auerbach, of the firm of years ago, when it was almost bankrupt. Last year the product of the works was 20,000 flasks of refined quicksilver, and this year it will be still greater.

The last mine visited in the Donetz basin was the Kharkow and the Donetz basin, and went thence to upper Permian strata of the Donetz are composed there was such a crater on Little Ararat. Neither cone Wladikavkaz. This last group saw more mines and of clay, red and green marls and friable sandstones, presents any great mountaineering difficulties to an traversed a region more varied geologically than either to which are subordinated gypsum, anhydrite and to the lower red beds of the Permian of eastern Russia. In the Donetz basin the Permian beds occur only in the western part, where they border the principal area of Carboniferous beds or emerge in isolated islands from beneath more recent rocks. For many years salt has been produced at Bakhmout by evaporating brines, but it was not until 1874 that the rich beds of rock salt at Detonskaïa were discovered in a boring put down according to the suggestions of two Russian geologists, Messrs, Karpinsky and Erofelew, Between the depths of 255 feet and 765 feet (the bottom) nine beds of rock salt with a total thickness of about 340 feet were pierced. The level visited by the party of geologists is about 500 feet below the surface. The mine consists of vast chambers cut in Nos. 26 and 27 of the bore section. The combined thickness of these two beds is more than 123 feet, the upper six feet of great geological interest, while viewing beautiful scenwhich is interstratified with gypsum. The salt usually ery and seeing some of the many different tribes and

Three beds of coal, which occur in the lower part of one often meets with large nests of perfectly transparent crystals and there are many cavities containand the arched chambers thus left are impressive on account of their size and height and beautiful with their glistening white walls lighted up with the electric lamp as usual, or illuminated with red and green fire, as was done for the benefit of the geologists. Active mining here was begun sixteen years ago, but the development of the industry has been so rapid that the present annual production exceeds 16,000,000 pounds (262,000 metric tons).

After leaving the Donetz basin the route lay across the broad flat plains surrounding the Sea of Azov to the northwestern foot hills of the Caucasus range, where most of the party visited the warm and cold mineral springs at and near Piatigiorsk and Kislowodsk. The waters are sulphurous and carbonated and have great reputation among the Russians, who have made a health and pleasure resort of the region. A small number of geologists who were specially interested in petroleum went to see the oil wells at Grozny instead of visiting the mineral water region, and another small section were left behind at Kislowodsk to make an excursion into the region near Mount Elbrus.

The drive over the famous Georgian military road from Wladikavkaz to Tiflis was inspiring on account of the wild grandeur of the mountain scenery and interesting to geologists, especially the petrographers, on account of the igneous rocks which were encountered during the first half of the ride. On the southern side of the mountains the road led for miles along the side of a canyon-like valley, the depth of which was more than 4.000 feet.

From Tiflis side excursions were made to the mineral springs at Borjoom, the Tertiary coal mines of Tkwibouli, and the monastery of Ghelati by some of the geologists, while the managers were waiting for all to come over the mountains. Then two days were spent in the Baku oil region on the Caspian Sea. So much has been written about this region that the readers of the Scientific American will not care for a detailed description of it here. The refineries of the Nobel Brothers and the wells at Bibi-Eibat, Balakhany, and Sourakhany were the objective points of the visit of the excursionists. Much of the oil is still lost by evaporation from the open reservoirs into which many of the wells discharge.

On leaving Baku the great body of the geologists went directly to Batoum and there took a special steamship for the Crimea, where about a week was spent in examining the volcanoes, volcanic rocks, and sedimentary deposits of that historic peninsula from Kertch to Sebastopol. The official close of the grand excursion took place at the latter city on October 5, and at Odessa the geologists scattered to their respective homes. A party of about thirty-five separated themselves from the rest at Baku, and, leaving the railroad at Akstafa, took carriages for a side trip into Armenia, the ascent of Mount Ararat being the main object of the excursion for most of the participants. After leaving the broad plain of the Kura River, the road traverses a short section of Cretaceous and then enters the great fields of lava, which cover an immense area in Russian Armenia and stretch to undetermined distances in Persia and Turkey. The literature on the region is very scanty. The drive of one hundred and twenty miles to Erivan was made in two days of hard work, but many items of interest to petrographers were picked up en route, while the scenery is very fine. At Erivan the party divided up somewhat, twentyeight going on to Ararat and the others disposing of themselves in various ways.

The Ararats are great volcanic cones which have suffered much from erosion. Augite-andesite constitutes the mass of Little Ararat and most of Great Ararat, but basalt occurs on the northwestern flank of the latter. The snow cap prevents the determination of ascent; success is a question of endurance, persever-

Before going to the mountain the party spent a day in visiting Etchmiadzin, the headquarters of the orthodox Armenian church; and after returning from Ararat the journey led over the lava-strewn plain at the base of Mount Alighenz to Alexandropol and out to Ani. the ruined capital of ancient Armenia, which stands on a bluff made up of a series of beds of interesting volcanic tuffs. From Alexandropol the party returned to Dilijan over a part of the route of the Kara-Tiflis Railway now building, and thence to Akstafa, where the train was taken for Batoum, and the Ararat party followed their predecessors to the Crimea and out of Russia, sorry to leave a country where they had met only friendship and unbounded hospitality from everyone, from the Czar to the meanest peasant, for nearly three months, and had learned much of presents the appearance of a granular white mass, but nations that constitute the Russian empire.