MASKS OF CLASSIC AND MODERN TIMES.—I.

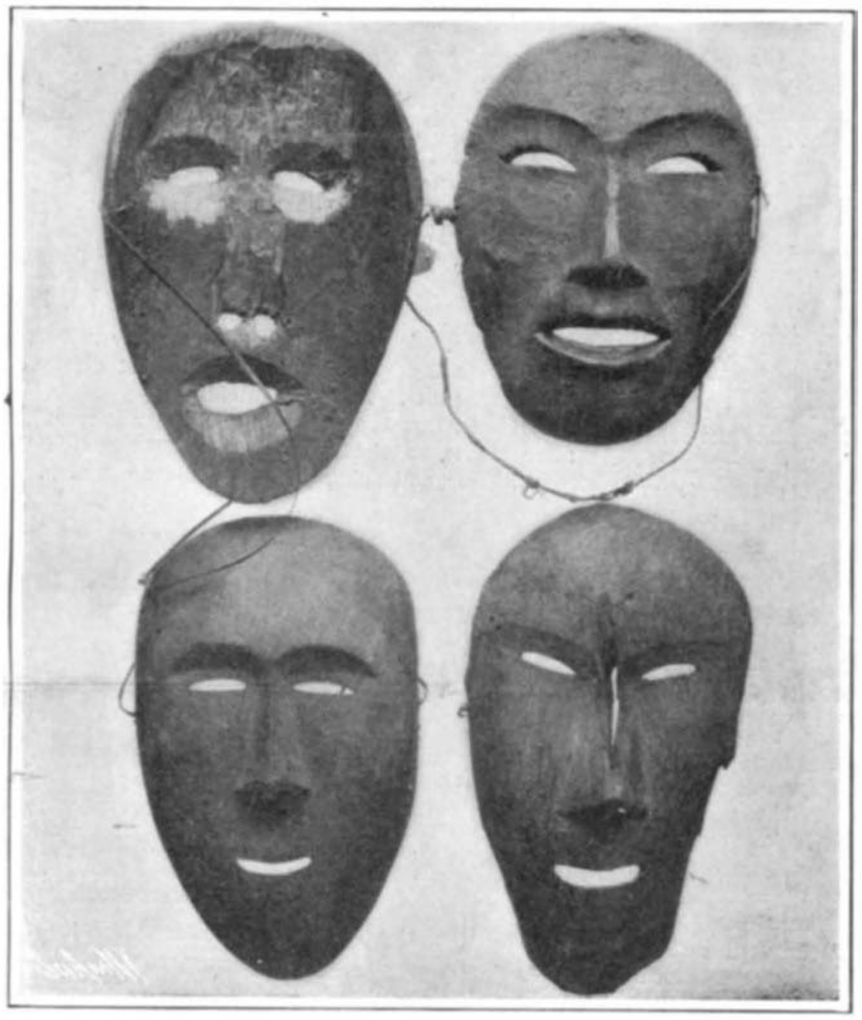
BY RANDOLPH I. GEARE.

The primal use of a mask was to shield or protect the face, and therefore ornamentation in the early stages of mask evolution was of far less importance than impenetrability. It naturally followed that fierce tribes adopted ferocious-looking masks, which succeeded more or less in frightening their enemies, and this tendency gradually increased, with a consequent decrease in defensive usefulness. Later special devices were invented for heightening the wearer's terror-inspiring powers, until the defensive idea was all but obliterated. It was not very long afterward that each warrior engrafted on his mask such features as were in his opinion best suited to carry out his own purpose; superhuman attributes were inaugurated, because of the influence which their representation exerted. In this way masks found their way among religious paraphernalia. It also came about that the portrayal of those very qualities which excited aversion or contempt in time of war, only provoked ridicule in time of peace; and ridicule, as Dr. Dall states in his excellent paper on Masks and Labrets, seems to be the only form of humor among savages. In the course of time, therefore, a set of devices became typical of buffoonery, and these were appropriate for use with the ceremonies attending the orgies of Dionysus, was general both in Greece and Rome. At first the Romans were only imitators of the Greeks, although in modern days the Italians, as well as the French, have endeavored to revive the art of the ancient stage, and other nations have made attempts in the same direction through the medium of tragedy. England and Spain are responsible for the romantic drama, which is neither tragedy nor comedy, and which began to flourish some three hundred years ago. Lastly came the German stage, which naturally showed evidence of influences derived from its predecessors. In all of these productions masks were frequently used.

But the use of masks was especially prominent in connection with histrionic art, and they differed in kind according to whether the play was tragic or comic. In their mimetic art the foremost idea of the ancient Greeks seems to have been to imbue their characters with heroic grandeur, a superhuman dignity and an ideal beauty. The exactness of the representation was not so important as its beauty, and from that standpoint the use of masks became essential, for the Greeks would have deemed it ignoble to allow an Apollo or a Hercules to be represented by a player who had perhaps a face that was anything but that of the god he represented. Masks were changed, too, to

A curious addition to the mask was the arrangement already mentioned for increasing the volume of sound. Some of the Grecian theaters held thirty thousand people and upward, and the natural voice [illegible]t strong enough, for which reason a mouthp[illegible] metal was introduced, whereby the voice could be thrown to the farthest seat. Everything was on a heroic scale—the stage, orchestra, and the buildings. And so critical were the audiences that a false intonation of a single syllable by an actor brought down on him a storm of vociferous dissent. The great tragedies of Sophocles, Æschylus, and Euripides, as well as the comedies of Aristophanes, were presented to the most intelligent audiences the world has ever known under the conditions which then existed.

The masks of wax used at more modern Roman carnivals afford a rather good idea of the appearance of the theatrical masks of the ancients. They imitate life movements in a masterly manner, causing an almost perfect deception when viewed from a distance. They always contain the apple of the eye, as seen in ancient masks, and the persons wearing them see only through the aperture left for the iris. The ancients went still further, and provided even an iris in their masks. Accidental circumstances were also imitated; as, for instance, the cheeks of Tyro, down which the



Wooden Masks of the Chuckchi Indians of Siberia.

Egyptian Stucco and Wood Masks from Mummy Cases, with Coarse Matting of Dhoom Palm.

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in public amusements. The scope of the mask thus became greatly widened, and henceforward it was applied in various ways, e.g., on the stage, as a social symbol, or in connection with religious ceremonies. Some masks were raised above the face of the wearer to the upper part of the headdress, in order to give increased height to the person playing the part of a supernatural hero. At times masks have so vividly portrayed the ideas for which they stood, that wearers could be dispensed with altogether, and the mask itself formed an independent object of attention. "It may be in this case," writes Dr. Dall, "associated with the bodies of the dead, as in Peruvian graves, or erected in connection with religious rites; a practice widely spread, and not to be confounded with statues or idols, which approach the same end by a different path; or finally attached to the altar or building devoted to such rites. In the last case weight is of no consequence; and, in general, durability is of importance, from whence are derived the stone models of faces or stone masks of which Mexico and the Caribbean islands have afforded such remarkable examples."

The stucco and wooden masks used by the ancient Egyptians for covering the faces of the dead, as well as the stone masks found in the ancient city of Pompeii, present another phase of this interesting study.

Having now briefly traced the origin of the mask, reference will be made to its particular uses in different regions, with illustrations of some conspicuous specimens in the collections of the United States National Museum.

The employment of masks in dramatic performances, as well as in funeral processions and in connection indicate different moods of the same person; such as joy, sorrow, or anger, according as the player was actuated by one or another of these emotions. Comic masks were distinguished by a grotesque, laughing countenance; while tragic masks had a more dignified appearance, but were sometimes hideous and frightful. Such arbitrary changes must have been very trying to the audience, and we can imagine their feelings if an absent-minded actor happened to present the wrong side of the mask. There were also satyr masks and other kinds for dancers. They usually had very large, open mouths, within which were metallic bars or other resonant bodies to strengthen the voice.

During the work of making excavations in Greece and Asia Minor some years ago, face masks of gold, bronze, and terra-cotta were found. In Greece they were also made of painted wood, bark, or linen.

Masks used on the stage were commonly head masks, which incased the whole head and rested on the shoulders, but such an increase of size in the head dwarfed the rest of the figure, and therefore the actor wore buskins with enormously thick soles, to augment his height and give a stately appearance to his gait. In order that due proportion might be preserved, the robes were also padded out, and the actor thus became like the statues which we call "heroic." The idea was that when a god or god-hero was to be represented, the ordinary proportions of a man were regarded as too puny. Even the mask itself was so designed as to present features in an exaggerated degree. The eyeballs were painted white, the pupils being left open to serve as peepholes. The mouth was left open in a square or trumpet shape.

blood had rolled from the cruel conduct of his stepmother.

(To be continued.)

The Waterproofing of Concrete Blocks and Walls.

It is well that attention be called to the general use of the word waterproof without due regard to its meaning, and without analysis of those properties of concrete blocks which have a bearing on the subject. Dense, impermeable, and waterproof, as well as porosity, permeability, and absorption, are terms often used in a manner so indiscriminate as to lead to the supposition that, if not themselves synonymous, their ratios at least are unvarying. Such is not the case, although there are certain relations existing between them which deserve consideration.

A dense block is one in which the interstices between aggregates are filled as far as may be possible in actual practice, and the porosity of a concrete block is the percentage of voids which it contains.

An impermeable block is one through which water under such pressure as the member is calculated to withstand will not pass with rapidity sufficient to transmit dampness, and permeability is the rate of speed with which water permeates the block.

A waterproof block is one which when immersed in water will not absorb any of the liquid, and absorption is the ultimate water-consuming capacity of a block partially submerged. Absorption tests are usually made for forty-eight hours, and the average results obtained in a series of tests on concrete blocks made by the Bureau of Building Inspection in Philadelphia show five per cent by weight in that time.

It is therefore evident: First, That no concrete block of ordinary manufacture is waterproof in the sense stated; second, that proper materials and care in manufacture will greatly increase the impermeability of blocks; third, that proper selection, gradation and mixing of materials will so far eliminate voids as to reduce greatly the absorption of the average concrete block. The chief causes of permeability are: 1. Use of fine sand without coarse aggregate. 2. Use of a very dry mix. 3. Insufficient cement. 4. Careless mixing.

Porosity has reference to the total voids in a block while permeability is governed by the size and continuity of voids. Proper proportions of coarse and fine material are better than either used alone. It will be found that the density of a sand mixture is greatly increased by the introduction of properly graded coarse aggregate and that the permeability of broken stone concrete is greatly lessened by the introduction of sand or screenings which reduce the size of the voids. The reader will understand that "run of crusher" usually contains fine particles in sufficient quantities. It is evident that unless cement be reduced to solution it cannot fill the voids in the sand, and the use of an exceedingly dry mix is without question responsible for the greater portion of unreasonably permeable blocks. It is so easy to work a dry mix and the blocks are so quickly and easily removable from the molds that many, regardless of consequences, yield to the temptation.

Following the same line of reasoning, it is easy to see that in using too lean mixture the quantity of cement is inadequate to fill the voids and the result is similar.

Though the amount of water be sufficient and the quantity of cement adequate, uniform distribution can be secured only by thorough mixing, while faulty mixing causes in portions of the block results similar to those shown by a lack of water or cement.

While it is entirely practicable by following suggestions already made to manufacture blocks as impermeable as required in ordinary construction, and more so than the average of other building materials, it is nevertheless a fact that the indifferent work of many operators is such that, except with the very best appliances, blocks are marketed whose inefficiency is proven by the first storm. Moreover, there are machines offered to the prospective operator with which the most expert labor would find it difficult to produce a reasonably impermeable block.

The first and most natural remedy is the use of lime. We find, however, that unslaked portions of lime will burn, and expansion and disintegration will follow. These difficulties are overcome by the use of the slaked and sifted powder commercially known as "hydrated lime," to the use of which there seems to be no valid objection. The admixture of one-half of hydrated lime to one part of cement gives added density, occasions no loss of strength and greatly decreases the permeability. Some authorities advise the use of equal quantities of hydrated lime and cement, and equal parts of slaked lime and cement are recommended by the writer for mortar in which the blocks are laid.

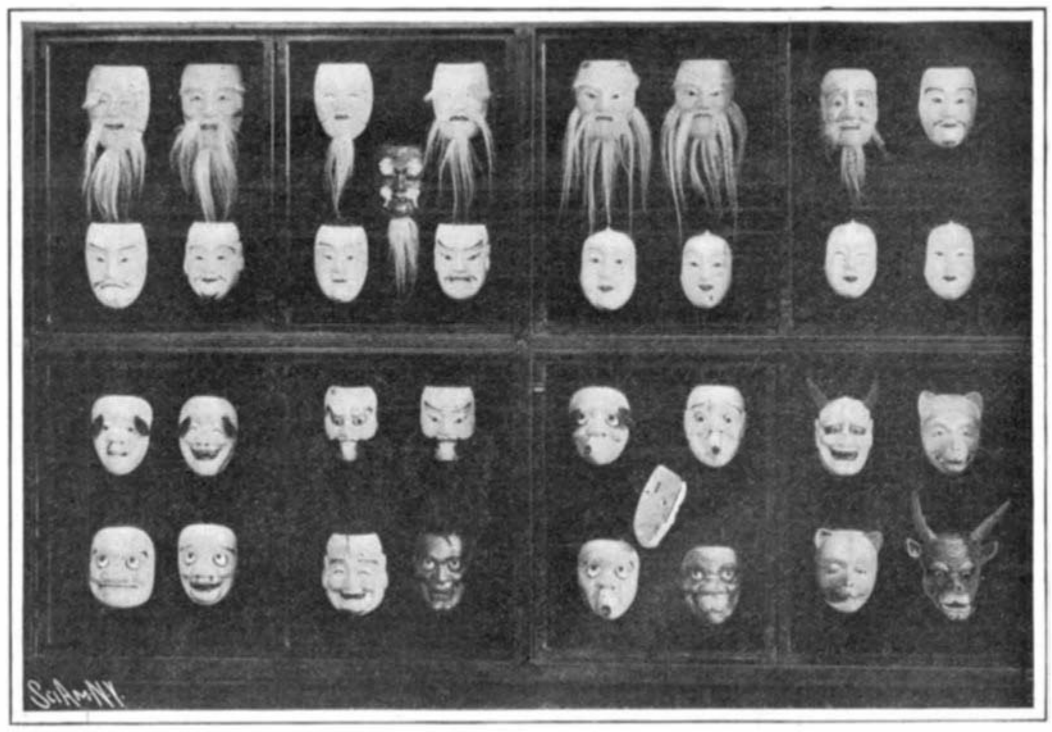
The application of a rich face has been found one of the most efficient methods of retarding the passage of moisture because of the protection afforded the interior of the block by an impermeable face. The process of manufacture must involve such condensation of the block as will thoroughly compact the face matter and firmly bond it with the underlying coarse concrete, leaving no distinct line of cleavage. If properly accomplished, this method gives excellent satisfaction, but any attempt to face a block after it is made, or to make separate operations of manufacturing the body and face of the block, will result disastrously.

With the usual materials of manufacture various ingredients may be incorporated designed to produce by chemical reaction substances impenetrable by water. Of those which may be locally compounded, doubtless the least harmful is five per cent of powdered alum, mixed with the cement and one per cent of soft soap, or ten per cent of a solution of laundry soap, mixed with the water. A number of chemical compounds of unknown ingredients are now offered to block makers and guaranteed to produce waterproof work. It is a serious question, even admitting that the initial strength of the cement might not be impaired by such adulteration, whether the life of the added ingredients will be as great as the life of the cement.

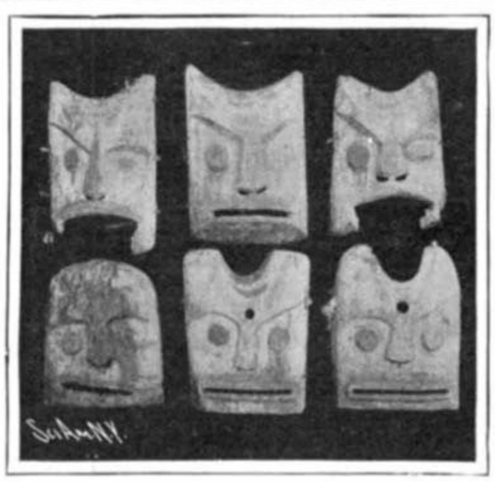
There are also numerous methods of waterproofing after erection. The alternate application of a hot solution of soap and a solution of alum is widely known as the Sylvester process. The patented colorless and odorless liquids of which one coat applied without heating will unquestionably render a wall proof against water under any reasonable pressure are advertised in technical journals. I have not found a man who was willing to venture an opinion as to the permanence, on work subjected to atmospheric exposure, of impermeability produced by the use of these solutions. Another method of waterproofing after erection, particularly adapted for cellar walls, is the application on the interior of hot roofing tar and Portland cement in equal parts, or of one of the patented waterproof paints.

Time is a factor of waterproofing. Careful observation has shown that in some cases the walls of buildings, damp during the first season, have gradually become more impermeable as the natural accumulation of soot and dust filled the exterior pores of the blocks.

The top mask is a mechanical contrivance made by the Thinkit Indians of S. E. Alaska. On the top is a jumping-jack. The bird'seyes and bill and the mouth and limbs of the manikin are worked by strings pulled by the wearer. The figure at the left is set on top of a small mask and is dressed in cedar-bark. It is used by the medicine men of British Columbia. The right-hand figure represents Olona, the mountain demon of the Kwakintil and other British Columbia Indians.



Papier Maché Masks Worn in the Sacred Japanese Drama "NO."



Burial Masks from Prince William Sound. These Are Laid Over the Faces of the Dead.

British Columbia Mask or Raven Costume Worn by Priest During Sacred Ceremonies.

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It must be admitted that this observation is of little value as a source of satisfaction to the householder; the average man, finding his dwelling damp during the first season, will sell at a sacrifice and thereafter be an enemy of concrete.

No standard building material in use at the present day is absolutely waterproof. Brick and stone absorb varying percentages of water, and a dry interior is obtained only by furring or some other method of producing an air space between the outer section of the wall and the inner finish.—The Cement Age.

Santos-Dumont's Experiments in His Aeroplane "14 Bis."

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

After the first trials of his new aeroplane, Santos-Dumont succeeded in making a flight above the ground which, although of but a short distance, speaks well for the future performance of the apparatus. The flight took place on the 13th of September, in the presence of the Aero Club Commission, with the official timekeepers, for it was intended to compete for the Ernest Archdeacon Cup or the lesser prizes. Starting at 7:50 A. M., the aeronaut threw on the motor, but did not succeed in getting more than 900 revolutions per minute out of it instead of the expected 1,300. The aeroplane traveled at a good speed over the Polo grounds upon its wheels, but without rising entirely. Then the aeroplane was turned about so as to head in the other direction and started on a second run. Before the event the ground had been staked out at 30-foot distances, with a man behind each stake. It was important to measure the space, for a flight of 80 feet would have won the Archdeacon Cup, while a 300-foot flight would have earned a prize of $300. At 8:40 the motor was again started and the propeller turned at more than 1,000 revolutions, which was a good figure, if not at the best speed. The aeroplane rolled over the ground at a speed of 25 miles an hour or thereabouts. When at the proper point Santos-Dumont, thinking that he had a good enough start, turned up the front rudder so as to take the flight in the air.

The two front wheels left the ground, then the rear wheel rose, according to some, three feet, and according to others six feet. This lasted for a second or more, and during this time the aeroplane covered a distance of 15 or 20 feet. For some reason which it is hard to discover, the machine came to the ground again, and in spite of the rubber springs, the shock was enough to bring the rear propeller against the ground. One blade flew off, and the back end of the shaft was fouled; also the bamboo frame was broken at the rear end, and the radiator somewhat damaged. Santos-Dumont was not disheartened by the mishap. He had succeeded in flying a short distance, at least. He hoped to make a longer flight, but perhaps went up too soon by a sudden movement of the rudder. Such a movement is of course difficult to carry out without some practice. Moreover, his propeller did not speed up enough. After making the needed repairs, which will take two weeks at least, he expects to resume his experiments. The aeroplane proper was not damaged in the flight.

On the whole, the result is promising. M. Ernest Archdeacon, president of the Aero Club Commission, made inquiry into the previous aeroplane records and found that none of the previous machines had ever left the ground entirely, so that to Santos-Dumont belongs the honor of having made the first flight in France. The official report states that the apparatus left the ground entirely and sailed at a height estimated diversely at two to three feet, over a distance of 15 to 20 feet, with a speed of 18 to 20 miles an hour in the air.

The Alleged Influence of the Seasons Upon Earthquakes.

The majority of seismologists admit a periodic relation of the shocks of earthquakes with the vicissitudes of the seasons. The maximum frequency is held to occur in the cold season; the minimum, in the warm season. According to a memorandum of Mons. de Montessus de Ballore presented to the Académie des Sciences by Mons. de Lapparent, this theory is without foundation. Mons. de Ballore compared in all 75,737 tremors recorded in 81 catalogues, and corresponding actually with about 60,000 different quakes. The maxima of frequency were distributed in the following manner:

	Maximum of Apparent Seismic Frequency Falling.	
	From October to March, Per cent.	From April to September, Per cent
North latitude to 45 deg	90	10
South latitude to 45 deg..........	47	49*

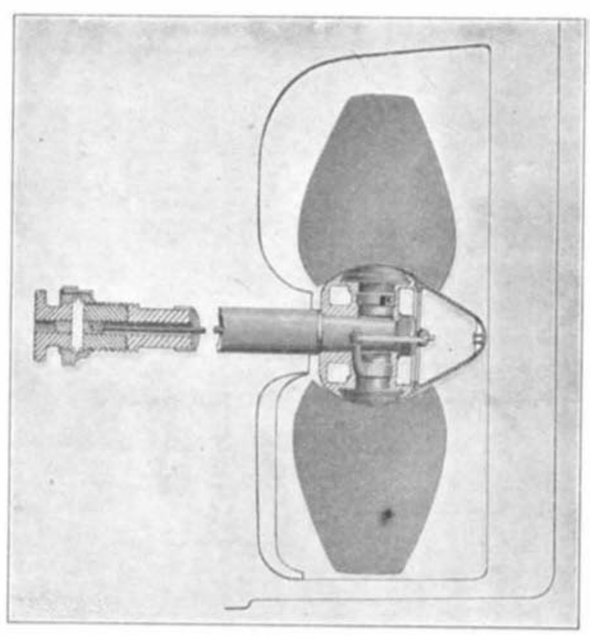
* Four per cent neither maximum nor minimum.

Thus the northern regions (north latitude to 45 deg.) show an enormous preponderance of cases in which the apparent frequency of earthquakes falls during the cold season; the southern regions appear indifferent to this point of view. Mons. de Ballore explains the matter in a very simple way. The number of weak shocks is in an enormous proportion more considerable than that of the shocks somewhat violent, and man perceives these light shocks much better when he is under the shelter of a habitation and quiet, than when he is about and in a state of activity. Now, in the northern regions it is during the cold season (from October to March) that we spend the most unoccupied time and are most under shelter; in the southern regions, the conditions remain perceptibly the same the whole year. Thus would be explained this apparent inequality in the frequency of earthquakes, which according to Mons. de Ballore occur equally at all seasons.—L'Illustration.

THE "R. C. RICKMERS"—THE LARGEST SAILING SHIP AFLOAT.

To Germany belongs the credit of possessing not merely the fastest steamships afloat, but also the largest sailing vessels. The credit for the latter distinction is due largely to the Rickmers Rice Mill, Freight, and Shipbuilding Company, at Bremerhaven-Geestemünde, who during the past few years have built several unusually large sailing vessels, chiefly for the handling of their enormous rice trade. The latest and largest of these ships is the "R. C. Rickmers," which recently arrived at New York on her maiden outward trip to Saigon and Bangkok by way of Cape Horn.

The "Rickmers" differs from her predecessors in the sailing fleet of this company, not merely in size, but in the fact that a decided innovation is being tried by providing her with an auxiliary steam engine, the object of which is to assist the ship across the belt of



FEATHERING PROPELLER OF THE "R. C. RICKMERS," WITH THE BLADES THROWN PARALLEL WITH THE KEEL FOR SAILING.

calms, and also in her movements in harbor when coming to an anchorage, warping alongside a dock, or threading her way through entrance channels and other narrow waterways.

The spirited illustration of this great ship, which we present on the front page of this issue, gives an excellent impression of her great length, graceful sheer, lofty bow, and towering spread of canvas. She is shown with practically everything set, and bowling along at 13 to 14 knots on her favorite point of sailing, which is with the wind over the quarter. On deck the "Rickmers" measures 441 feet in length; her extreme beam is 53 feet 8 inches; her draft is 26 feet 9 inches when fully loaded, and her molded depth is 32 feet. Her gross tonnage is 5,548 tons, and on her maximum draft she displaces 11,360 tons. She carries, of course, a huge spread of canvas, the vertical height from the deck to the truck of the mainmast being 177 feet, and the length of the main yard 100 feet. There are five masts, known respectively as the fore, main, middle, mizzen, and spanker. All of the masts are of steel, except that at the extreme top of each there is a 6-foot wooden stump. The total spread of canvas is 50,000 square feet, and as the captain does not hesitate to hang onto every rag of this, long after smaller craft are shortening sail, it can readily be understood that the dimensions of the masts, and the number and size of the steel rope of the wire rigging, are unusual. The mainmast, which is built of half-inch steel plates, measures three feet in external diameter. To stay and hold up to its work the towering spread of canvas on this mast alone calls for no less than thirty shrouds and backstays, fifteen on each side. First there are six shrouds of special 5½-inch steel wire; then come six backstays of the same dimensions, two backstays of 4½-inch wire, and one of 4-inch; and so great is the holding strength of these fifteen ropes, that in the strongest breeze there is very little perceptible slackening of the lee shrouds or backstays. A rather surprising feature in this [illegible] that, in spite of her great size, all the sails are [illegible] by hand by means of special windlasses. The ship's complement consists of fifty-nine hands, two officers and two captains, the ship carrying two captains on the maiden trip only.

The auxiliary equipment consists of a triple-expansion engine of 750 indicated horse-power, steam for which is provided by two boilers; and in the side and between-deck bunkers a fuel supply of 650 tons can be carried. It was found that, in moderate weather, when the ship is in ballast, the engines can drive her at a speed of 8 knots per hour; when she is loaded the speed under steam is from 6 to 7 knots. Because of the great length and easy lines of the "Rickmers" and her large spread of canvas, she is capable, under favorable conditions, of sailing faster than any ship afloat, and probably faster than any ship that was ever built. On the trip to New York, for a period of eight hours, with the wind free, she averaged 15¾ knots per hour, and Capt. A. Walsen informed our representative that judging from this performance and the ability of the ship to carry her canvas in heavy weather, she would probably be able to make 17 knots an hour when going free in half a gale of wind. She is fitted with the well-known Bevis type of patent feathering propeller which, when sail power is to be used, can be so adjusted by means of a central shaft inclosed within the stern shaft, that the propeller blades will lie in the vertical plane of the keel.

The hull of the "Rickmers" is constructed with a cellular water-tight double bottom which, together with the four water-tight divisions, constituting the "deep tank" in the middle of the vessel, can be filled with water ballast to the amount of about 2,700 tons, which is sufficient to give the vessel the necessary sailing stability when she is in ballast. The actual weight of the ship itself is 3,350 tons, and she has a maximum carrying capacity of about 8,000 tons.

THE BIRKELAND-EYDE PROCESS AND THE ARTIFICIAL PRODUCTION OF NITRATES FROM THE ATMOSPHERE.

BY M. ALOER.

For years Prof. Birkeland, of the Christiania University, and S. Eyde, a civil engineer, have been experimenting with a process of removing nitrogen from the atmosphere by electrical processes for the ultimate purpose of employing it as a fertilizer, in the form of calcium nitrate. The Birkeland-Eyde plant is located at the waterfall Svaelgfos, Notodden, in the district of Telemarken, Norway, where 30,000 horse-power will soon be utilized, and large amounts of nitrate of calcium for direct use will be produced. In all processes for the reduction of atmospheric nitrogen the air is exposed to the high temperature of the electric arc, and cooled as rapidly as possible after the combination of a portion of the atmospheric oxygen and nitrogen. Without rapid cooling the compound decomposes. Furthermore, only very small arcs can be employed, for the larger the arc the smaller will be the amount of air exposed to the flame. In the Birkeland-Eyde process a short arc is formed at the terminals of the closely adjacent electrodes, establishing an easily movable and ductile current conductor in a strong and extensive magnetic field, i. e., from 4,000 to 5,000 lines of force per square centimeter in the center. The arc then moves in a direction perpendicular to the lines of force, at first with an enormous velocity which subsequently diminishes; and the extremities of the arc retire from the terminals of the electrodes. As the length of the arc increases its electrical resistance also increases, so that the tension is increased until it becomes sufficient to create a new arc at the points of the electrodes. The resistance of the short arc is small; hence the tension of the electrodes drops suddenly, with the result that the outer long arc is extinguished. In alternating current such as that used by Birkeland and Eyde all the arcs with a positive direction run one way, while all the arcs with a negative direction run the opposite way, assuming that magnetization is effected by direct currents. In this manner a complete luminous disk is presented to the eye.

The arcs are contained in flat iron drums or furnaces lined with asbestos and mica. The electrodes are formed of copper tubes, through which cooling water flows, and are placed equatorially between the poles of a powerful electromagnet. The temperature to which the current of air passing through the drum is exposed is approximately 3,000 deg. C. (5,432 deg. F.); and it is calculated that one-fifth of the air acquires this temperature.

The nitrogen and oxygen combine to form nitric oxide; if this gas were allowed to cool slowly to atmospheric temperature, it would again be resolved into its constituents, but the arc closes and the gas is suddenly cooled, so that much of it escapes decomposition, and is swept along with the current into absorbers. It issues from the drum at a temperature