this system was carried out, in sinking seventy cylinders to a great depth in the bed of a strong tidal river like the Medway. The bed of the river was found to consist of strata of soft clay, sand, and gravel over the chalk, which was reached at a depth of 44 feet below average water line. Each cylinder was like an immense diving bell, always having its top out of the water, no matter at what depth the bottom was. They are formed of cast-iron pipes, 9 feet long and 7 feet diameter, with internal flanges, so that the external faces are free of any projections that would interfere with their free descent through the bed of the river. The access to and from the inside of the pile, while being sunk, was through two air-locks or chambers, made of cast iron, passing through the cover-plate bolted on the top length of the pipe forming the pile. The tops of these locks had openings 2 feet in diameter, and flap-doors which, when closed, allowed them to be filled with the compressed air from the cylinders. From each air-lock there was a vertical door opening into the air-chamber, which, when closed, was also air-tight, so that when the workmen had to pass in or out, or to take out the excavated material, they could do so without decreasing the pressure of the air very much. In coming out, they entered, through one of the vertical doors, into one or the other of the air-locks, and when this door was closed, the pressure of the air was reduced to atmospheric pressure by means of a small cock, opened to the atmosphere. As soon as there was an equilibrium of pressure, the top door was opened and the men came out. The operation of entering the pile or cylinder was the reverse of coming out. The only loss of the compressed air from the cylinder at each operation was the amount contained in the small air-lock.

Within the cylinder were two small cranes to lift the full buckets and lower the empty ones, which were worked by a two-handled windlass. As each pile was sunk 9 feet, the air-chamber was disconnected and a fresh length of pipe bolted on, and the air-chamber bolted on top of this. At each joint a floor or staging was fixed, with openings to allow of the ascent and descent of the workmen and the full and empty buckets, etc. These cast-iron pipes form part of the permanent structure of the piers, and when they were sunk to their proper depth they were filled in with concrete and brick-work.

The method of working was by setting the air-pumps in motion, having the top door of one of the air-locks and the bottom one of the opposite air-lock closed. The pumps were of such a size that in about five minutes 15 feet head of water was forced out through the bottom of the piles; and while the pumping continued the workmen passed through the air-locks to their various stations.

The engineering illustration which we give this week shows a more economical method of building piers in the beds of rivers, or under water. It shows a caisson or diving-bell, designed by Messrs. Burmeister and Wain, and adopted by them in building the piers of the new bridge in Copenhagen. The principal economy consists in having the caisson, or cylinder, of less cubic capacity than the finished pile of the piers, and in being able to take it away as each pile was built. When the excavation was made deep enough for a firm foundation, the building of the pile was commenced, and as it increased in hight the caisson was lifted accordingly until the pile was above water-line, when the caisson was removed to the required position of the next pile, and so on, until the two piers, each formed of two piles, were completed. This plan of lifting the caisson avoided leaving the whole of the piles of the piers encased in ironwork, as in the piers of Rochester and many other bridges. This caisson was made of wrought-iron, 18 feet diameter at the lower part by 8 feet high, and above this to the air-chamber out of the water it was only 10 feet diameter. Just above the 18-feet diameter chamber there were two annular rings, or chambers—one to contain iron ballast, A, and the lower one water ballast, B, so that in sinking the caisson the water chamber was filled with water for weight in addition to the iron ballast in the annular chamber above. When they had excavated to the solid strata, a bed of concrete 3 to 4 feet thick was formed, and on this the remainder of the pile was built with granite facing filled in with brickwork. As the building of the pile proceeded, the caisson was lifted by means of the suspension chains, C, connected with staging overhead, and by pumping air into the annular air-chamber, B, to displace the water. The finished piles are about 18 feet diameter at their bases, and 16 feet diameter at their tops, by 30 feet high. The whole of the work below water line was done in the 18 feet by 8 feet chamber at the bottom of the caisson. Between the time of lowering it to the bed of the river and the completion of the first pile to water line was only twenty-eight days, and then the apparatus was moved into position for the next pile. In lowering it for the second pile, it unfortunately got upset, and caused so much delay that it took thirty-six days to complete this pile. The third pile, was, however finished in sixteen days, and the fourth in seventeen days.

The air-chamber and locks on top of the caisson were very similar to those used for sinking the piles of Rochester Bridge.

OBJECTS OF INTEREST ON A GUANO ISLAND.

A recent writer from Baker's Island, in the South Pacific, off the coast of Peru about 2,500 miles, gives an interesting account of life on that little patch of *terra firma* which carries upon its bosom nearly a million tuns of guano.

He mentions that fish of remarkable size and beauty, weighing from fifty to sixty pounds, are abundant, and are easily taken with a hook. Sharks abound also—murderous sharks who swarm about the ship with greedy and persistent devotion. These sharks are, by hereditary proclivity, man-eaters; and the white man who comes within their reach is snapped at in an instant by a score of ravenous mouths. But, strange to say, a dark-skinned Polynesian will swim about in their midst and rarely be molested. I have seen a native of the Hawaiian Islands fearlessly jump from the bow of a ship into the midst of a "school" of these fellows, swim, with the end of a line in his mouth, to one of the buoys, and return to the vessel uninjured.

Whether there is a sort of freemasonry between the sharks and the Kanakas, or whether the tastes of the shark are too fastidious, and not sufficiently cannibal to relish cannibal flesh, has not been satisfactorily explained. But the shark and the Kanaka are on the friendliest terms imaginable.

The flying fish abounds in these waters. When pursued by the dolphin, their foe, whole schools of them may frequently be seen to leap out of the water and fly for several hundred yards, skimming along quite near the surface, and now and then gaining new velocity by striking the crest of a wave with their long, ray-like, pectoral fins. But this beautiful fish has enemies in the air as well as in the sea, and frequently its aerial flight is cut short by some fleet sea bird that is ever on the alert to seize its prey.

THE FEATHERED INHABITANTS.

Among the chief objects of interest on the Island to a visitor are the birds; and they are well worthy of study. The sea-fowl are at all times a noisy set, but at night, while the older ones are engaged in the quarrels of love-making, and the young are complaining over their scanty rations, the Babel of their chattering is destructive to the sleep of one unused to such disturbance.

During the first night of my stay on this forlorn spot, it seemed at times as if the house were besieged by innumerable tom-cats; then the tumult resembled the suppressed bleating of goats, and I heard noises as of bats grinding their teeth in rage; again it was the querulous cooing of doves, and soon the chorus was strengthened by unearthly screams, as of ghouls and demons in mortal agony. But on going forth into the darkness to learn the cause of this infernal serenade, all was apparently calm and serene, and the radiant constellation of the Southern Cross, with the neighboring clouds of Magellan, looked me peacefully in the face, while, from another quarter of the heavens, the Pleiads shed their "sweet influence" over the scene.

The most quiet time of night with the birds is about day-break, when they seem to subside into "cat-naps," preparatory to the labors of the day.

By day many of the birds range on tireless wing, over leagues of ocean, in quest of fish. But still the number of those that remain about the island is so great as to defy computation, and as you pass through their haunts, in some places they rise in such clouds as actually to darken the air above you.

The eggs of some of the birds are of fine quality, and are much esteemed by the Americans as well as the Hawaiians on the island. Those of a bird called the *nu-e-ko* are most valued. This name is an imitative word, derived from the cry of this restless creature, and is applied to it by the Hawaiians, who have quick intuitions in onomatopoetic matters.

The *nu-e-ko* is a bird of moderate size bearing a strong resemblance to the piping plover. It is less phlegmatic and stupid than most of the other birds, and does not waste so much of its time in droning and crooning and love-making.

Yet it is not undomestic in its habits. While the father is engaged in the business of the island, providing for the wants of the family by fishing, the mother is ever hovering near her half-fledged young, now invitiug them to try their wings in flight, and now hustling them out of sight under some clump of brown grass, and teaching them to lie close in order to escape observation.

The *nu-e-ko* does not make its home on the guano fields, but prefers the sandy shingle nearer to the ocean. The plumage of its back is brown, spotted with gray, a color so nearly resembling that of the sand upon which it makes its nest, that it might almost escape detection. But, when danger approaches it rises on the wing, uttering its shrill, peculiar cry of "*nu-e-ko! nu-e-ko!*" and leaves its egg or its young to the tender mercy of the intruder. As it spurns the ground it shows its throat, breast, and wings, lined with sheeny feathers, that glint in the sun like flakes of silver, while it whirls and curvets in the air. This bird is plain in its tastes, and for a nest is content with a simple hollow, scooped out of the sand, the warmth of which assists in the incubation of its speckled egg.

The gannet (*Sula bassana*) is a bird of great power and beauty. The color of the grown bird is white, with wings that are tipped with black. It has a long sharp beak which is serrated and slightly curved at the end, a formidable weapon of attack as well as of defense. Its wings are of immense strength, and when fully spread, they span about seven feet from tip to tip. In their fishing expeditions they range for hundreds of miles from their nesting places, and late in the day ships in mid-ocean often see long files of them returning home like heavy laden treasure vessels speeding to port. This sight is regarded by seamen as a sure indication that land lies in the direction of their flight, though it may be scores of leagues away.

In regard to moral character, the birds may be divided into two classes—those which make an honest living, and those which are robbers. The gannet stands at the head of the respectable birds, and is a thrifty and honest citizen of the air.

The representative of the thievish class is the frigate-pelican, or man-of-war hawk, (*Tachypetes aquilus*). This bird has a dense plumage of gloomy black, a light wiry body, that seems made for fleetness, and wings of even greater spread than the gannet's. Its tail is deeply forked, its bill is long, sharp, and viciously hooked. Audubon regards the frigate bird as superior perhaps, in power of flight, to any other. It never dives into the ocean after fish, but will sometimes catch them while they are leaping out of the water to escape pursuit. It is often content to glut itself on the dead fish that float on the water, but it depends mostly, for a subsistence, upon robbing other birds. It is interesting to watch them thus occupied.

As evening comes on these pirates may be seen lying in wait about the island, for the return of the heavily laden fishing-birds. The smaller ones they easily overtake and compel them to disgorge their spoils; but to waylay and levy black-mail upon those powerful galleons, the gannets, is an achievement requiring strategy and address. As the richly laden gannet approaches the coast of his island home, he lifts himself to a great hight, and steadily oars himself along with his mighty pinions, until he sees his native sands extending in dazzling whiteness below. Now sloping downward in his flight, he descends with incredible velocity. In a moment more he will be safe with his affectionate mate who is awaiting his return to the nest.

But all this time he is watched by the keen eye of the man-of-war hawk, who has stationed himself so as to intercept the gannet in his swift course.

With the quickness of thought the hawk darts upon him, and, not daring to attack boldly in front, he plucks him by the tail, and threatens to upset him, or he seizes him at the back of his neck and lashes him with his long wings. When the poor gannet, who cannot manœuvre so quickly as his opponent, finds himself pursued, he tries to buy his ransom by surrendering a portion of his fishy cargo, which the hawk, swooping down, catches before it has had time to reach the earth. If there is but one hawk this may be a sufficient toll, but if the unwieldy gannet is set upon by a number of these pirates, he utters a cry of real terror and woe, and, rushing through the air with a sound like a rocket in his rapid descent, he seeks to alight on the nearest point of land, well knowing that when once he has a footing on *terra firma* not even the man-of-war hawk dare come near him.

The man-of-war hawk is provided about its neck and chest with a dilatable sack, of a blood-red color, which it seems to be able to inflate at pleasure. On calm days, about noon, when the trade-wind lulls, giving place to a sea-breeze that gently fans the torrid island, these light, feathery birds may sometimes be seen at an immense hight balancing themselves for whole hours without apparent motion on their out-stretched vans.

Whether they are able to increase their specific levity by inflating their pouches with a gas lighter than the atmosphere, or whether they are sustained by the uprising column of heated air that comes in on all sides from the ocean, is a question I am unable to answer. While floating thus, this bird has its pouch puffed out about its neck, giving it the same appearance as though it had its throat muffled in red flannel.

The most unique and novel bird on the island is the tropic-bird or marlin-spike (*Phæton phœnicurus*).

Its wings are long and its flight very rapid. It is distinguished by two slender, tapering feathers, of rare beauty, which project like a long steering oar from its wedge-shaped tail.

I cannot resist the temptation of alluding to one other bird that abounds here. It is the Mother Carey's chicken (*Thalassidroma Wilsonii*)—an ocean butterfly—the pet and favorite of every true sailor. This bird is about the size of a chimney swallow. Its pretty ways and seemingly innocent affectations, are enough to win the heart of almost any one. The society and study of these birds are not without an inspiration.

(From the Waltham Watch Papers.)

EFFECT OF MAGNETISM ON TIME-PIECES.

The intention of the present paper is to point out a defect in the construction of time-pieces of every description in which balances are used, and at the same time a source of error in their performance, which has been hitherto little, if at all, suspected, but which, where it occurs, completely defeats all the ends intended to be answered by the application of the above-mentioned ingenious contrivances; and that it does occur very frequently will be made sufficiently obvious by a simple detail of facts supported by actual experiments.

It has been suspected by some and denied by others that the balances of watches when manufactured of steel, as they mostly are, might be in a small degree magnetic, and consequently be disturbed in their vibrations, but that a circular body, such as a balance is, should possess polarity—that a particular point in it should have so strong a tendency to the north, and an opposite point an equal tendency to the south, as to be sufficient to materially alter the rate of going of the machine when put in different positions, has never, I believe, been even suspected. If it had, the use of steel balances would have been laid aside long ago, particularly where accurate performance was indispensable, as in time-pieces for astronomical and nautical purposes. Though I have frequently examined with great care watches that did not perform well, even when no defect in their construction or finishing was apparent, and suspected the balance to be magnetic, yet I never could have imagined that this influence, operating as a cause, could produce so great an effect as I found upon actual experiment; for I did not expect to find that a balance, even when magnetic, should have distinct poles.

Happening to have a watch in my possession of excellent workmanship, but which performed the most irregularly of any watch I have ever seen, and having repeatedly examined every part with particular attention, without being able to discover any cause likely to produce such an effect, it put me upon examining whether the balance might not be magnetic enough to produce the irregularity observed in its rate of going. I took the balance out of its situation in the watch, and after removing the pendulum spring, put it into a poising tool, intending to approach it with a magnet, but at a considerable distance, to observe the effect, while at the same time the distance of the magnet should preclude the possibility of the magnetic virtue being thereby communicated to the balance. I had no sooner put it into the tool than I observed it much out of poise—that is, one side appeared to be heavier than the other; but, as it had been before examined in that particular by a very careful workman more than once, I was at a loss to determine what to think of the effect I saw; when happening to change the position of the tool upon the board, the balance then appeared to be in poise. As there could be no magic in the case, it appeared that the balance had magnetic polarity, as no other cause could produce the effect I had witnessed, and which was repeated as often as I chose to move the tool from the one position to the other. It happened that I was then sitting with my face to the south—a circumstance that led me, in placing the plane of the balance vertically, to put it north and south, and of course the axis east and west, the only position in which the magnetic influence could make itself most apparent, and which will account for the circumstance not having been observed by the workmen who examined the poise of the balance before I did; for, as often as I placed the plane of the balance vertically between east and west it was in poise, whichever end of its axis was placed toward the south.

Having pretty well satisfied myself as to the cause, I now proceeded to determine the poles of the balance. With that view I placed its axis in a vertical situation, and of course its plane was horizontal; and I was much surprised to find that in that position it possessed sufficient polarity to overcome the friction upon its pivot, for it readily turned on its axis to place its north pole toward the north. Making a mark on that side, that I might know its north pole, I then repeatedly turned that point toward the south; and, when left at liberty, it as often resumed its former position, performing a few vibrations before it quite settled itself in its situation and came to rest, exactly as a needle would do if suspended in the same manner. I was extremely happy that that I had observed these effects before I brought a magnet to make the experiment I first intended, as I might, and as others also might have concluded, that the polarity had been produced by the approach of the magnet. I now, however, brought a magnet into the shop, and presenting its south pole to the marked side—that is, to the north pole of the balance, the balance continued at rest; but upon presenting the north pole to the marked place, it immediately receded from the magnet, and resumed its former position whenever the magnet was withdrawn.

No doubt now remaining as to the facts, and being in possession of the position of its poles, I proceeded to examine the effects produced by this cause upon the watch's rate of going. Having put on the pendulum spring, and replaced the balance in the watch, I laid the watch with the dial upward, that is, with the plane of the balance horizontally, and in such a position that the balance when at its place of rest should have its marked side toward the north; in this situation it gained 5′ 35″ in twenty-four hours. I then changed its position so that the marked side of the balance when at rest should be toward the south, and observing its rate of going for the next twenty-four hours, found it had lost 6′ 48″, producing by its change of position alone a difference of 12′ 23″ in the rate.

It must be obvious to every person, that even this difference, great as it was, would be increased or diminished as the wearer should happen to carry in his waistcoat pocket a key, a knife, or other article made of steel. This circumstance, taken along with the amount of the variation occasioned by the polarity of the balance, was fully sufficient to produce all the irregularity observed in the going of the watch. I then took away the steel balance, substituted one made of gold, and found it as uniform as any watch of the like construction; for though it was a duplex escapement, which is perhaps the best yet invented, at least for common purposes, it had no compensation for the expansion and contraction by the heat and cold, and therefore a perfect performance was not expected. Steel balances being commonly in use, and on that account easiest to be procured, and being on many accounts preferable to any other, I was unwilling to abandon them entirely, but resolved to take the precaution of always trying them before I should apply them to use. The mode I adopted was, to lay them upon a slice of cork sufficient to make them float upon water, and I was in hopes that out of a considerable number I might be able to select sufficient for my purpose; but, to my surprise, of many dozens which I tried in this manner, I could not select one that had not polarity. Some of them had it but in a weak degree, and not more than one or two out of the whole quantity appeared to have it so strong as the one which gave birth to these experiments and to the present paper, which is perhaps more prolix than could be wished; but the subject appeared to be not uninteresting, and I hope the remarks I have offered will be not altogether useless, as everything that can tend to add to the perfection of time-pieces, to remove any cause that operates against their perfection, is of some importance.

SOME English capitalists are about to dispatch workmen to New Zealand to commence the business of preserving mutton. The meat is to be put up in tin cans of various sizes. Meat has thus been successfully and profitably shipped from Australia to England, and there is no good reason why it may not be transported any distance in this manner.

ON ROPEMAKING.

(From Chapman's Treatise.)

HEMP.

Seed to be sown, should be of the preceding year, because it is an oily grain, and is apt to become rancid if kept too long; it is also advisable to choose the seed every second year from a different soil.

The time for sowing is from the beginning to the end of April; if sown earlier, the plants become tender, the frost will injure, if not totally destroy them. The plants should be left thick, as without this precaution, the plants grow large, the bark woody, and the fibers harsh.

The ripeness of the male plant is known by the leaves turning yellow, and the stem of a whitish color; and the ripeness of the female, by the opening of the pods so much that the seed may be seen—they will have a brownish appearance.

The harvest for pulling the male is about August, the female not being fit until Michaelmas. When gathered, it is taken by the root end in large handfuls, and with a wooden sword the flowers and leaves are dressed off—twelve hands form a bundle, head, or layer. It is immersed in water as soon as possible; as by drying, the mucilage hardens, and it requires a more severe operation to develop the bark than when macerated directly, which is injurious to the fiber. If let lie in water too long, the fibers are too much divided, and by an undue dissolution of the gum, would not have the strength to stand the effort it should, in being dressed. But if not sufficiently steeped, it becomes harsh, coarse, non-elastic, and encumbered with woody shives, which is a great defect. The next operation is to separate the fibers from the stem; this is done by a process called scutching, formerly practiced, but now by a machine called a brake; the operation is only breaking the reed or woody part, for the fiber itself, of which is the filamentous substance; hemp only bends, and does not break. The strength of the longitudinal fibers is superior to the fibers by which they are joined; or, in other words, it requires more to break them than to separate them from one another, as rubbing or beating causes the longitudinal fiber to separate, and in proportion to the greater or less degree of that separation, it becomes more or less fine, elastic, and soft.

When intended for cordage or coarse yarn, it requires only to be drawn through a coarse heckle; but if for fine yarn, through heckles of various degrees of fineness. In this process the pins carry off a part of the gum in the form of dust, which is very pernicious, and by dividing the fibers, separate entirely the heterogeneous mass. To effect this, the heckle is fixed upon a frame, one side inclining from the workman, who, grasping a handful of hemp in his hands, draws it through the heckle pins, which divides the fibers, cleanses and straightens them, and renders the hemp fit for spinning; if the fibers were spun longitudinally, the yarn would be stronger, would more easily join, and require less twist.

SPINNING.

When the spinner has placed the hemp around him, he commences by taking hold of the middle of the fibers, and attaching them to the rotary motion that supplies twist, which, upon receiving, he steps backwards, doubling the fibers in the operation. When the yarn is spun, it is warped into hauls or junks, which contain a certain number of threads or yarns in proportion to the size and weight. The hauls are then tarred, if required. The tar should be good, and of a bright color when rubbed by the fingers—Archangel being the best; mixing with it, at times, a portion of Stockholm, to ameliorate and soften that which has been boiled, as by repeated boiling it becomes of a pitchy consistency, and makes the cordage stiff, difficult to coil, and liable to break. The tar should at first be heated to a temperature of 220 degrees of Fahrenheit previous to commencing operations, so that the aqueous matter may be evaporated, and any dirt or other dense matter precipitated and taken out, thereby cleansing it from all impurities; as the yarn, passing through the tar, takes or draws in a quantity of moisture, and the atmospheric air in contact with the surface has a tendency to lower the temperature, it never should descend while in operation below 212 degrees to evaporate that moisture. The yarn should not pass through the tar at a greater speed than fifteen feet per minute, to allow it to imbibe a sufficient quantity to prevent decay, and cause an amalgamation to take place, rendering the cordage more durable in exposed situations, weaker by its adhesion to the fiber which makes it more rigid, and destroys a small portion of its strength and elasticity. After being tarred, the hauls are left for several hours to allow any moisture to evaporate; it is then coiled into the yarn-house, and left for several days to allow the tar to harden, and adhere more closely to the fiber; otherwise, should it be made into cordage directly after being tarred, the tar would press to the surface, decay take place in the center, and give the cordage an unsightly appearance. When the hauls have lain a time in store, they are wound upon bobbins, the haul being stretched along the floor of a shed; and each end being formed in loops or bights, are placed upon hooks, and made taut by tackles; the workman takes the end of four yarns, separates them, and, passing each end through a gage, attaches them to bobbins placed upon a machine to receive them, called a winding machine. When the bobbins are full, they each contain about 500 fathoms of yarn, or in proportion to the size of the yarn, and are taken from the machine and replaced by empty ones, and the operation proceeds.

The bobbins of yarn are then taken to a frame made to receive them, and the ends passed through a metallic plate perforated with holes in concentric circles; each yarn is passed through a single hole to the number of yarns required to form a strand; the whole are then brought together, and drawn through a cylindrical metallic tube, having a bore equal in diameter to the number of yarns when compressed. It is then attached to a machine which is drawn down the rope-walk by steam or some other power; at the same time a rotatory motion is given to twist the yarns into a strand, making an uniform cylinder. These machines are called registers, because they register the length. Forming, giving a proper formation, and equalizing for the equality of twist given the strands over the old method.

There are other machines for making cordage upon more scientific principles, and which give a greater uniformity of twist or angle, such us Captain Huddart's, for these reasons: —the backward traveling movement of any register, forming, or equalizing machine that is or may be used in a rope-walk, or the retrograde movement of such a machine towards the bottom of the walk to which the strands are drawn, and where the most improved and best principle is or may be adopted, has hitherto been found defective. The machines being worked by ropes applied in different ways, causes non-uniformity in the twist or angle; as, in some cases, the rope is made to draw the machine by fastening one of its ends to the machine and the other to a capstan at the bottom of the walk, the twist being given by the rotatory motion of the wheels upon which it travels; in other cases, a rope, termed a ground-rope, is made fast at each end of the walk, and, having one or more turns round the barrel of the machine, gives the required twist to the stands. Also an endless rope passing from one end of the walk to the other, the one end passing round a movable pulley, the other round a capstan, with power to drive the machine; the rope is then passed round a gab-wheel upon the machine the capstan being put in motion, the endless rope drives the gab-wheel, and causes the machine to retrograde or travel along the ground-rope which gives motion to the pinions, and twist the strands. The great object to be obtained is in regulating the retrograding or traveling motion, and to preserve a certain speed in a given time, in order that the strands may receive a proper degree of twist in a certain length.

The next operation, the strands are made into a rope by being attached to the machines at each end of the walk, and brought to a certain degree of tension by the means of tackles; a wood frame, called a drag, is made fast to the machine, and some heavy material placed upon it to retain that tension when released from the tackles. The machines are then put in motion, and as the strands receive tortion they shorten in their length—this is called hardening; but from various causes, during this process, an inequality of tension takes place, one strand becoming slack and the others tight, therefore of unequal lengths, although originally of equal lengths, and received the same number of twist or turns by machines of the most approved principle. The method practiced to remedy this, is to twist up the slack strand, making it harder and smaller, and consequently it cannot lay evenly in the rope, and will be the first to break. It is also obvious that an after-twist must be given the rope to cause the strands to unite, as for every twist given the rope the same is taken from the strands; hence the same number of twists the rope receives, the same number must be given to the strands, and any increase given the rope in making or rounding cannot be retained, but must come out when the rope is put upon a strain. When the strands have received a sufficient hardness of twist, they are placed upon one hook upon one of the machines; a cone of wood, called a top, with grooves cut in the surface sufficiently large to receive the strands, is then put between them; the machines are then put in motion, the strands made to bear equally, the tails wrapped around the rope, and all is ready for closing. The machine that twists the rope being set so as to make two revolutions, while the machine that twists the strands makes but one revolution; this extra revolution given the rope being requisite to overcome the friction which is caused by the top, tails, and the stake heads which are placed at every five fathoms to support the strands and rope, and which extra revolutions cannot be retained in the rope.

Acid Proof Cement.

R. F. Fairthorne writes to the *Journal of the Franklin Institute* that he has found the best preservative for corks exposed to acids to consist of a coating of silicate of soda and powdered glass. The cork having been bored to suit the size of the tube, is soaked for two or three hours in a solution of silicate of soda, consisting of one part of commercial concentrated solution, to three parts of water. The tube is next inserted, and when dry, the cork is covered with a paste made by mixing the condensed solution of the silicate with powdered glass in such proportion as to form a mass of about the same consistence as that of putty. This is spread on the under surface, and then washed with a solution of chloride of calcium. It soon hardens, but it is advisable to make the connection with the flask while the paste is in a plastic state, and to allow it to become solid before applying heat to the vessel containing the acid.

Corks protected in this manner are but slightly acted upon, though remaining over the boiling nitric acid more than four hours, and over hot acid for ten. In some instances, when not entirely covered, the vapor softens the cork beneath the silicate to the depth of about a quarter of an inch, but the cement has proved sufficiently strong to form a compact diaphragm, enabling the tube to be removed from the flask without danger of the fluid contained being contaminated. The application of this cement as a luting for chemical apparatus for general use, is suggested, as it is found that it remains unaffected even when immersed in strong nitric, sulphuric, or muriatic acids. The immersion in these liquids, made while the paster is still soft, has the only perceptible effect of hardening the same immediately.