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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

INCREASING RAILROAD FATALITIES.

The Interstate Commerce Commission is doing valuable work in collecting and publishing, every quarter, the statistics of railroad accidents for the preceding three months. It was only by the institution of such a commission, equipped with ample authority, that the country could keep itself informed on this most momentous question. The steam railroad enters so thoroughly into our modern life that the question of the safety of travel touches the citizen very closely, and while it is a fact that the killing of passengers is the one thing above all others that an up-to-date railroad management wishes to avoid, it cannot be denied that the publicity given to accidents by these bulletins of the Interstate Commerce Commission is a decided safeguard to the life and limb of the traveling public. On the other hand, it is a most disquieting fact that the statistics of train accidents for the year ending June 30, 1904, show not only the largest record of deaths and injuries, but one that has never been approached in any year covered by the investigations of the Interstate Commerce Commission. Last year 3,787 passengers and employes were killed and 51,343 were injured in train accidents. In the previous year, 3,564 were killed, and 45,977 injured, and in 1902, 2,819 were killed and 39,800 more or less severely injured. This is an increase in two years of nearly one thousand, or 34 per cent, in the number of killed, and over 11,500, or 29 per cent, in the number of injured. Now, just what these figures mean can be understood when we remember that they far exceed in killed and wounded the losses in some of the greatest battles of the present Japanese-Russian war, battles which we are informed will go down to history as among the most bloody on record.

In casting about for an explanation of this appalling list of casualties, various causes have been suggested. Two years ago, the increase in railroad accidents was attributed to the enormous volume of traffic due to an exceptional era of prosperity. This necessitated the employment of a large number of green hands who had to be broken to new duties, and to handle apparatus with which they were not familiar. The past two years have seen a return to normal conditions; and yet the ratio of accidents has greatly increased. Of the causes which may have contributed to this increase, we think one of the most fruitful has been the higher speeds at which trains are now run. Because of the heavier dynamic forces acting on the track, the bridges, and in the rolling stock, there must be a more rapid deterioration; moreover, the higher running speeds render the chances of avoiding collision by sudden application of the brakes smaller than they were, while the greater momentum renders a collision or a derailment proportionately more fatal. These considerations are strengthened by the fact that the weight of engines and cars has gone up enormously in the last few years, and weight is the other important factor with velocity that shortens the life of track and structures, and increases the smashing effects of a collision. It is difficult to explain the apparent increase in carelessness or absent-mindedness among employes, an increase which is very largely responsible for the growing list of fatalities. Orders apparently are read, understood, and by some curious mental aberration are entirely disregarded. This has been particularly true on single-track railroads. Many recent accidents have been due to trainmen failing to wait at the designated station for a train coming in the opposite direction. In one notorious case, the engineer and conductor were old employes who had been running that particular train carefully and successfully for many years. If accidents can happen in a case like this, the obvious lesson is that the single-track road and the train-order method of operation are an extremely perilous combination. The only sure remedy is to double-track such roads and run them under some form of the block signal system. Of course, in many cases this could not be done for the reason the outlay involved would throw the road into immediate bankruptcy; but there are undoubtedly thousands of miles of single track in the United States whose owners could well afford to make the change, and would find that in the long run it was a profitable improvement.

In the presence of this awful fatality list, does it not look as though the time had come when the Interstate Commerce Commission should be authorized by the government to render the installation of a block signal system imperative upon every road that is in a financial condition to warrant the outlay? The Commission was given such power with regard to automatic coupling and the air brake, and much fatality and suffering has been prevented by that most wise provision. If similar powers were conferred with regard to the question of signals, the Interstate Commerce Commission would succeed, we do not doubt, in reducing the annual list of deaths and injuries to a rate less alarming than that which now prevails.

THE VENTILATION OF THE SUBWAY.

It was inevitable that soon after the opening of the Subway, public attention should be directed to the question of its ventilation. When a traveling public that has been accustomed to ride on elevated railroads, where the amount of fresh air is unlimited, commences to travel in a tunnel, it will naturally be apprehensive as to the purity of the air therein; and those who have an instinctive dislike to underground travel, are pretty sure to be seized with an instant conviction that the air is more or less foul and pernicious. In the case of the New York Subway the inevitable has happened, and some very alarming statements have been made as to the small amount of oxygen and large amount of poisonous gases that are to be found there, even at this early stage of its operation.

It is not for the Scientific American to decry a reasonable agitation of this subject, inasmuch as we have several times during the construction of the road suggested that, when it came to be opened, conditions might result which would necessitate some form of mechanical ventilation in that portion of the Subway lying below 59th Street. What we do protest against is the publication of results of so-called investigations, containing statements as to the bad condition of the Subway atmosphere, which, if they were true, would involve the decimation by disease of the passengers, to say nothing of the operators who spend ten hours a day in Subway service. It is not to be expected that an analysis of the air twenty feet below ground in an inclosed four-track road that carries several hundred thousand people a day, will give as good results as that of air taken at the street level; but that conditions are anything like as bad as has been suggested, is quite out of the question. Even the London tubes, which lie at places some sixty to eighty feet underground, do not show as bad results.

A careful observation of conditions since the opening of the road, seems to prove that the theory of the engineers as to ventilation is to a certain degree correct. It was believed that the moving trains would induce sufficient drafts, and movements of the air as a body, in the Subway to maintain a thorough circulation and renewal. In the course of a trip over the whole length of the line, made with a view to special observation of this feature, a member of our staff noted that on that particular day, with a fresh northwesterly breeze blowing, strong currents of cold air swept through the westerly and northerly entrances and exits at the stations, and that an equally strong current of warm air poured out through the easterly and southerly exits. On the station platforms, it was noted that the local trains carried into the station ahead of them a body of air that moved at a considerable velocity, and that while standing on the local platform twenty feet away from the express tracks, the wave of air carried ahead of the expresses as they swept through the station was distinctly discernible. The air throughout the tunnel on that day was apparently fresh and sweet; though it must be admitted that the conditions were ideal, the trip being taken in the middle of the afternoon, when travel was not heavy, and on a day when a cold northwesterly breeze was blowing. The supreme test of the ventilation occurs, of course, toward the close of the rush hours, and on days when the atmosphere is muggy and there is no breeze blowing to assist in creating drafts at the station exits. Whether the movement of trains and the provision of eight stairway openings at intervals of a quarter of a mile along the road will prove equal to the task of periodically renewing the whole body of air in the Subway, has yet to be proved. It must be borne in mind that it is renewal, and not mere circulation, of the air in the tunnel that is desirable.

The tests which have been ordered by the Board of Health will be made with every refinement known to modern science, and the results can be accepted as absolutely accurate. If it should prove that the percentage of carbonic-acid gas exceeds the safe limit for health, it will be possible to remedy matters by the installation of mechanical ventilation on such sections of the road as may be affected. Should the present official investigation prove that changes are necessary, the public may rest satisfied that the company, which has shown such liberality in equipping the new system, as far as its rolling stock and motive power are concerned, with the very best that the state of the art affords, will do everything that is necessary to render the Subway atmosphere perfectly wholesome.

THE MINING DEBRIS PROBLEM IN CALIFORNIA.

In the early days of gold mining in California, the operations consisted of the washing and concentration of the surface gold-bearing deposits, which were found along the western slopes of the Sierra Mountains and near the headquarters of certain rivers and streams that entered the Sacramento and San Joachin valleys. The process of recovery was the simple one of washing and amalgamating, which was done at first by the simple miner's pan and riffle, and later on a much vaster scale by means of hydraulic mining. Under the latter system the gravel beds were broken up and washed into the sluices by means of streams of water directed at enormous pressure from nozzles which in some cases were as large as nine inches in diameter. Under the terrific impact of the water, whole hillsides were broken up and washed away, the quicksand and gravel being swept into the canyons and small streams in the vicinity, to be ultimately carried farther and farther down into the valleys with each succeeding season's floods. The accumulations of debris at last reached the lower and fertile valleys, where they choked up the streams and caused heavy overflows, during which the sand and gravel were carried out over the adjoining land, and deposited in enormous quantities. The complaints of the owners of the valley property resulted, in 1883, in action by the courts in California, which put a complete stop to hydraulic mining, and about ten years later, Congress appointed the California Debris Commission, consisting of three army officers, who were to permit hydraulic mining under such conditions as would prevent obstruction of the navigable waters of the United States. The commission also was charged to make plans for restoring the channels of rivers in the Sacramento and San Joachin valleys, so as to render them once more navigable.

This important work is now well under way, and the means adopted by the army engineers present one of the most interesting studies in this class of work. In the current issue of the Supplement will be found an illustrated article by one of the United States army engineers, describing the extensive work that is being done in reclaiming the Yuba River, which was selected because it had suffered more than any other river in California from the accumulation of mining debris. In 1849 the Yuba was a narrow stream running between lofty banks in its upper portion, and winding through the lowlands to a juncture with the Feather River. At the present time this stream contains over 70,000,000 cubic yards of mining debris. The lower river, once a narrow stream, is now in the neighborhood of three miles in width, and the mining debris varies from 24 feet to about 125 feet in depth. The river during low water winds through this deposit in a narrow stream, and at high stages the entire bed is covered with a rushing flood. The plan of the commission provides for holding in place, and preventing any further movement downstream, of this enormous deposit of waste material. It also aims to prevent any further accumulation, by holding back such debris as may in future be carried down from the upper reaches. These results are to be secured, first, by building barriers across the river to prevent the coarse detritus, consisting largely of heavy bowlders, from being carried down from the upper branches of the river; secondly, the provision of a huge settling basin, six miles below the embankment, for the impounding of flood waters carrying fine material, whereby the suspended matter may be deposited; and thirdly, the confining of the river to a selected channel, by means of training walls. The work that has already been done has been subjected to a heavy flood, and its action gives reason to believe that when the whole plan is completed, the government will succeed in repairing the great damage that has been effected in the Yuba district.

WORK ON THE SIMPLON TUNNEL

It is expected that the two sections of the Simplon tunnel, which are being carried forward on opposite sides, will come together by the end of the year. The work on the tunnel has been greatly hindered by the springs of hot water which were met with on the north end, and special precautions had to be taken to draw off the water as fast as it came, and also to keep the tunnel cool enough for the workmen. As far back as last November a flow of water had been encountered on the north section of the tunnel at 1,000 feet beyond the point of highest level. This made it necessary to stop all the drilling, not on account of the volume of water, which was only 20 gallons per second, but owing to its temperature, which equaled 48 degrees C. For this reason the work was suspended in the north end and during November, 1903, only 260 feet had been cut on that side, while on the opposite side 525 feet were cut. In December, the southern side had advanced 460 feet, while the northern remained stationary. In the south end some very hard rock was encountered, composed of gneiss and mica schist, and here the advancement was only 16 feet per day. The total length of the tunnel is 64,119 feet, and by December 31 the north end had reached 32,968 feet, and the south end 25,194, making a total of 58,162 feet, and leaving 5,957 feet to be finished. But on account of the water flow which had been met with in November, steps had to be taken to carry off the water before any further work could be done on that side. The hot water which had filled the tunnel in the farther end, which sloped downward, was first drawn off and the pumping was continued until the two springs at this point delivered only 20 gallons per second. The conditions were not the same here as for the cold springs on the Italian side. The hot springs come from great depths of the earth and are inexhaustible, while the cold springs are fed by surface water and the flow diminishes as this supply is lessened. When the hot water had been drawn off as fast as it appeared, it became possible to remain in the gallery, as the heat was overcome by means of atomizers. These were already in use in some parts of the tunnel.

The south end was continued until the geological inspection of the strata gave evidence that the water-bearing layer lay not far off. The work was accordingly discontinued so as to avoid meeting the water flow. In the north end a cross-gallery was dug, starting some 10 to 20 feet back of the end where the water occurred, and coming to an end at the point where the south tunnel was to stop, so that they could bore from here to the end of the latter section. At the end of each gallery a solid wall was built, and each wall had a manhole and different openings for admitting the pipes for the air, cooling water, and drain pumps, using tight joints. Beyond the two walls the work of drilling was then taken up, but this time by hand. This operation was quite successful. However, in January the work had to be suspended on the north side on account of a great water flow which reached a total of 15 gallons per second from the two springs. Two pumps were installed to draw off the water, at the 3,200-foot point of the tunnel. Drilling was then continued by hand in the parallel gallery, and on January 31 the latter had reached a depth of 32,672 feet, counting from the mouth of the main tunnel. The end of the latter remained as before at 32,968 feet. At the end of January the work of drilling the transverse gallery which led to the south end was commenced, starting from the 32,925-foot point of the main tunnel. The south tunnel advanced by 475 feet, or at the rate of 14.5 feet per working day. At this time the latter tunnel had reached 25,669 feet, which, with the 32,968 feet on the other section, gave a total of 58,637 feet, leaving 5,482 feet to be finished.

The mechanical drilling of the north end was recommenced on the 20th of March. During the month of April it pierced through calcareous schists and the advance was about 13 feet per day. The temperature at the end of the tunnel reached 115.7 deg. F. At the south end, the tunnel advanced through granitiferous mica schists with veins of quartz. The drilling progressed at the rate of 20 feet per day. The temperature here was 92.2 deg. F. The water in the south end was carried off without any trouble, as before. At the end of June there were but 2,057 feet remaining to be finished, and allowing 475 feet per month, there would still be about five months' work, and this would bring the junction of the two ends of the tunnel up to the last part of November. After this, six months more must be counted for the entire completion of the tunnel, and this gives the finishing of the enterprise at the first of June, 1905. This calculation supposes that the south end will not meet with an excessive flow of hot water when it arrives at the place where the springs are located.

The air supply plays an important rôle in connection with the tunnel construction. In the north tunnel the temperature rose as high as 119.8 deg. F., and then fell to 107.9 deg. On the other side it rose regularly to 101.1 deg. The temperature is taken at a depth of five feet in the side of the rock, as near as possible to the end of the tunnel. Great care was taken to secure a good ventilation, especially on the north side, and the result was quite satisfactory. The mean temperature of the air, in spite of the heat of the rock, is only 86 deg. F. The quantity of air sent in is only slightly higher than last year, but this air is cooled several times and in different ways before it comes to the different working points. The air is brought from the exterior by way of the parallel gallery and is cooled at the 21,870-foot point by a large water-spray apparatus. It then passes into the tunnel by one of the cross-galleries (at the 32,160-foot point) and then goes to the outside. Just back of the working front of the tunnel the walls are sprinkled plentifully by watering nozzles, and this lowers the temperature considerably. For the masonry working point there are two cooling apparatus placed at the entrance of the cross galleries. This apparatus has sixteen horizontal tubes 8 inches in diameter. In each tube is a jet of water. The air which passes in the gallery before the cooler is drawn through the tubes with great force and is cooled by the water sprays. Besides this, there are two large spray apparatus in the tunnel at the 31,600 and 26,550-foot points and another in the finished part of the tunnel at the 22,425-foot point. The use of ice cars has been entirely discontinued, as the system was not found practicable. On the south end the air is cooled in about the same way. The mean quantity of air sent into the tunnel per 24 hours is 30,000,000 cubic yards on the north side and 35,000,000 on the south.

THE AUTOMOBILE AND ITS UTILITY IN THE INDUSTRIAL DEVELOPMENT OF LATIN AMERICA.

BY MARRION WILCOX.

The employment of automobile trucks or trains which can run on ordinary wagon roads and serve as feeders to the railway and steamship lines is a subject which must before long command the attention of the governments of the Latin-American republics. By the introduction of the automobile truck or train a new era of industrial expansion is in store for South and Central America and the West Indies, which is likely to bring about the adoption of a special policy by many of the Latin-American governments. There is also an increasing social and commercial Europeanization of certain Latin-American communities going on which will aid in hastening the use of the automobile, especially in its advantages for the easy and rapid transportation of agricultural, and, to a smaller extent, of mineral products, over short distances and in regions where moderately good roads and bridges can be maintained. Within these strict limits the field is vast, and vastly interesting it is certain to become in the near future to statesmen and manufacturers alike.

Let us glance first at Cuba.

To the insufficiency of the supply of agricultural laborers is commonly, but erroneously, ascribed the circumstance that 100,000 tons of sugar cane were left in the fields of Cuba when the last crop was harvested; and now we find that the Cuban Congress has appropriated $800,000 to be expended for the encouragement of immigration—that is to say, practically to pay the expenses of families or individuals who shall cross the Atlantic (from Spain, as a rule) to help load, drive to the mill, and there unload, those primitive ox-carts and mule-carts that "creep like snail, unwillingly," with creaking remonstrance along the country roads. With excellent intentions, the Cuban government is following old-fashioned methods and practices. Of course the immigrants thus secured will serve other purposes as well; but a fact which will not escape the attention of anyone who is familiar with the conditions of Cuban agriculture is this: Given automobile trains, or capacious gasoline cars, with or without trailers (the engines and the trains being in all respects specially and perfectly adapted to the purpose of moving the sugar cane swiftly from field to mill, and the raw sugar from the mill to the railway or port of shipment) even the present laboring population would be sufficient to handle an average sugar crop thoroughly, and indeed to extend the area of cultivation. We shall realize the force of this assertion and reflect upon it as it well deserves (since it is applicable to a score of countries besides Cuba) if we remember that a large number of the best laboring men now employed in building, repairing, or driving the carts, and caring for the animals, would be available in that case for the planting and cutting. It may be said with the energy of positive conviction, though most courteously, that the best plan which the Cuban government could adopt for promoting the agricultural interests of the island would be to continue the admirable work for the improvement of highways which it has already begun, and to admit free of duty all machinery used in handling and transporting the crops.

It will be remarked with interest in this country that El Economista, a valuable review published at Havana, advocates in its issue of October 1 the reduction of duty on machinery and material for railways to two per cent *ad valorem*, with complete exemption to be accorded to that of American origin, in grateful recognition of the advantages conferred upon Cuba by the United States through the treaty of reciprocity.

A step in the right direction is thus advocated, since in Cuba, as in German East Africa and Togoland, automobile trains may soon be run on the wagon roads as feeders to the railway lines; and the Cuban government, when building bridges and improving roads, will be only following the precedent established by the German colonial administration in Africa. It is self-evident that an enormous increase in the national wealth of Cuba will result from extending the margin of cultivation, by the means indicated, so that it will include fertile tracts that lie at a distance from railway or port.

Similar but very much greater opportunities exist in other Latin-American countries. Thus it has been customary to say that the natural resources of some of the Mexican States are still almost wholly undeveloped—and, more pointedly, the mineral wealth of certain localities nearly untouched—simply because their railways, though long ago projected, it may be, are not yet in operation, or the existing lines of railway are inadequate. But good wagon-roads are common there, and it may be assumed that in automobile trains, to be run on ordinary roads, even such as have steep grades, will be found the best solution of the problem of bringing out the products of field, forest, and, in some cases, of the mines as well.

Again, in the Argentine Republic, Uruguay, and Paraguay—in general, throughout the valley which in so many respects is comparable with our Mississippi Valley—automobile trains are required in very large numbers, as feeders to railways, or as substitutes for short railway lines in many fertile regions bordering the Paraná, Paraguay, and Uruguay rivers, to transport both the products of the cattle-ranches and those cereal crops which are grown for export in rapidly increasing quantities. To southeastern Brazil, with its valuable crops of coffee, etc., the same system of transportation is applicable in a measure, though the natural features of the country are less favorable. In the aggregate, territory in Latin America nearly equal in size to all that part of the United States lying east of the Rocky Mountains may be brought within the margin of cultivation; and a year may ripen what the centuries never matured. It is a territory rich enough to secure immediately whatever is imperatively needed for its development, for we are considering now the moderately level or rolling agricultural country, the products of which are so valuable that the local governments are vying with each other to obtain immigration in many parts of the world—using the governmental resources to pay the expenses of settlers from point of departure to destination.

SCIENCE NOTES.

The 36½-ton meteorite which was brought to this country some years ago by Lieut. Peary has been removed from the Brooklyn navy yard to the American Museum of Natural History. It was necessary to use the big derrick owned by a wrecking company. The meteorite was landed at the West Fifty-fifth Street pier, Manhattan, whence it was brought to the museum on a large truck.

Up to the present it seems that hydrochinon has not been extracted from any living plant. It has now been extracted from the buds of the pear tree by Messrs. G. Riviere and G. Bailhache, of Paris. The buds are macerated in ether for a certain time, and in this case they lose the viscous matter which adheres to the scales. The ether solution is evaporated and the matter which remains is slightly heated. It is sublimed and yields some transparent crystals. The proportion of crystalline matter which is obtained is found to increase with the progress of vegetation. The experimenters show conclusively that the crystalline matter is hydrochinon, and they also prove that it exists in the buds themselves and is not a product of decomposition. What is somewhat singular is the relation between the pear and the apple tree in this respect. The buds of the apple tree do not yield hydrochinon, but on the other hand they contain a considerable quantity of phlorizine, and this latter body does not exist in the buds of the pear tree. In this way the two different species are each characterized by an appropriate chemical compound.

Among the most recent objects which have been found by the Rev. P. Delattre in the excavations at Carthage may be mentioned a sarcophagus of large size containing relief sculptures. The sarcophagus is of white marble and is painted, like some other specimens which have been found here. It was found along with some other objects at a depth of nearly 60 feet. On the two main faces of the sarcophagus is a relief which represents the monster Scylla with her arms extended. At the middle of the body are seen dogs which are facing in different directions, following the ancient tradition. The same subject has been found before upon a sarcophagus at Carthage, but in the latter case it is simply painted and not in relief. What is to be especially remarked concerning this group is that the same subject is found in the mausoleum of El-Amoroumi in Tripoli, which belongs to the later Punic period. It occurs among other well known mythological subjects. It is therefore of interest to find that at the Punic period of Carthage the myth of Scylla already occupies a prominent place. Up to the present it has only been found on Roman remains.