in action is the result only of knowledge, skill, and courage, these qualities will entitle him to respect, if his other qualifications are such as to insure the good will of those under his charge.

The choice of a good foreman is one of the most important essentials to success in many kinds of business. and the difference between a good and a bad one is hard to estimate in dollars and cents. He that can be firm with kindness, and just without harshness, has the elements of good leadership. These qualities, joined with knowledge and skill, make a combination of qualities somewhat rare, but when found, sure to be prized and rewarded.

THE RELATIVE MERITS OF NEW IRON AND OF SCRAP IRON AS MATERIALS FOR THE SHAFTS OF OCEAN STEAMERS.

In number 22, Vol. XX., of the SCIENTIFIC AMERICAN, we discussed the method, hitherto in vogue, of forging shafts for sea-going steamers, from mixed scrap iron. We most decidedly disapproved the method, maintaining that a perfectly homogeneous shaft of such materials, even if its achievement were possible, must necessarily be a highly improbable result, of a plan opposed, not only to scientific principles, but to common sense.

Since writing the article alluded to, we have seen no reason to alter the opinions we then entertained and expressed with reference to this subject; and we now have the pleasure to state that those opinions are not only winning adherents, but that their truth is actually being tested, practically, by the Pacific Mail Steamship Company. This company have recently had a shaft forged for them at the Franklin Forge, corner of Twenty-fifth street and Third avenue, New York, of the Collins Iron Company's Lake Superior charcoal pig iron. This shaft is intended for the steamer *Japan*, San Francisco and China, and is, in the rough, 39 feet 7 inches long, weighing 80,000 lbs. The body of the shaft will be, when finished, 26 inches in diameter, and the diameter of collars 31½ inches. The forging of this shaft required a working force of 38 men, and consumed 15 days of ten hours each.

The iron from which this shaft was forged, was puddled by Tugnot, Thompson & Co., of the above works, expressly for the purpose, and twice hammered before the shaft was forged. None of the iron used has had less than three heats after the billets were prepared.

We were present on two occasions during the forging, and our opinion as to the great superiority of shafts made of such iron over those of scrap-iron, has been greatly strengthened by our observations. Mr. Tugnot, of the above works, under whose supervision the whole work has been performed, is one of the most experienced iron masters and forgers in this country, and the work throughout is of the most perfect character.

The steam hammer used weighs nine tuns, and under its ponderous strokes, the heated billets seemed as plastic and cohesive as wax.

Such a shaft must, necessarily, cost more than one made of scrap-iron, but its greater strength and consequent security, will more than compensate for its increased cost. The iron from which it is made is of a very superior quality, a larger quantity of charcoal being used in its manufacture than is ordinarily employed. It is made of half hematite and half specular ore, a mixture of which gives an iron of remarkable tensile strength. A chain link of this iron, made of 1½-inch bar, was once tested by D. B. Martin, formerly Engineer-in-Chief to the Secretary of the United States Navy, and broke only at the enormous tension of 169,120 lbs. We have also seen a specimen of this iron which had only been subjected to two heats, and which was tested by Paulding and Kendall, of the West Point foundery, which, after breaking at a tension of 63,376 lbs. per square inch, was found, upon examination, to be defective. These facts speak sufficiently for the excellence of this iron, and we are glad that the importance of using shafts made of the very best material is beginning to be appreciated by capitalists. A steamer with a broken shaft is almost as helpless as a ham-strung horse; it may, if it has good luck, finally crawl into port, after a delay which has cost more than two shafts would, or it may encounter bad weather and go to the bottom. Where so much is depending, considerations of first cost should weigh little in the scale against security, and it does weigh little to the engineer who knows his business. Unfortunately, however, these facts are too often overlooked by the men who invest their money, and who, not acquainted with the nature and quality of different kinds of iron, are too apt to consider them pretty much on a par. Nothing could be more unwise than such a conclusion, and the difference between a shaft made of inferior iron and one of the best quality, is so great in its contingent results that, within reasonable limits, cost should not be considered.

We hope the precedent established by the Pacific Mail Steamship Company, will prove the beginning of a wiser practice than has hitherto prevailed in reference to this subject.

THE RECENT AURORAL DISPLAY.

On the evening of the 15th of April remarkable auroral display took place, which, according to the newspaper reports, extended over nearly the whole of the Eastern, Western, and Middle States, and was also visible in some parts of the Southern States. At this point the display was a fine one, but was probably exceeded in many other localities. Accounts from portions of Ohio indicate that the maximum brilliancy was observed in that section. A correspondent writes us from Piqua, Miami Co., in that State, that at 10 o'clock, the beauty of the display was at its hight, and that its splendor was never equaled in the memory of the oldest inhabitant.

On the night of the occurrence we chanced to be in a suburban district away from gaslights and buildings, and in other respects favorably situated to observe the phenomenon. Our attention was first called to it about forty-five minutes past seven o'clock, at which time, although the new moon was shining brightly, the heavens were gorgeously lighted up. Mars was almost exactly in the zenith. Around this planet there seemed a small unilluminated space, inclosed by a ring of pale light. From this ring extended radial bars of light in all directions like spokes of a huge wheel, to the horizon. As these bars of light neared the horizon, they increased in width and brilliancy in some parts of the heavens, giving the most beautiful prismatic colors, of which violet was the most conspicuous. The moon looked like the nucleus of a huge comet, with a tail extending westward, and reaching quite below the horizon. The entire sky was covered with a maze of tremulous light, beautiful beyond description, but it soon diminished in splendor, and although visible much later, did not again appear as bright as in the earlier part of the evening.

The aurora borealis is not confined to the Northern hemispere, or to any zone. It has been seen within 14° of the equator, although its most frequent and brilliant displays occur nearer the poles. It is without doubt electrical in its character, and bears an important relation to terrestrial magnetism. This is more particularly evidenced by its effects upon telegraphic wires and instruments. During the last display, as on frequent previous occasions, telegraphic wires were disconnected from the batteries and messages transmitted without their help. Some have assigned to this phenomenon a cosmical cause, like that of meteoric showers; but the analogies all seem to point to electricity as the prime agent in auroral displays, although the fact has never been positively demonstrated.

There also exist, no doubt, peculiar atmospheric conditions necessary to the occurrence of an aurora, but the precise nature of these conditions is not yet understood. They occur at all seasons; one of the most brilliant we ever saw occurred in midsummer. There has never been discovered any relation between the relative positions of the earth and moon, and the occurrence of auroras, although some have thought it probable such relations exist.

Professor Olmstead thought he had discovered secular periods in the occurrence of auroral displays, but we consider this as hardly warranted by the facts. He fixed the commencement of such a period as being August 27, 1827; the length of the period being twenty years with intervals of from sixty to sixty-five years.

The observations of auroras have not been so frequent in the Southern Hemisphere as in the Northern, and it is quite probable that the whiteness of the light and absence of color, described by navigators as being characteristic of Southern auroras, may rest upon insufficient evidence.

The subject is one fruitful of speculation, and calculated to excite the most intense interest in the minds of investigators. The application of the spectroscope to such investigations seems obviously promising.

Tree Mining.

From the new work by Prof. Cook on the Geology of New Jersey, recently noticed in the SCIENTIFIC AMERICAN, we condense the following account of Tree Mining in New Jersey. In most of the marsh, known as the "Jersey Flats," near the upland, which is shallow, fallen timber is found buried; and the stumps of trees are still standing with their roots in the solid ground where they grew. The timber found in this condition is of oak, gum, magnolia, cedar, pine, and other species, such as are now the natural growth of the country. Where they are of pine, cedar, or other durable wood, their broken and weather-worn trunks are seen projecting above the marsh which has overrun the place of their growth. On the land-side of the beaches, along the sea-shore, large numbers of leafless and dead red cedars may be seen standing in the marsh, the indestructibility of the wood keeping the trees erect, although the marsh has, in some instances, gathered around them to the depth of several feet.

The remains of trees are not equally abundant in all localities, owing partly, perhaps, to differences of exposure, but more to the difference in durability of the various species of wood. In many places where oak, gum, and other deciduous trees were known to stand formerly, there are no traces of them now; they have entirely rotted away. On the contrary, the pine and the red and white cedar are almost indestructible. Pine stumps are found several feet under the marsh, where they have been for an unknown period, and which retain the characteristic smell and appearance of the wood almost as perfectly as the fresh-cut specimens. At several places in southern New Jersey, an enormous amount of white cedar timber is found buried in the salt marshes, sound and fit for use, and a considerable business is carried on in mining this timber and splitting it into shingles for market. In some places it is found so near the surface that fragments of the roots and branches are seen projecting above the marsh, while in other cases the whole is covered with smooth meadow-sods, and there is no indication of what is beneath till it is sounded by thrusting a rod down into the mud.

The tree of which these swamps are composed, is the white cedar, the *Cupressus huyoides* of the botanists. It is an evergreen, which thrives best in wet ground, and in favorable situations forms dense swamps. It is most commonly found on the head-waters of streams.

Timber which is buried in the swamp undergoes scarcely any change; trees which are found several feet under the surface, and which must have lain there for hundreds of years, are as sound as ever they were; and it would seem as if most of the timber which had ever grown in these swamps was still preserved in them. Trunks of trees are found buried at all depths beneath the surface, quite down to the gravel; and so thick, that in many places a number of trials will have to be made before a sounding-rod can be thrust down without striking against them. Tree after tree, from two hundred to one thousand years old, may be found lying crossed one under the other in every imaginable direction. Some of them are partly decayed, as if they had died and remained standing for a long time, and then been broken down. Others have been blown down, and their upturned roots are still to be seen. Some which have been blown down, have continued to grow for a long time afterwards, as is known by the heart being very much above the center, and by the wood on the under side being hard and boxy. These trunks are found lying in every direction, as if they had fallen at different times, as trees would in a forest now.

The cedar logs which are buried in the swamps are mined, or raised, and split into shingles; and this singular branch of industry furnishes profitable occupation to a considerable number of men.

In conducting this latter business, a great deal of skill and experience is requisite. As many of the trees were partly decayed and worthless when they fell, it becomes important to judge of the value of the timber before much labor is wasted upon it. With an iron rod the shingler sounds the swamp until he finds what he judges to be a good log; he tries its length and size with this rod; with a sharp cutting spade he digs through the roots and down to it; he next manages to get a chip from it, by the smell of which he can tell whether it was a windfall or a breakdown; that is, whether it was blown down or broken off. The former are the best, as they were probably sound when they fell. If he judges it worth taking, he cuts out the matted roots and earth from over it, and saws it off at the ends. This latter operation is easily performed, as the mud is very soft, and without any grit. By means of levers he then loosens it, when it at once rises and floats in the water, which is always very near the level of the swamp. The log is then cut into shingle lengths, and split into shingles. The logs are sometimes, though rarely, worked for thirty feet.

It is very interesting to see one of these logs raised. It comes up with as much buoyancy as a freshly fallen cedar; not being water-logged at all. The bark on the under side looks fresh, as if it had lain but a few days; and what is remarkable, the under side of the log is always the lightest; the workmen observe that when the logs floats in the water it always turns over, the side which was down coming uppermost. The buoyancy of the timber remaining, it is probable the lower logs rise in the mud when the roots over them are cut loose, and the logs which laid upon them are removed.

These logs are found not only in the swamp, but also out in the salt-marsh, beyond the living timber. Such marsh has, however, a cedar swamp bottom, which has been overrun by the tide. The heaviest part of the business in making the shingles is done in the neighborhood of Dennisville.

By sounding with an iron rod, these logs can be felt under the surface at all depths, from one to ten feet, and some have said for even more than that. At Dennisville a well was dug in the marsh eleven feet in depth. The mud near the surface was the common blue mud of the marshes; at a small depth the peaty cedar swamp-earth was reached, and in it cedar timbers, logs, and stumps, were found for several feet, and near the bottom the sweet gum (*Liquidambar styraciflua*) and the spoon-wood or magnolia (*Magnolia glauca*) were found. The well reached hard bottom. The white cedar grows on peat, and its roots run near the surface, so that it might be supposed the mud had settled with them, were it not for the fact that, when cedar grows where the mud is shallow, so that its roots reach hard bottom, its wood is unfit for timber, the grain or fibers being so interlocked that it will not split freely. Such is found to be the case in the buried timber; the bottom layer, as it is called, is worthless. From this the inference is conclusive that the hard ground was above tide-level when these trees grew. Large stumps are frequently found standing directly on other large logs, and with their roots growing all around them, and then other logs still under these, so that one soon becomes perplexed in trying to count back to the time when the lower ones were growing. Dr. Beesley, of Dennisville, some years since communicated to the newspapers an article on the age of the cedar swamps, which was copied by Mr. Lyell in his Travels in the United States Second Visit, Vol. I., p. 34; in which Dr. B. says that he "counted 1,080 rings of annual growth between the center and outside of a large stump six feet in diameter, and under it lay a prostrate tree, which had fallen and been buried before the tree to which the stump belonged first sprouted. This lower trunk was five hundred years old, so that upward of fifteen centuries were thus determined, beyond the shadow of a doubt, as the age of one small portion of a bog, the depth of which is, as yet, unknown."

TO OUR CORRESPONDENTS.—We repeat what we have often published in our columns, that no notice will be taken of letters not signed by the writers. The correspondence of this office amounts to several hundred letters daily, and we have a right to know the names of parties who write to us for information, and also what claim they have upon our attention. All letters (except anonymous) are carefully read, and when the subject of the inquiry is one that we deem useful and important, we endeavor to answer it; but it sometimes happens that the information sought for is beyond our immediate reach, or is considered too frivolous to merit time and attention. In all such cases, we are necessarily obliged to decline answers, but, as a general rule, letters addressed to this office are either noticed in the SCIENTIFIC AMERICAN, or answers are sent by mail. Our correspondents seldom complain of inattention to their inquiries; but we urge upon them to be clear and concise in stating their points.