THE GREAT ANT-EATER AND ITS YOUNG.

BY C. F. HOLDER.

The ant-eaters (*Myrmecophagidæ*) form one of the most interesting families known to science, and comprise a number of forms that, as their name indicates, gain a living by assaults upon the nests of ants found in the countries to which they are indigenous. The largest and best known of the family is the great ant-eater, or ant-bear, which is covered with long, coarse, shaggy hair, except the head, where it is short and close; it has a very long and slender head, and a bushy black tail of enormous size and length, the whole animal measuring often eight feet from the tip of the snout to the extremity of the tail. Being plantigrade, it stands lower on the hind legs than before, which is the case with bears and other quadrupeds similarly formed. It has four toes on the fore feet, the second and third being provided with long, sharp-pointed, and trenchant claws; so that nothing upon which it has an opportunity of fastening can escape. The hind feet have five toes, furnished with short weak claws, resembling those of ordinary quadrupeds. In the fore limbs we notice that the ultimate phalanges of the toes, which support the claws, are so constructed as to allow the movements of the latter being restricted to flexion inwards; and in order to maintain this position there are powerful ligaments which keep the phalanges directed toward the palm, and never allow the digits to be stretched out in the manner of the plantigrade carnivora. The relative size and strength of the toes are also very significant in this family; in those which have five toes the central digit attains an enormous bulk, while the outer pair are comparatively very small. And, in order to afford adequate power for the digging and burrowing propensities of these animals, the phalanges are all closely connected together up to the base of the ultimate phalanx, converting the hand into a kind of trowel, similar to that found in moles.

From what has been advanced, it will readily be remarked that ant-eaters do not walk on the soles of their feet; neither do they tread on their strongly-curved toes, which would damage the claws, but, in the fore feet at least—as may be seen by referring to the engraving—the anterior part of the body is seen to rest entirely upon their outer edge; and that part of the hands thus subjected, as it were, to an unusual pressure, is, in these creatures, supplied with an efficient callous pad to protect the outer phalanges from injury.

THE GREAT ANT-EATER AND ITS YOUNG.

The prevailing color is a deep gray, with a very broad band of black running from the neck downward on each side of the body; its habits are slothful and solitary; and it sleeps during the greater part of the day. It lives entirely upon ants, to procure which it opens their hills with its powerful crooked claws, and draws its long flexible tongue, which is covered with glutinous saliva, lightly over the swarms of insects who flock from all quarters to defend their dwellings. It is a native of Brazil and Guiana.

It seems almost incredible that so robust and powerful an animal can procure sufficient sustenance from ants alone; but this is nothing strange to those who are acquainted with the tropical parts of America, and who have seen the immense quantities of these insects, which swarm in all parts of the country to that degree that their hills often almost touch one another for miles together. The favorite resort for the great ant-eaters is the low swampy savannas, along the banks of rivers, and stagnant pools.

The enormous claws of the forelegs are terrible weapons. Waterton records an instance of their power in his "Wanderings," and in Brown's "Canoe Life in Guiana" there is a similar account. He says: "We had not gone many miles before the guide lost the path, and we all scattered to look for it. In doing so, I almost walked on the top of a sleeping ant-bear, which, springing up, sat on its hind legs, and grasped at me with its huge fore claws. I sprang quickly to one side, and thus escaped. Thinking that it was good eating, I shot it, but the Indian said that it was not wholesome food, although, from the great interest they took in seeing it killed, I thought it was." (Waterton says that its flesh is good eating.)

These large ant-eaters are very dangerous customers, and have been known to kill men. Williams told me that an Indian, living near Roraima, was hunting in the forest to the north of that mountain with some others, armed with his long blow-pipe. In returning home, considerably in advance of the rest of the party, it is supposed that he saw a young ant-eater, and, taking it up in his arms, was carrying it home, when its mother gave chase, overtook, and killed him; for, when his companions came up, they found him lying dead on his face in the embrace of the ant-bear, one of its large claws having entered his heart. In the struggle he had managed to stick his knife behind his back into the animal, which bled to death, but not before the poor fellow had succumbed to its terrible hug. It was evident that he had only heard the ant-eater coming when it was close upon him, and in turning round to look, his blow-pipe got caught across the path in front of him; then, as he turned to run, it formed a bar to his progress, and he fell over it as the animal seized him. So firmly had the animal grappled him that to separate it from the corpse the Indians had to cut off its fore legs.

It is very rarely that an opportunity offers to observe in this country the habits of one of these curious creatures, but recently an ant-bear was brought here alive from South America, and on the passage gave birth to two young, which the writer afterward saw, and watched with great interest their movements about the mother. The poor creature fared badly on the voyage to the United States, as the sailors were ignorant of the nature of the animal, and its curious appearance impressed them with such a feeling of aversion that no one could be found to approach the family of compulsory immigrants, and they were only kept alive by the boiled eggs that were tossed them by some of the more humane of the crew. The little ones, as we saw them, were about a month or six weeks old, and were perfect images of the mother, with the exception that the tail was not so large in proportion to the body, and the curious color markings were not so pronounced as in the adult. As we approached the cage, nothing could be seen but a bunch of coarse grizzly hair; but a word from the owner, and the enormous tail of the parent was raised, and the young were seen. She was lying on her side, the young embracing her abdomen, after the fashion of young monkeys, and over all came the tail of the mother, shutting and inclosing them like a lid, forming effective protection. As she clumsily rose the young scrambled over and attained a position on her back, clinging to her with their long claws, their bushy tails in air, lost in the voluminous folds of the mother's, that covered them even now as a canopy, being equally protective.

At a word from the keeper, she came laboriously toward us, walking upon the outside of her sharply clawed feet, and the long noses of the entire family were presented and rubbed against our hands with every demonstration of friendliness.

The tongue is extremely long, and below its roots are two large glands that emit a glutinous secretion that is so effective in conveying the swarms of ants to its mouth. They were fed exclusively upon hard boiled eggs, upon which we were informed they thrived. The climate, however, is against them, and since our first visit one of the young has died, and the other will probably follow.

In the accompanying illustration the position of the young on the mother's back is shown, where they presented an amusing spectacle.

The little ant-eater occurs also in Brazil and other countries of South America. Its habits are similar to those of its more powerful species.

Von Sack, in his "Voyage to Surinam," gives an interesting account of the tame ones in his possession; and, after describing their characters, he tells us that the inhabitants of that country aver that when captured these animals cannot be induced to eat, and only lick their paws after the fashion of a bear. "When I obtained the first," he says, "I sent to the forest for a nest of ants, and during the interim I put into its cage some eggs, honey, milk, and meat, but it refused to touch any of them. At length the ants' nest arrived; but the animal did not pay the slightest attention to it either. By the shape of its fore paws, which resemble nippers, and differ very much from those of all the other species of ant-eaters, I thought that this little creature might perhaps live on the nymphæ of wasps, etc. I therefore brought it a wasps' nest, and then it pulled out with its nippers the nymphæ from the nest and began to eat them with great eagerness, sitting in the posture of a squirrel. I showed this phenomenon to many of the inhabitants, who all assured me that it was the first time they had ever known that species of animal to take any nourishment. The ants with which I tried it were the large termites upon which fowls are fed here." According to Von Sack and most observers, the tail is employed as a prehensile organ. It is larger than the body, very stout and broad at its origin, thickly clothed with short hairs, and much attenuated toward the extremity. Generally speaking, the fur displays a thick, soft, shining, woolly texture. The female, it is said, produces a single young one at a birth, although it is furnished with four mammæ.

In the Old World the ant-eaters are represented by the aard-vark and spiny ant-eater (*Echidna hystrix*), the latter a curious creature with a long, slender, toothless bill, with a palate armed with rows of strong sharp spines; the tongue is similar to that of the great ant-eater of South America, while the body is covered with quills like a porcupine. It is common in various parts of Australia, Port Moresby, New Guinea, and quite recently a new species has been discovered in Northern New Guinea.

The aard-vark, a South African ant-eater, is a strange-looking creature, and a very distinctive character is seen in the head, which has long-pointed ears; while the tail, being of moderate length, not so long as the body, is very thick, rounded at the root, and densely clothed with hair. Altogether it is a stout, heavy animal, the large bones of the neck, in particular, demonstrating its strength in the cervical region. The fur, which is very scanty, is generally of a grayish-brown color. The permanent teeth of the adult, twenty in number, have a simple form and structure, being made up of rootless cylinders, those in front displaying a slightly flattened aspect at the sides. It is rather larger than the common badger, attaining a length of upward of four feet. Its habits are nocturnal, and it constructs large subterraneous burrows with extraordinary rapidity. It ap

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pears to live entirely upon ants, and for this purpose the tongue is largely developed, and armed with a glutinous secretion. It is not so long, however, as in the true ant-eaters, while it is at the same time more flattened and attenuated. The aard-vark invariably fixes his retreat near to some large ants' nest, which he ventures only to attack after dark. He is a timid creature, and does not move far from his burrow; and when attacked, should he succeed in gaining access to his abode, it is next to impossible to get him out, for it is said he can burrow faster than his enemies can dig. According to those who have witnessed its method of procuring food, the aard-vark, having approached an ant-hill, forthwith proceeds to scratch a small part of it, just sufficient to allow of the introduction of its long, narrow snout. These ant-hills are sometimes three or four feet in height, and contain myriads of insect inhabitants—strongly ensconced in fancied security complete!

"Here," observes Mr. Ogilby, "after having previously ascertained that there is no danger of interruption, he lies down, and inserting his long slender tongue into the breach, entraps the ants, which fly to defend their dwellings upon the first alarm, and, mounting upon the tongue of the aard-vark, get entangled in the glutinous saliva and are swallowed by whole scores at a time. If uninterrupted he continues this process till he has satisfied his appetite; but on the slightest alarm he makes a precipitate retreat, and seeks security at the bottom of his subterranean dwelling. Hence it is that these animals are seldom seen, even in those parts of the country in which they are most numerous. Like other nocturnal animals, passing the greater part of their lives in sleeping and eating, they become exceedingly fat, and their flesh is considered to be wholesome and palatable food. The hind-quarters particularly, when cut into hams and dried, are held in great esteem."

There are some ants that these animals cannot face, and the so-called fire ants of South America will put to flight the largest ant-bears.

To any one who has handled the soft, velvety nose of these animals, it is a mystery how they are able to withstand the savage attacks to which they are subjected. The rapid movement of the snake-like tongue, however, is probably the secret of its boldness.

Our Ancestors.

BY GRANT ALLEN.

There are few questions more immediately interesting to Englishmen than the question: Who are our ancestors? From what elements and in what proportions are we compounded? May we consider ourselves as all pure Teutons? or are we partly Celts as well? Furthermore, may we even reckon among our immediate ancestry some still earlier and less historical races than either of these? Such questions are full of practical importance to ourselves, and they are also of a sort upon which modern investigations into language and the science of man have cast a strikingly new and unexpected light.

Of course, in considering the origin of Englishmen, we must look at the matter in no petty provincial spirit. We must include roughly in that general name Welshmen, Scotchmen, and Irishmen as well; and if our friends in the north prefer to speak of Britain rather than of England, I am sure I, for my part, will have no objection. There are many learned modern historians, with Mr. Freeman at their head, who will tell us that Englishmen are almost pure-blooded Teutons, of the same original stock as the Germans, the Dutch, and the Danes and Norwegians. But when we come to inquire more fully into their meaning, it turns out that they are speaking only of the native inhabitants of England proper and the Scotch Lowlands, without taking into consideration at all the people of Wales, Ireland, and the Highlands, or the numerous descendants of immigrants from those districts into the southeastern half of Great Britain. Even in the restricted England itself, these same doughty Teutonic advocates admit that there is a nearly pure Celtic (or pre-Celtic) population in Cornwall, in Cumberland, and in Westmoreland; while the western half of the Lowlands, from Glasgow to the border, is also allowed to be inhabited by a mainly Welsh race. Furthermore, it is pretty generally granted by our stoutest Teutonic champions themselves, that the people of Dorset, Somerset, and Devon, of Lancashire, Cheshire, Shropshire, Herefordshire, and Worcestershire, are all largely mingled with Celtic blood. Thus, in the end, it appears that only the native inhabitants of the Lothians and the eastern and southern coast of England are claimed as pure Teutons, even by those who most loudly assert the essentially Teutonic origin of the English people. We may possibly find that this little Teutonic belt or border itself is not without a fair sprinkling of earlier blood.

Perhaps the best way to clear up this question will be to glance briefly at the various races which have inhabited these islands, one after another, and then to inquire how far their descendants still exist in our midst, how large a proportion of our blood they have contributed, and whereabouts their representatives are now mainly to be found. Of course, in such an inquiry we can only arrive at very approximate results, for in our present advanced stage of intermixture, it is almost impossible for any man to say exactly what are the proportions of various races, even in his own person. Each of us is descended from two parents, four grandparents, eight great-grandparents, and so forth; so that, unless we could hunt up our pedigrees in every direction for ten generations, involving a knowledge of no less than 1,024 different persons at the tenth stage backward, we could not even say how far we ourselves were descended from Irish, Scotch, Welsh, or English ancestors respectively. As a matter of fact, every one of us is now, probably, a very mixed product indeed of Teutonic, Celtic, and still earlier elements, which we cannot practically unravel; and, perhaps, all we can really do is to point out that here one kind of blood is predominant, there another, and yonder again a third.

The men of the very earliest race that ever lived in England are probably not in any sense our ancestors. They were those black fellows of the palæolithic or older stone age, whose flint implements and other remains we find buried in the loose earth of the river-drift or under the concreted floors of caves, and who dwelt in Britain while it was yet a part of the mainland, with a cold climate like that of modern Siberia. These people seemed to have lived before and between the recurrent cold cycles of the great glacial period; and they were probably all swept away by the last of those long chilly spells, when almost the whole of England was covered by a vast sheet of glaciers, like Greenland in our own time. Since their days Britain has been submerged beneath several hundred feet of sea, raised again, joined to the continent, and once more finally separated from it by the English Channel and the Straits of Dover. Meanwhile our own original ancesters—the people from whom by long modification we ourselves are at last descended—were probably living away in the warmer south, and there developing the higher physical and intellectual powers by which they were ultimately enabled to overrun the whole northern part of the Old World. Accordingly, interesting as these older stone-age savages undoubtedly are—low-browed, fierce-jawed, crouching creatures, inferior even to the existing Australians or Andaman Islanders—they have yet no proper place in a pedigree of the modern English people. They were the aboriginal inhabitants of Britain; but their blood is probably quite unrepresented among the Englishmen of the present day.

Long after these black fellows, however, and long after the glaciers of the ice age had cleared off the face of the country, a second race occupied Britain, some of whose descendants almost undoubtedly exist in our midst at the present day. These were the neolithic, or later stone-age men, who have been identified, with great probability, as a branch of the same isolated Basque or Euskarian race which now lives among the valleys of the Western Pyrenees and the Asturias Mountains. They seem to have crossed over into Britain while it was still connected with the Continent by a broad isthmus, or, perhaps, even by a long stretch of land occupying the entire beds of the Channel and the German Ocean. Our knowledge of them is mainly derived from their tombs or barrows—great heaps of earth which they piled up above the bodies of their dead chieftains. From these have been taken their skeletons, their weapons, their domestic utensils, and their ornaments, all the latter objects having been buried with the corpse, for the use of the ghost in the other world. From an examination of these remains we are able largely to reconstruct the life of the Euskarian people—the earliest inhabitants of Britain whose blood is still largely represented in the existing population.

In stature the neolithic men were short and thickset, not often exceeding five feet four inches. In complexion they were probably white, but swarthy, like the darkest Italians and Spaniards, or even the Moors. Their skulls were very long and narrow; and they form the best distinguishing mark of the race, as well as the best test of its survival at the present day. The neoliths were unacquainted with the use of metal, but they employed weapons and implements of stone, not rudely chipped, like those of the older stone age, but carefully ground and polished. They made pottery, too, and wove cloth; they domesticated pigs and cattle; and they cultivated coarse cereals in the little plots which they cleared out of the forest with their stone hatchets or tomahawks. In general culture they were about at the same level as the more advanced Polynesian tribes, when they first came into contact with European civilization. The barrows which they raised over their dead chieftains were long and rather narrow, not round, like those of the later Celtic conquerors. They appear to have lived for the most part in little stockaded villages, each occupying a small clearing in the river valleys, and ruled over by a single chief; and the barrows usually cap the summit of the boundary hills which overlook the little dales. Inside them are long chambered galleries of large, rough-hewn stones; and when these primitive erections are laid bare by the decay or removal of the barrow, they form the so called "Druidical monuments" of old-fashioned antiquaries, a few of which are Celtic, but the greater part Euskarian.

At some future period I hope to lay before the readers of *Knowledge* a fuller account of these neolithic people and their existing remains. At present the points to which I wish to call attention are, first, the fact of their existence in early days in Britain; and, secondly, the fact that many of their descendants still remain among us to the present day. Nor do I propose in this paper to estimate the numerical strength of the Euskarian element in the population of the British islands as it now stands. It will be best to consider that part of the question at a later point in this series, when we have seen what were the subsequent races which overcame, and in part displaced, the aboriginal Euskarian folk. For the moment, it will suffice to point out that before the arrival of the Celts and other Aryan tribes in Britain these Euskarians spread over the whole of our islands, and were apparently the only people then inhabiting them. At least the monuments of this date—perhaps from 5,000 to 20,000 years old—seem to be similar in type wherever they occur in Britain, and to contain the remains of an essentially identical race. I shall also add here, by anticipation, what I hope to show more in detail hereafter, that their descendants exist almost unmixed at the present day as the so-called Black Celts in certain parts of Western Ireland and Scotland, and in a few places in South Wales; while their blood may be still traced in a more mixed condition in Yorkshire, Lincolnshire, East Anglia, the Scotch Highlands, and many other districts of England and Scotland. How they have managed to survive and to outlive the various later Celtic and Teutonic conquests we shall have to inquire when we come to consider the origin and progress of those subsequent waves of population.—*Knowledge.*

The Ribbon Manufacture of St. Etienne.

It may safely be said that St. Etienne is the largest ribbon producing town in the world. In speaking of ribbons, we mean all productions of the small ware looms, in which more than two pieces are woven at one time, and which include ladies' scarfs, ties, and similar goods. This industry is, with few exceptions, quite a domestic one. St. Etienne and district employs about 17,000 looms, of which only about 1,500 are driven by mechanical means, say 1,000 by water, and 500 by steam power. These 1,500 make partly plain silk ribbons, and partly velvet ribbons, the latter numbering about 600. Most of the weavers have not more than three looms, more frequently only one or two. Generally the master works one and the members of his family the others; sometimes he has also a journeyman. A loom costs from £32 to £100, according to its complexity, for some looms with Jacquard arrangements, and 7 to 12 shuttles for different wefts, are costly. When a journeyman has saved a few hundred francs he buys a loom, paying part of the price down and the remainder in installments as he makes his profit on it. When he has paid for the first loom, and takes a second one to be worked by an assistant, he becomes a member of the masters' guild, who fix the prices to be paid by the manufacturers. From the complicated nature of the work these wages cannot be always alike, but they are regulated according to the difficulty of the pattern, the quality of the silk, etc. If, for instance, a weaver receives a silk which is rather weak, and which necessitates frequent stoppages on account of broken ends, he calls in an expert, who, after examining his case, fixes the amount of the wages to be paid. On the other hand, the master finds it to be to his interest to pay good wages, and to give the weaver an advance when any new article which happens to be in fashion enables him to make extra profits himself. Where a master employs a journeyman he gives him half the wages earned by the loom, retaining the other half as hire for the loom and profits. In ordinary times a loom earns about 5s. per day, which leaves 2s. 6d. for the assistant (not very tempting wages our weavers will say). Sometimes, a loom can make as much as 12s. a day, against which, however, slack times must be taken, when the hands get no work, and after spending their wages have to find work in the neighboring mines or elsewhere for a time. They, however, seldom leave altogether, and stick to their homes as long as possible. The preparatory work of minding and spooling is paid by the day, generally from 1s. 3d. to 2s. for 10 hours' work. In 1848 the longest permissible time was fixed at twelve hours in summer and eleven hours in winter. With the ordinary sort of ribbons wages form about 10 per cent to 15 per cent of the price, but with the superior kinds the wages run up to 40 per cent. A singular feature is the fact that the weavers making silk ribbons are more steady and frugal, and work best at home, while those making velvet ribbons have not such a good reputation, and are also more frequently collected in larger numbers in factories. Can the latter fact affect their morals? is the question suggested.

New Street Letter Boxes.

New letter boxes are being placed in a portion of New York city. They are painted a bright red, so as to be seen from a long distance. Collections are made through a door that occupies the whole side of the box, and is more convenient for taking out large letters than the openings in boxes of the old style. A card is placed under a square of glass in the side of the box, on which is printed a list of the times at which collections are made. There is also in one corner a card on which is printed the hour of the next collection. This card is to be taken out by the collector at each trip, and another giving the time of the next collection is substituted. The card taken out is given to the superintendent on the return of the collector as a proof that the collection has been made. The number of the box to which it belongs is shown on each of these cards.

New Mineral Water from Amherst, British Burmah.

A mineral spring having been discovered in the Amherst district, which is attracting great crowds by the wonderful cures reputed to be performed by its waters, the authorities forwarded a few gallons for analysis by R. Romanis, D.Sc., Government Analyst. The following is the composition in parts per million:

Carbonate of lime	1,092·6
" " potash	57·8
" " soda	27·0
" " magnesia	29·2
Silicate of lime	31·1
Alumina and oxide of iron	12·8
	1,244·6

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Crystallization of Iron.*

BY N. P. BOWLER.

The theory that pieces of wrought iron or steel will crystallize by merely hanging for a certain length of time in a vertical position seems to be confirmed as true in this instance.

We had a chain in daily use in our foundry—used for raising flasks and castings—requiring it to hang in a vertical position most of the time. It had been in use probably eight or ten years. The links were of about one-half inch wire, as you can see by this piece of it. The service usually required was light compared with the ability of the chain. One day a link broke squarely off. The chain was sent to the blacksmith shop for repairs. The smith called my attention to the fact that if he put any of the links on end upon the anvil a light blow of the hammer would break them into four pieces. He tried several of them, and they broke as easily as poor cast iron. I asked him to put a link in the fire, heat it to a red heat, and let it cool gradually. He did so, and found it would not break then, but bend like good iron. I had the chain mended, and after emptying one of our large ladles of the molten iron, thus leaving it red hot, the chain was put into it to remain all night. That was done over three years ago. The chain has been in constant use ever since, with no signs of weakness by crystallizing.

We served all our chains the same way, by heating them and cooling gradually, and have had no recurrence of this kind. I would recommend that the ladle shanks used about the foundry be treated the same way.

A very interesting fact was related to me not long since by a division master mechanic of the Lake Shore and Michigan Southern Railway. He had just made two fire boxes for a couple of his engines from steel plate or homogeneous iron. They were completed, and the engines were ready to run; steam had been got up in both, and found all right.

The following day the fireman of one was told to fire up his engine, the same as he had fired the day before. After starting a pretty good fire, and seeing no signs of steam, he ran horror-stricken to tell his engineer that there was not a drop of water in the boiler, and that everything was red hot. The master mechanic, who happened to be there, quieted his fears by telling him to "never mind—just pull your fire and let the engine stand and cool off."

That was, I think he told me, ten years ago, and that fire-box has been in use all the time, and is good to-day; while its mate, made of the same material, lasted but a few years before it cracked and became useless.

Although that fire-box was not crystallized by using, yet is it not more than probable that the same conditions existed in this metal that we find in iron and steel that have become brittle by long usage—it becomes what is called crystallized?

There is no doubt that car axles become crystallized by long usage; but the time it takes to reach that point—when they are entirely unsafe to use—varies undoubtedly according to the good or bad quality of the iron. Some kinds of iron are brittle, and will soon fail, while others are of softer and more tenacious fiber, and require a longer time to crystallize.

The above facts suggest to me the feasibility and utility of converting old car axles into good ones, by merely annealing them.

It is the practice of master mechanics of railroads to condemn axles that have been in service a certain number of years, if for no other reason than that of being crystallized, acting on the theory that such an axle is unsafe for further use.

They are taken out and cast into the scrap pile, to be sold to the junk dealers for about one-third the price of new ones.

Some master mechanics that I know do practice the annealing of old axles, but by the number known to be for sale as scrap, one would think but very few did so.

The practice now is to increase the capacity of freight cars from what they were formerly—ten and twelve tons—to fifteen and twenty tons, thus making it necessary to take out the small axles; but when confidence can be put in these annealed ones, there will be no objection to using in narrow gauge cars axles once under standard gauge cars.

The crystallization of cast iron to such an extent as to make it unsafe for further use is still a mooted question. Railroad men in the early history of that enterprise, before the use of fish plates—believed that the car wheel, by striking the head of the rail, would become crystallized—and were disposed to remove all wheels from under passenger coaches, after having been in service a certain length of time, to be worn out under freight cars. What the length of time is, beyond which it was considered unsafe to run them, was never definitely settled. I think the practice has quite gone out of use, and the belief that chilled car wheels will crystallize by running so as to become unsafe is not very generally entertained.

Old car wheels are used to some extent in the mixture of iron for new ones.

I have, for a period of sixteen years, watched the appearance of those old wheels, as they were broken up, and I have been unable to notice any difference that could be charged to the time in service. We sometimes find wheels that have been made twenty years—of course, the amount of service they had done could not be known. Wheels ten years old are quite common, but that time had wrought changes in the metal was not perceptible by any means that I possessed. And my belief is that car wheels, at least, do not grow weaker as they grow older by reason of crystallization. It was but recently we had at the foundry some old cast shafting, and I noticed it particularly when broken up for the cupola, that there was no appearance of change in the metal, either by breaking or in looks, to indicate crystallization.

*A paper read before the Civil Engineers' Club, of Cleveland.

DISCUSSION.

In the after discussion of his paper, Mr. Bowler stated that he did not believe cast iron subject to crystallization; that during his long experience in the manufacture of car wheels, where large numbers are broken up, he had never seen a case of crystallization among them. He thought car axles might be so affected and that wrought iron is more subject to it when used in a vertical position.

Mr. Dunham—Was not your chain subjected to unequal strains by passing over a pulley?

Mr. Bowler—It did not pass over a pulley.

Mr. Bidwell cited a case at the Chickering Piano Works, where a vertical chain had broken from crystallization, without apparent cause, except what might be due to its vertical position.

Mr. Renschel, of the Cleveland Bridge and Car Works, thought that iron never crystallized unless overstrained. He thought that car axles are being constantly overstrained by a force that cannot well be estimated. The passing of the wheels over rail heads was but a succession of blows that result in overstrain, and crystallization follows.

Colonel Wilson, of the United States Harbor Improvement, mentioned the fact that he recently condemned a number of tons of bolts and spikes before being used, because they were crystallized. They could not have been overstrained.

Mr. Renschel—They were doubtless made from very poor iron at first.

Mr. Bidwell thought cold-drawn wire a good example of overstraining that does not produce crystallization.

Mr. Porter, of the King Bridge Works, stated that the experiments conducted by the United States Government went to show that no crystallization takes place where iron is not strained beyond one-half its elastic limit.

Mr. Latimer, Chief Engineer of the N. Y., P. and O. R. R., said that the question was once asked at a meeting of his roadmasters: "Is it not a fact that iron lasts longer, that it will sustain more wear, by allowing it to rest one day in seven?" The answer was not given.

The Horse Power of Turbines.

The power of water is its weight multiplied by the velocity, and in order to illustrate we will suppose a turbine wheel, working under 15 feet head, will discharge 3,168 cubic feet of water per minute, and utilize 80 per cent of the full power of the water. Multiply the cubic feet discharged per minute by 62½, which is the number of pounds each cubic foot of water weighs at the average temperature, and this product by height of head under which the wheels are working, and that product divided by 33,000 pounds, this number of pounds raised one foot high in one minute being one horse power, which will give the full horse power of 3,168 cubic feet per minute, under 15 feet head; and as no wheel will produce 100 percent, the percentage the wheel in question is known to produce or utilize must be taken as the actual horse power, as in the example here given:

```
  3168   cubic feet per minute.
  62½    weight of one cubic foot.
 ------
  1056
  6336
 19008
 ------
197472 full weight of water.
    15 feet head.
 ------
 987360
 197472
 ------
33000)2962080(  89 76  full value of water.
  264000          80 per cent utilized.
 -------  --------
  322080  71·8080 net horse power, or 80 per cent
  297000           [of the full power of water.
 -------
  250800
  231000
 -------
  198000
  198000
```

It will be seen that the effective horse power at 80 per cent of the full value of the water is 71·80. We will now suppose the wheel had only utilized 60 per cent, then multiply the full value, 89·76, by 60, and the horse power would be 54·55. If the wheel would utilize 75 per cent, the effective horse power would be 67·32. From the explanation and example given it can easily be ascertained what number of horse power any wheel will produce, with a given number of cubic feet of water per minute, on any head, provided the percentage the wheel in question will utilize is known.—*Stout, Mills & Temple.*

New Process for Sewage.

The difficulty of dealing with the deposit technically known as "sludge," which has always and everywhere been a source of great trouble and inconvenience in treating town sewage by precipitation, has, it is claimed, been overcome by the Rivers Purification Association, Limited, at the Coventry Sewage Works, at Whitley. The various processes which have been tried by the association during the five years they have had the disposal of the Coventry sewage in their hands, have hitherto yielded anything but satisfactory results. The association tried, in succession, methods of drying the sludge by heat, and also by continuous rotary filtration. These processes, however, besides being costly, did not dispose with sufficient rapidity of the twenty-five or thirty tons of sludge which are precipitated at the works daily, and they were therefore abandoned, being succeeded by the present system of "pressing."

Some two years ago a model press was erected at the works, and although this description of press failed to fully answer the purpose for which it was intended, it has been very aptly described as the egg from which the process now adopted was hatched. The presses now in use were manufactured by Messrs. S. H. Johnson & Co., of Stratford, and the manager is Mr. E. F. Coddington. The sewage flows through a rotary sieve, by which the solids are extracted. The rotary motion of the sieve causes the solids to fall to its center, from whence they are conveyed by an archimedean screw. The sewage, now free from heavy suspended matter, is chemically treated, and the precipitated matter, called "sludge," is pumped into an iron trough which supplies two cylinders, and is forced from these into the presses by one of Johnson's patent air compressors. Once within the presses, the pressure is kept constant and uniform, and the water of which the "sludge" is chiefly composed pours out in continuous streams, leaving, at the conclusion of the process, the "sludge" in the form of dry, firm sewage cakes, 3 feet by 3 feet, 1¼ inches in thickness, and smelling faintly of ammonia. Thus, it is said, is performed in a few hours a task which was previously but imperfectly done in many months, and the sludge, which was before an almost unsalable commodity, now meets with a brisk demand, being readily purchased by farmers, one large cultivator of the soil having recently ordered a thousand tons.—*Building News.*

To Take Out Milk and Coffee Stains.

These stains are very difficult to remove, especially from light colored and finely finished goods. From woolen and mixed fabrics they are taken out by moistening them with a mixture of one part glycerine, nine parts water, and one-half part aqua ammonia. This mixture is applied to the goods by means of a brush, and allowed to remain for twelve hours (occasionally renewing the moistening). After this time, the stained pieces are pressed between cloth, and then rubbed with a clean rag. Drying, and if possible a little steaming, is generally sufficient to thoroughly remove the stains. Stains on silk garments which are dyed with delicate colors, or finely finished, are more difficult to remove. In this case five parts glycerine are mixed with five parts water, and one-quarter part of ammonia added. Before using this mixture it should be tried on some part of the garments where it cannot be noticed, in order to see if the mixture will change color. If such is the case no ammonia should be added. If, on the contrary, no change takes place, or if, after drying, the original color is restored, the above mixture is applied with a soft brush, allowing it to remain on the stains for six or eight hours, and is then rubbed with a clean cloth. The remaining dry substance is then carefully taken off by means of a knife. The injured places are now brushed over with clean water, pressed between cloths and dried. If the stain is not then removed, a rubbing with dry bread will easily take it off. To restore the finish, a thin solution of gum arabic, or in many cases beer is preferred, is brushed on, then dried and carefully ironed. By careful manipulation these stains will be successfully removed.

Old German Newspapers.

At the end of last year there were in circulation in Germany 4,413 newspapers. Of these 98 were older than the present century. Among them the *Frankfürter Journal*, 261 years old; the *Magdeburg Zeitung*, 253 years old; the *Leipziger Zeitung*, 221 years old; the *Jenaische Zeitung*, 207 years; the *Augsburger Postzeitung*, 195 years; the *Gothaische Zeitung*, 190 years; the *Vosetsche Zeitung*, 159 years; the *Berlin Intelligenzblatt*, 128 years; the *Kolnische Zeitung*, 84 years. There are 200 newspapers averaging from 80 to 50 years; 1,127 averaging from 50 to 21 years; 1,542 between 20 and 6 years; and 1,380 between 5 years and 3 months old. Altogether there are 1,491 German newspapers more than 20 years old. That a newspaper's existence in Germany is often a very ephemeral one may be inferred from the fact that 20 per cent of the newspapers which circulated through the German post office in 1880 came first into existence within the same year, and the average existence of those newspapers was not more than six months. Some have been more hardy, and have survived into the present year.

Formation of Alloys by Pressure.

W. Spring has shown that, when a mixture of bismuth filings, cadmium, and tin, in the proportions necessary for the formation of Wood's alloy, is subjected to a pressure of 7,500 atmospheres, the mass thus obtained powdered and again subjected to the same pressure, a metallic block is formed which has all the physical properties of the alloy. Its specific gravity, color, hardness, brittleness, and fracture are the same; and when thrown into water heated to 70°, it melts at once. In like manner Rose's metal was made by subjecting the proper mixture of lead, bismuth, and tin to high pressure. If zinc and copper filings are repeatedly subjected to pressure, a mass resembling brass is finally obtained.—*Berichte der deutsch. chem. Gesell.*

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