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NEW YORK, SATURDAY, OCTOBER 19, 1907.

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 t regular space rates.

OLD FRENCH MACHINERY AT PANAMA DOES GOOD WORK.

We have been so accustomed to consider the French machinery at Panama as a worthless asset, that it comes as a very gratifying surprise to learn that one of the old dredges, which had been lying in the Rio Grande River for more than twenty years, has been rebuilt at a moderate cost, and is now capable of excavating 120,000 cubic yards of material per month; or as much as can be removed by four of the most modern 95-ton five-yard steam shovels. When the dredge has been put in service at the La Boca entrance to the canal, it will be capable of doing more work than a modern dipper dredge costing $102,500. The story of the reconstruction of this derelict reads almost like a romance; for the various parts which have been used in rebuilding were all of French construction, and were found in the jungle or among other abandoned material scattered along the line of the canal, all of which had lain neglected and exposed to the action of the elements for fully two decades. Thus, the three boilers, which were found in the jungle near San Pablo, were in excellent condition, being quite free from corrosion. In good shape, also, were the two cylinders; and it seems that the engine, which was in place in the hull, was, in the words of the Canal Record, "in excellent condition, and could not be surpassed by modern machinery, either as to adjustment or economy of operation." Moreover, "the copper piping on all the machinery is of very heavy design, and shows more careful workmanship than is found in modern machinery." The excellent state of preservation is due, in the first place, to the high quality of the material, and, secondly, to the fact that it was all abundantly covered with white lead and grease when the work was shut down. This dredge is similar in type to an old Scotch dredge, which was reconstructed by the Panama Railroad Co. five years ago, and which has been steadily at work in the interim on the channel from La Boca to Maos Island, with a record of less than forty days out of commission for repairs during that time. It is expected that these two dredges will prove to be of about equal capacity; and that when both of them are in active operation, there will be a marked increase in the total yardage removed from the canal prism. The material removed is taken out and dumped in deep water by eight self-propelled old French hopper barges. It is also stated that another old French dredge of a similar type is now being repaired in the Cristobal drydock, and will be placed in commission about the last of this month.

THE FOUR-DAY BOAT.

The success of the "Lusitania" in steadily breaking all transatlantic records stands for something more than the achievement of an individual steamship company, commendable though that is, and for something more than the success of one of the two great maritime nations who are contending for supremacy on the high seas. For a technical journal the significance of the fine performance of this ship lies in the fact that it marks the successful accomplishment of a supreme effort in the development of the latest type of motive power, the steam turbine. For all his reputation for caution and conservatism, your typical Briton, when he does break away from traditions, is apt to go just a little further than his competitor, whether it be in the building of a 1,710-foot Forth Bridge cantilever, or the construction of a 45,000-ton turbine steamship. When the dimensions of the two new Cunarders were first announced, and it was learned that each was to carry about 70,000 horse-power in motors of what was then considered to be of a comparatively experimental and untried type, the marine world stood aghast that $13,000,000 should be risked on such a doubtful venture; and when the supposedly 25-knot "Lusitania" completed her first voyage with an average speed to her credit of 23 knots an hour only, or half a knot less than that achieved by the German boats with the reciprocating engine, there was much wagging of wise heads, and reiteration of "I told you so's"; and this in spite of the assertion of the owners that the ship had been jogged along on between two-thirds and three-quarters of her full power, and had come into port with 1,500 tons of coal in her bunkers.

The second trip of the "Lusitania," which commenced at 10:25 A. M. on Sunday, October 6, and ended at New York at 1:17 A. M. Friday morning, has served to set at rest all doubts as to the success of this boat. The whole voyage from Daunts Rock to Sandy Hook was completed in four days, nineteen hours and fifty-two minutes, at an average speed of just 24 knots an hour, the passage being made in five hours and four minutes less time than was taken on the vessel's maiden trip. Added significance is given to this performance by the official announcement that the vessel was not driven to her full capacity, the intention being to let her extend herself a little more on each succeeding voyage, until she has demonstrated her maximum transatlantic speed. It should be remembered that her contract with the government, on which hinges the payment of a $750,000 annual subsidy, makes it necessary for the "Lusitania" to make a complete voyage from Queenstown to New York and back at an average speed half a knot faster than was made on this trip, or 24½ knots an hour. Seeing that the "Lusitania" averaged on her trials nearly 25½ knots for 1,200 miles, there can be little question of her ability to make sure of the subsidy. When everything is thoroughly shaken down, and the officers and the crew are familiar with the ship, it will not be surprising if, under favorable conditions of a smooth sea and fair weather, she should make the run at 25 knots an hour, or in four and a half days. This would bring the ship to her dock in New York Thursday evening, and would enable not only New York, but cities far in the interior, to receive their mail one day earlier than they do at present—a convenience which, in itself, would go far to justify the great expense of the construction of these two fine ships. The arrival of these boats on Thursday evenings could be made a certainty by setting the hour of departure of the last mails from London three or four hours earlier in the day than at present.

In addition to securing the land-to-land record, the "Lusitania" on two days broke the record for all-day steaming, doing 608 knots on one day and 617 knots on another, as against the highest previous record of 601 knots, credited to the "Deutschland." Her average speed of 24 knots an hour is about half a knot faster than the highest average of the "Kaiser Wilhelm II." and the "Deutschland." In looking back over the record for the past fifty years of transatlantic travel, it is interesting to note how steady has been the increase in speed and the reduction in time. In 1856 the "Persia" crossed over the same course in 9 days, 1 hour, and 45 minutes. The first eight-day boat was the "Scotia," which in 1866 cut the record to 8 days, 2 hours, and 48 minutes. To the "City of Brussels" is due the credit of being the first seven-day boat, her time being 7 days, 22 hours and 3 minutes, made in the year 1869. It took eleven years to bring the record below seven days, the honor of this performance falling to the "Alaska," which, in 1882, made the trip in 6 days, 18 hours, 37 minutes. Seven years later, in 1889, the "City of Paris," the first of the twin-screw liners, reduced the time to 5 days, 19 hours and 18 minutes. To develop the four-day boat has required eighteen additional years of development; and apparently the feat became possible only with the advent of the Parsons steam turbine.

PROSPECTS OF RELIEF OF BROOKLYN BRIDGE CRUSH.

The Public Service Commission is to be congratulated upon the lucid analysis which it made in a recent report on the causes of the Brooklyn Bridge crowding and the probabilities of its early relief. The congestion was rendered inevitable by the fact that the Brooklyn Bridge is practically the only avenue between the two most important boroughs of the city, and that no less than eight elevated lines in Brooklyn are focused onto the single elevated bridge track, and sixteen Brooklyn surface lines converge onto the one trolley track. Evidently, the most rational method of relieving the congestion would be to divert as many of these tracks as possible to other river crossings, whether by tunnel or bridge. This, however, will take time, and can only be done by degrees as the various alternative routes are completed and put in operation.

Meanwhile, it is possible to quite materially reduce the congestion by putting in operation various devices and plans designed to give temporary relief. One of the most important of those which have been adopted by the Commission, is to do away with the change of cars at the Brooklyn terminal during the rush hours, and introduce a service of through trains. This through service, and the better distribution and handling of the passengers at the Manhattan terminal, will be greatly facilitated by the construction of the large station which is to be erected on the site of the Staats Zeitung building, where the necessary clearing and excavation is now being pushed with great activity. The steps for immediate relief ordered by the Commission include the construction of new types of surface cars with double-size platforms to facilitate quick loading; increased policing to prevent disorder; increased traffic regulations to prevent obstruction on the roadways; the lengthening of the elevated terminal at the Manhattan end of the bridge to accommodate six-car trains; and the rearrangement of the Brooklyn terminals to enable additional empty trains to start in Brooklyn.

Although the above-mentioned changes will have an immediate and beneficial effect in loosening up the congestion, the fundamental remedies are to be found, as we have said above, in the opening of other routes across the East River. The first relief of this kind will occur within the next few months, when the completion of the Battery tunnel will deflect a considerable portion of the travel from the bridge. Another important agent will be found in the connection of the Brooklyn Broadway elevated road with the Williamsburg Bridge, so that through trains may be run to the new station which is being constructed below Delancey Street. The completion of this work will cause a considerable portion of the Williamsburg and Ridgewood travel to come to Manhattan by the Williamsburg in preference to the Brooklyn Bridge. The greatest relief to the Brooklyn Bridge of any single improvement under way will be afforded in about two and a half years' time, when the Center Street Subway from the Williamsburg Bridge to the City Hall, Manhattan, which is now under active construction, is completed; for the new route will afford the most direct line to Manhattan for the populous district lying between Williamsburg and Jamaica.

The Commission, judging from the present state of the work, believes that soon after the completion of the Center Street Subway, the new Manhattan Bridge, which is being built about a quarter mile to the east of the Brooklyn Bridge, will be completed and ready for traffic. As this structure will provide four sets of tracks for trains instead of one set, as on the Brooklyn Bridge, it is reasonable to expect that upon its being thrown open for service, the Brooklyn Bridge congestion will become a thing of the past. Moreover, immediately upon the completion of the Manhattan Bridge, the older structure will be taken in hand by the Bridge Department for a thorough reconstruction and strengthening and an enlargement of its present capacity.

BATTERY TUNNEL READY IN TWO MONTHS.

Apropos of the prospects of early bridge relief, we note that, if the forecast of the recent special report by Chief Engineer Rice on the Battery tunnel to Brooklyn proves to be correct, this most important section of the Rapid Transit system will be open for service in about two months' time. The present condition of the contract is that the first section in Manhattan is in operation; the third section in Brooklyn is well advanced; and the second section, the completion of which has been delayed by various more or less serious mishaps, is "in a fair way of being put in operation in about two months' time." In this section the tubes are practically complete and ready for track laying and the installation of the signal system, except for the section from the middle of the river to the Brooklyn shore. In this particular stretch of the tunnel a variety of work is being done to finish the tubes. The reconstruction work proper is entirely finished; the piles are all down, and the lining has been made watertight. The principal work remaining to be done before laying tracks consists in lining the roof and sides of the tunnel where the bottom is in fine sand, and in finishing the ventilating shaft. The report states that on account of the methods pursued by the sub-contractor, the extent of the variation provided for in alinement and grade when the tunnel was designed, was exceeded; but that those portions of the tube in sand where the trouble occurred have been now so reconstructed, that a clearance of four inches as a minimum can always be maintained throughout the work. This minimum conforms to the clearance which exists throughout the Rapid Transit Subway in Manhattan, of which this work has been made a part.

In view of the fact that the stability of a portion of the Battery tubes has been seriously called in question by more than one expert who has reported upon them, we have asked the Chief Engineer for a statement as to the exact condition of this work. He assures us that the whole of the tunnel in both tubes, from shore to shore, is a perfectly safe and reliable work; that considering the nature of the material through which it passes, it is remarkably dry; and

that when the calking and concreting have been completed, there will be no question whatever as to its dryness and security.

SOME MECHANICAL ADAPTATIONS IN ANIMALS.

BY R. LYDEKKER.

Every one of the higher animals is in some way mechanically adapted to its mode of life and surroundings; a horse or an antelope being from one point of view a living galloping or trotting machine. Putting such examples on one side, there are numerous cases of more peculiar adaptations to which attention may be confined.

Taking climbing animals first, it may be noted that a number of species, such as Old World monkeys and squirrels, present no special modifications for a life in the trees, the essential being that they should have the power of rotating the forearm on the upper portion of the limb and that their toes should be mobile, and furnished with nails or claws.

There is, however, a group of African rodents, designated scaly-tailed squirrels, the members of which seem to have felt the necessity of additional aid for the purpose of tree-climbing. They have accordingly developed on the under surface of the tail certain structures which may be compared to the climbing-irons used by workmen. These take the form of a few transverse rows of large, triangular, horny scales, with their points directed backward. These scales, when pressed against the bark of a tree, must afford material aid in climbing. Another group of animals in which "climbing irons" have been developed is that of the scaly anteaters, or pangolins, of India and Asia—creatures which look more like living fir-cones than mammals. The scales—much larger than those of the scaly-tailed squirrels—cover both surfaces of the body, as well as the head and limbs, so that it can scarcely be supposed they have been developed for climbing. Indeed, only a few species climb; but these have found the assistance afforded by the scales on the under side of value in an ascent, and habitually make use of them as climbing-irons.

Quite a different type of climbing, or rather hanging, apparatus has been developed in the sloths of tropical America, which spend their time in the tree-tops, where they remain suspended back-downward by their hook-like claws. These claws, which may be three or two, have been modified from ordinary claws, and afford a striking instance of adaptation to an abnormal mode of life. The thumb of bats is likewise modified into a hood-like claw—also used for suspending purposes when the creatures hang head upward. Generally, however, bats suspend themselves head downward by the hind claws, grasping power being retained by the toes, so that the modification has not been carried to the same extent as in sloths, in which the claws act in a mechanical manner.

Certain bats appear to have found their hook-like thumbs and hind feet insufficient for suspension, and have made use of the sucker principle for this purpose. This mode of suspension has been developed independently in two distinct bats, one a native of Brazil and the other of Madagascar. In the Brazilian species the suckers take the form of stalked disks attached to the palms of the thumbs and the soles of the feet. The suckers of the Malagasy species are horseshoe-like. By means of the suckers these bats are able to ascend vertical surfaces. Very curious is it to note the similarity between the suckers of these bats and those on the arms of cuttle-fishes. The geckos which run up the walls and over the ceilings of houses in warm countries, afford another instance of the sucker principle. Bats are not the only mammals which have availed themselves of the sucker. In the Malay islands and the Philippines dwell large-eyed and slender-limbed little lemur-like creatures known as tarsiers, whose habits are nocturnal. In these weird little animals the tips of the toes are expanded into cushion-like disks, capable of acting as suckers, by means of which they ascend such smooth surfaces as the stems of bamboos.

Hoofed, or ungulate, mammals, such as sheep, pigs, camels, and elephants, have given up using their forelimbs in a hand-like manner, and employ them solely for progression. Consequently, tree-climbing is out of their line. In Africa and Syria there occur, however, certain representatives of the order known as rock-rabbits, or hyrax, the Syrian species being the one referred to in the Bible as the coney (the old name of the rabbit). Certain African hyraxes have, however, taken to tree-climbing, and the way they manage it is this: In each foot the sole is somewhat cup-shaped, and by the aid of muscular action the center can be more elevated, so that when the edges are applied to the bark the foot acts like a sucker.

This sucker-like action in the feet of the tree-hyraxes is probably of recent origin, since it is certain that these animals have taken to an arboreal life at a late stage in their career. Enlisting the services of the tail to act as a fifth hand in climbing, is, on the other hand, in all probability a feature of great antiquity, seeing that it occurs in the American opossums, which are among the oldest of mammals. Doubtless, however, this development of grasping power in the tail has occurred independently in several groups. It is found not only in the American opossums, but also in their Australian cousins, which naturalists designate phalangers, and likewise in most South American monkeys, as well as in the tree-anteaters and tree-porcupines of America. In all these the extremity of the tail has a portion of its lower or upper surface naked, and marked by transverse ridges and grooves, which when applied to a bough by curling the tail-tip round it, give great grasping power. The fact that either the upper or the lower surface of the tip may be naked, implies the independent origin of the grasping power in different groups. Prehensile tails are more common among mammals inhabiting the forests of tropical America than anywhere else. The kinkajou, a relative of the raccoon, is a creature in which this feature is developed. So great is the grasping power of tails of this type that opossums and spider-monkeys when shot will remain suspended. In spider-monkeys the thumb has disappeared, although whether this is connected with the development of grasping power in the tail is not easy to decide. Probably there is no connection between the two features, the loss of the thumb being the commencement of the reduction of the hand to the hook-like organ of the sloths.

None of the animals mentioned above use their tails for any other purpose than grasping boughs, or, in the case of opossums, the caudal appendages of their parents. The Australian rat-kangaroos have, however, gone one better than this, for they employ their tails for carrying grass and other herbage for building their nests. Whether these prehensile tails are inherited from arboreal ancestors, may be a question, although they are probably a new development.

The trunk of the elephant, when contrasted with the tail of the kangaroo-rat, affords an example of the fertility in resource in animal development. In this case the specialization has proceeded farther than in the kangaroo-rat, so that the trunk is capable of serving many of the purposes of a hand. One of the most remarkable points connected with this organ is that it has been developed in the group of ungulate mammals which, as already mentioned, have abandoned the use of their fore limbs as hands, and become specialized for progression on the ground. The elephant's trunk (a development of the nose and upper lip) is therefore in one sense a confession of failure and consequently a sort of makeshift arrangement. By this I mean that in the elephant group the abolition of hands would not work, and consequently some other contrivance had to be invented to take their place.

One more instance and I have done. The antelopes and their kin are the descendants of short-limbed marsh-loving animals with large four-toed splay feet adapted to support them on yielding ground. Antelopes, on the other hand, are made for racing over hard, open plains, and their limbs are consequently long and slender, with the lateral pair of hoofs on each foot small and useless or wanting. Certain African antelopes, and more especially the situtunga of the equatorial lakes, have, however, gone back to the habits of their four-toed ancestors, and pass their time in the water or on the yielding mud of the great lakes. Now although there may be a reversion in the matter of habits, there is never any going back in nature as regards structure, and consequently the rudimentary lateral toes in these water-antelopes could not be restored to their original size. Nature is, however, resourceful, and the way in which she has managed matters in this instance is by elongating the two main hoofs, thereby giving to the situtunga a power of sustaining itself on yielding ground to as great an extent as was the case with its many-toed forerunner.

THE WATER SUPPLY OF THE UNITED STATES.

Water is by far the most important among the vast natural resources of the United States; and with the growth of cities and towns, and the advance in sanitary science, its importance is becoming more strongly emphasized each year. While large cities spend scores of millions of dollars to secure a supply of pure water, millions of acres of arid land offer agricultural possibilities provided irrigation can reach them. The rapid settling of the country adds to the problem; for while it calls for additional supply, it at the same time contaminates surface waters. The pioneer may drink from the nearest stream; the town dweller must be chary of his own well. Like other natural supplies, water has suffered in the past—and is still suffering—from neglect and waste. The consequences of deforestation—the spring floods and changing river beds; here scoured and there silted—are well known. When a well is tapped, it is at once declared "inexhaustible." In answer to this, the ground-water level in northern Indiana has fallen ten feet in ten years.

Water is a vital necessity, but it is also of great economic value. Water power for the generation of energy, water depth for the navigation of our rivers and canals, the transportation of water for irrigation purposes, are problems in which vast capital and much labor are invested. Many large projects calling for the use of water have been doomed to failure, owing to the fact that plans were made and work undertaken without sufficient knowledge of the conditions governing the supply.

The investigation of water supply is too broad a problem for State handling. Many streams traverse more than one State, and the needs of one may be the handicap of another. The United States Geological Survey has therefore been commissioned to undertake the work. Special appropriations have been made by Congress, and for several years systematic records have been made of river flow, with the view of ultimately determining all the important features governing the flow of the principal streams of the country. The more important streams are being first measured; stations are established on them, and maintained for a period long enough to insure adequate average records. When sufficient data have been obtained, the work is discontinued at that point, and transferred to some other stream. During 1906 flow was studied at about 700 stations, distributed along the principal rivers throughout the United States. In addition to these records, data in regard to precipitation, evaporation, water power, and river profiles were obtained in many parts of the country.

Correct measurement of surface river flow calls for a skilled collecting of data, and much after-calculation. But it is straightforward work when properly undertaken. In the case of underground supplies of water, the problem is complicated by the difficulty of obtaining complete data. Until the folding and faulting of geologic horizons are more fully known than they are at present, it will not be possible to make the fullest or most economical use of underground water supplies. It is unfortunate that while many deep borings have been made, samples of the cuttings have been carelessly preserved or labeled, or even destroyed. In some of the Western States, where the rainfall is slight, future prosperity depends on the tapping or transportation of water. In many cases an adequate supply is stored under foot, waiting to be tapped. If the geologic horizons were fully mapped, it would be possible to indicate the exact spot for borings, to obtain the maximum flow of water. Under present chance methods of boring, some wells gush out and send millions of gallons of water to waste; others flow feebly or cease altogether. Sometimes a well is sunk which robs some other well of its flow, and in some districts of artesian wells the water level is gradually falling.

Many eastern and southern sections of the country are to-day suffering from ignorant tampering with water or water-collecting areas in past years, and a similar carelessness in the West of to-day might lead to similar trouble there in the future. It is well that the seriousness of the question is fully understood at headquarters, and is being gradually appreciated throughout the country. With wider knowledge comes a hope that this greatest of our natural resources will be developed in a broad-minded, conservative manner.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1659, presents an unusual number of practical and useful articles. In the first place, we must mention Bradley Stoughton's excellent contribution on the Modern American Blast Furnace, in which the practical aspects of smelting are considered. The value of original research to applied science and engineering forms the subject of a brief paper. Mr. Henry C. Ter Meer writes on a method of constructing a modified electrical meter bridge, which is of such design that it can be made by anyone possessing a little mechanical skill, and at a cost which should not exceed five dollars. Mr. J. H. Morrison's paper on the development of armored war vessels passes to an eighth installment. "How Monazite is Mined" is the title of an article which should appeal to every householder, inasmuch as the mineral enters so largely into the composition of Welsbach and other forms of incandescent gas mantles. E. Ramakers contributes a copiously illustrated article on the laying of the Pupin telephone cable under Lake Constance in Switzerland. Felix Singer writes on aluminium coils, and prophesies for them an important future. The work of Berthelot, Mendeléeff, and Moissan is excellently reviewed. Dr. H. Liepmann, in an article on the left hemisphere of the brain, tells much that is new about the influence of the brain on the use of the arms and hands. Charles F. Holder tells how marine animals, such as starfishes, are photographed in their native element. The discus thrower of Castel Porziano, one of the famous statues of the Greek sculptor Myron, has probably been incorrectly restored, if we may judge by some fragments of an ancient marble copy which were discovered in July, 1906. The probable appearance of the discus thrower is depicted and described.