SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Monthly (Established 1885)..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "
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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, OCTOBER 31, 1903.

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.

A TRANSATLANTIC CLIPPER SERVICE.

A lover of the sea has been prompted to write to the daily press, suggesting, in all seriousness, that it would be a profitable and popular move on the part of our leading steamship companies if they were to add to their fleet one or two passenger sailing ships, with a view to affording those passengers who take the transatlantic trip purely for health and pleasure, an opportunity to spend more days upon the ocean than they can enjoy in a trip between America and Europe on a fast, modern steamship. At the first blush, the suggestion that we should return to the leisurely speed of the clipper sailing ship, seems almost preposterous; and yet on second thought, when we bear in mind the wonderful growth of the yachting spirit, as shown by the vast fleet of sailing yachts and steam yachts that covers our waters in the summer season, the idea is by no means visionary; and, indeed, if put into effect to a limited extent, it would probably prove to be a very successful venture. To a large and ever-growing percentage of European travelers, the sea voyage is one of the greatest inducements to make the trip. With all our vaunted advance in speed and comfort, there is a question whether we have not sacrificed many of those very features of a sea voyage which tend to give rest to mind and body. The great demand for space for engines, boilers, and coal bunkers has made it necessary to cut down the stateroom accommodation to absurdly narrow limits—so narrow that not the most elaborate furnishings and finish can disguise the fact that the average stateroom is not much more than a stuffy little box in which one is veritably "cribbed, cabined, and confined." The compensation for many travelers is to be found in the short duration of the passage, and for those to whom time is an object, either for business engagements or to escape the inevitable miseries of seasickness, the cramped quarters are regarded as part of the price which must be paid for high speed. If a clipper sailing ship, however, were designed especially for transatlantic summer travel, it would be possible, in the absence of any provision for steam power or cargo, to give up practically the whole ship to passenger accommodation, and individual staterooms could easily be made double the size of those usually found on the modern liner. There would be a complete absence of vibration, and of smoke and cinders, and a general steadiness of motion which only those who sail the seas under canvas can properly appreciate. If the ship were built with modern speed lines, it should be able under favorable circumstances to make the eastward passage in from twelve to fifteen days. The westward passage would, of course, take longer; but as the travelers on such a vessel would be taking the trip largely for the sake of the sea voyage, a three or four weeks' journey would be looked upon rather with favor than with regret. Such a vessel would be fitted with every luxury that is to be found on the modern liner, and the absence of engine-room skylights and smokestack openings, would render it possible to provide magnificent promenades extending the full length of the vessel and almost entirely free from obstruction. The experiment is surely worth a trial on the part of one of the more wealthy companies; for it would be somewhat in line with that most successful venture of the German companies, in building steam yachts of slow speed exclusively for yachting cruises of many weeks' or months' duration.

WIND RESISTANCE IN HIGH-SPEED TRAIN SERVICE.

Just now the most interesting development of electric traction is its invasion of a field which was supposed to belong exclusively to the steam locomotive—that of long-distance interurban service. The success that has already been achieved in such service on the lines already built is naturally leading electrical engineers to consider the possibility of maintaining a regular long-distance service at speeds equal to those of the steam railway. Before such a competition can be successfully carried out, however, there are certain important elements of the problem, other than those of a strictly financial and commercial character, that must be fully recognized; and, perhaps, the most important of these is the question of wind resistance at high speeds, say of 40 miles an hour and upward. In a series of trials carried out two or three years ago on the Buffalo & Lockport electric line of the International Railway Company, it was proved that at the higher speeds it requires much more power per ton to drive a single car than it does per ton to drive a train of cars. Thus, it was found that whereas a train made up of several cars required a consumption of 47 watt-hours per ton per mile for a sustained speed of 75 miles per hour, if one of these cars were detached and run over the same track under the same conditions at the same speed of 75 miles per hour, the consumption of energy rose to 137 watt-hours per ton per mile. That is to say, at the given speed a single car requires 2.9 times the expenditure of energy per ton that is necessary for the same car if it forms one of a train of several identical cars. Now, assuming that the track, the weather conditions, and the speed were the same for the single car as for the several-car train, the engineers who made the tests were justified in their conclusion that the increased power necessary in the case of the single car was due almost entirely to air resistance. In other words, the work done by the car running alone and by the same car running in the middle or at the tail end of a train of cars was the difference, to borrow from bicycle parlance, between the work done at a given speed by a rider unpaced and by the same rider when he is behind the shelter of a pacing machine. That this view of the case is correct, is further borne out by the fact that the coupling of only two identical cars for a run at 75 miles an hour, showed that only 92 watt-hours per ton per mile were necessary, as against the 137 watt-hours required by a single car. This fact presents us with another parallel to bicycle conditions; for all of us who have ridden a tandem are well aware that, where two riders may be unable to make much headway against a strong gale of wind when they are riding separate wheels, they can make good speed if they couple up for united effort on a tandem. As a matter of fact, on level roads and a well-made track, by far the most serious element of resistance will be found to be the inertia of the air, and the higher the speed, the greater will be this resistance. The front face of a moving car has to open a path for the vehicle, and set the surrounding envelope of air through which it passes more or less in motion in its own direction. The car immediately behind it has no such head resistance to encounter, and is simply affected by the sliding friction ("skin friction" it would be called in considering the case of a sailing vessel), and, of course, the surplus power of the car is thus available to assist the leading car in overcoming the head resistance. Consequently, it follows that the longer the train, supposing the cars to be similar in weight, form, and power, the greater is the power available against head resistance and the less the expenditure of energy per car necessary to maintain a given rate of speed.

This fact will, of course, exercise a powerful influence in determining the character of future high-speed, long-distance electric service; and, where each car is a separate self-propelled unit, its tendency, because of the economies secured, will be to induce the companies to operate trains made up of several cars at long intervals, rather than run individual cars at more frequent intervals. The latter system would be the ideal one for the convenience of the public; but the cost, because of the larger amount of power that would be necessary, would probably render it impossible for the electric companies to compete successfully with the steam railroads. It must be understood that these considerations apply only to high-speed service; for up to speeds of 30 miles the difference in power required per ton per mile in running cars singly and in trains is so inconsiderable as to present no serious objection from the standpoint of economy to the operation of single-car service.

Another question to which proper attention has never yet been given, whether in steam railroad or electric railroad service, is that of the superelevation of the outside rail on curves. It is true that of late years engineers of maintenance of way on steam railroads have been showing a more intelligent appreciation of the necessity for superelevation; and on certain eastern roads where a high-speed service is to be maintained over a track with heavy curvatures, superelevation has been carried as high as 8 inches, with the very best results in safety and comfort of operation. Eight inches of elevation, however, is not by any means the maximum possible, and there is no physical reason why a train should not be run at 60 miles an hour around a 10-degree curve, provided the outer rail were elevated to the point at which the pull of gravity toward the inside rail balanced the centrifugal pull toward the outside rail. The trouble on steam railroads is that it sometimes happens that a slow passenger or freight train may, through the exigencies of traffic, be obliged to run at a low speed over the highly superelevated express tracks, and in such a case the component of gravity might be so far in excess of the centrifugal force that loaded freight cars with a high center of gravity would be in danger of capsizing to the inside of the track—and this has actually happened on some eastern roads. But on the high-speed electric road of the future, it will be absolutely necessary to take special precaution in the way of fencing in the tracks, and enforcing a very rigid observance of the block signal system; and these precautions will have to be arranged so that no train will have to slow up or stop upon any of the sharper curves. With the certainty that the electric train will be running at its maximum speed on such curves, it will be possible to give extreme superelevation; and by laying out the curves on what is known as the spiral system, where the curve commences with a one-degree curve and runs up by gradual increments to a maximum of 10, 15, or 20 degrees, as the case may be, it will be possible to maintain a 75-mile service with safety on the necessarily tortuous location on which many electric lines will have to be built.

PREHISTORIC DRAWINGS OF ANIMALS, ETC., IN THE CAVE OF ALTAMIRA, SPAIN.

Messrs. Emile Cartailhac and H. Breuil recently presented a paper to the Académié des Sciences relating to the discoveries which have been made in the cave of Altamira in the province of Santander. This cave was remarked in 1880 by M. Santuola as containing numerous debris of habitation and industry of the stone age, with paintings or drawings in red and black which represented various animals with great originality. At that time these cave drawings were the only ones which had been discovered, but in the last few years the discovery of several caves of the same kind in France has shown that the ornamentation of caverns by line drawings and paintings at an epoch as ancient as the quaternary is a question which should be carefully studied, and each new find will throw fresh light on the subject.

For this purpose Messrs. Cartailhac and Breuil made a trip to Spain and examined the cave very carefully during a month or more. The region is formed of cretaceous limestone and its aspect shows a considerable underground water circulation. In many places the cave has fallen in, especially in the front part, which is thus opened for a length of 800 feet. A series of narrow galleries branch off from the main cave. One of these is 150 feet long. The traces of prehistoric habitation are numerous, especially near the mouth of the cave. Here are to be seen most of the frescoes and drawings, which at first are almost all on the roof of the cave, and extend clear to the back. Their distribution is unequal and somewhat remarkable. Numerous small characters or signs drawn in black, and formed of points and lines, are to be seen only in the farther galleries and distributed without any order or appreciable significance. Five complicated figures drawn in black are observed side by side in the end of the last gallery. They have a certain analogy with the geometric decoration which is seen on the long Australian shields, made up of lines in a varied design. Numerous animal drawings are observed in all parts of the cave. Some of these are in black, generally of small size, 20 or 30 inches high, and are often indicated by a simple outline. Others are drawn in red dotted lines or in a broad line and are better executed, especially in the front cave.

Some of the most remarkable drawings are found superposed upon the former series and are consequently more recent; the latter are of larger size and have the appearance of frescoes. The exactness of the proportions and the correctness of the outline leaves but little to be desired. This perfection in the drawing is seconded by a good technique and the utilization of all the tints and effects which can result from a mixture or juxtaposition of red and black. The outline of the animal has been generally traced beforehand by a series of light scratched lines, in which the drawing of the feet, the eyes, nostrils, and horns is most noticeable. These large drawings, from 4 to 8 feet high, are distributed over a ceiling 140 feet long by 35 feet wide. Often the natural relief of the stone and its projections, which are sometimes large, has determined the choice of the place and the character of the drawing, so that the whole or a part of the animal has the appearance of a colored relief. The animals are represented standing, running, or lying down, and their attitudes are correct as well as singular. Among the fresco drawings are noticed the Bovidæ, with the bison in the majority, also the wild boar, horse, deer, and others. In the line drawings the deer's head is the most numerous, also the wild boar, and a very fine deer's head with the horns well drawn. On the ceiling around the animal drawings are noticed a great number of curious red characters, and these seem to have a certain significance. Other