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The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE TRIUMPH OF THE SCOW.

Among the many conditions that contribute to our apparently impregnable defense of the America cup, not the least important is the great popularity in America of the smaller classes of racing yachts, of from 21 to 30 foot measurement, and the rich store of experience which has been gained by our younger architects in the designing and building of these small craft. To the influence of the Seawanhaka cup (which for many years past, in the hands of its present Canadian holders, has seemed about as impregnable as the America cup itself) is no doubt to be largely attributed the development of the vast fleet of small racing craft which forms such a picturesque element in our waters during the summer season. On account of the relatively small cost of these boats, and the absolutely free hand usually given to their designers, every possible form of model and variation of sail plan has been tried. Several seasons ago it had been proved beyond a doubt that what has come to be called the "wholesome" yacht of reasonably large displacement, moderate beam, easy lines, and small sail plan, has no chance whatever in competition with the broad-beamed, shoal, light-displacement craft, with enormous overhangs, which has come to be known by the thoroughly descriptive and generic name of "scow." Of course, the scow has its limitations. In light breezes and a troubled sea it has a way of standing bolt upright, slatting the wind out of its sails, and moving with sluggish and leewardly gait through the water, while its sweeter-modeled and rounder-bodied sister, despite its smaller sail power, was eating its way comfortably to the weather mark. These conditions, however, are comparatively infrequent; and as soon as there was any heart in the wind, the scow moved so fast through the water that the advantage of higher pointing by the other type was easily wiped out, and in nine times out of ten, the boat with the larger sail spread was first home across the finishing mark. It was only a question of time when the success of the scow in the smaller classes should lead to the incorporation, in a modified form, of its principles in the larger yachts. When Gardner brought out his "Weetamoe" and "Neola" and Crowninshield his "Independence," it was proved that with proper modifications the speedy qualities shown by the scow in the 21-footer could be repeated in the 60-foot or 90-foot racing yacht. Had she been the fourth or fifth 90-foot racer to come from the Crowninshield board instead of being the first, there is not the least doubt that "Independence" would have proved much the fastest boat in the "Columbia"-"Constitution"-"Independence" trials. As it was, she contained errors both in form and construction which were due to the facts, first, that her designer followed too closely the lines of his successful 21-footers and secondly that he had no accumulated constructive data to work upon.

We never doubted for a moment that when the new yacht that was to be built by Herreshoff to meet "Shamrock III." made her appearance she would embody the characteristics of shoal body, full waterlines, and long overhangs and excessive sail plan that distinguish the scow type. It was evident that in "Constitution" Herreshoff had developed the normal type to about its ultimate possibilities, and it was pretty certain that, of the rival designers, the one who struck out boldly in the direction of the scow would fly the winning flag in the next series of international contests. When "Shamrock III." came over here and went into drydock it was evident that she conformed entirely to the type of boat to which "Shamrock II.," "Columbia," and "Constitution" belonged, and a great deal of the interest attaching to the present races is due to the fact that in "Shamrock III." we see an attempt to beat the scow type by a vessel of what might be called the normal design. The closeness of the contests proved that Fife has carried the development of the normal type further than Herreshoff was able, for "Constitution," except in absolutely smooth seas and light winds, was never able to push the "Reliance" as closely as "Shamrock III." has done, especially when sheets were hard aboard. What was true of the 21-footer is true of the 90-footer, namely, that the boat with the larger sail spread and smaller displacement will win out against a boat of larger displacement and carrying a relatively small rig. As a matter of fact the displacement of "Shamrock" is about as large if not greater than that of "Reliance"; yet such is the power that is gained from the scow form, that the "Reliance" is able to carry about 14 per cent more sail area on equal or less displacement. It is a great tribute to the skill of Herreshoff that in adopting the scow type he should have modified its objectionable features to such an extent that "Reliance" appears to be relatively just as fast if not faster under conditions supposed to be unfavorable to her type as she is under those in which the scow has hitherto done its best work. It is equally to the credit of Fife that, while retaining the wonderful windward qualities of the more normal boat, he has so improved the reaching qualities that on this point of sailing she is practically a match for the "Reliance" in spite of the 120-foot waterline on which the latter sails when heeled to a scupper breeze.

"SCIENTIFIC HOOLIGANISM" AGAIN.

The claim to perfect secrecy of wireless messages suffered another shock last week during the yacht races, when the Marconi and the De Forest wireless messages were interfered with by some "scientific Hooligan" as Prof. Fleming would call him. The scientific world is still chuckling over the clever work of Mr. Neville Maskelyn in upsetting Prof. Fleming's claim that tuned messages could not be intercepted or interfered with, and the trick was justified on account of Mr. Maskelyn's motive and the fact that he did not maliciously interfere with Prof. Fleming's lecture. Mr. Maskelyn's unknown imitator in this country, however, went to a spiteful extreme in entirely interrupting with floods of profanity and obscenity the news for which the public was eagerly waiting. The perpetrator of such a cowardly deed should be vigorously prosecuted, the act being similar to that of severing telegraph or telephone wires. The difficulty of apprehending such vandals will always be great, and for this reason the question of safeguarding wireless messages should receive renewed attention. The fact that tuning of systems has failed to accomplish all that was required of it is confirmed by the statement of the De Forest Company, that prior to the races an understanding was entered into with the Marconi Company whereby their respective systems should not be worked simultaneously to interfere with each other. The character of the telegraphic signals received on these two systems is very different. In one system the dots and dashes are short and sharp; in the other they are of much longer duration, and we are informed that it is possible for two operators to receive on one receiver messages sent simultaneously from a Marconi and a De Forest transmitter, provided one operator devotes his entire attention to the Marconigram while the other pays strict attention to the De Forest message. Now if, with systems so different in character, it was thought best to make arrangements for non-interference, how much more necessary would it have been to prevent interference in systems using approximately the same length of telegraphic signal.

Wireless telegraphy is essentially similar to heliographic signaling. As the Hertzian waves are invisible, there is used in wireless telegraphy an electric receiver which Lord Kelvin has aptly called the "electric eye." To carry out our comparison, all efforts so far have been made to cause the light flashed out to have such a wave length or color as the "electric eye" is best adapted to receive. The failure of this attempt is due to the fact that the "electric eye" does with varying efficiency receive Hertzian waves of greatly varying lengths, the difference in efficiency being too slight for practical detection. One thing seems to have been forgotten—the "eye" as now arranged is capable of receiving waves from every point of the compass, and similarly, the transmitting station spreads out its waves to all parts of the horizon. Why would not a practical solution of the difficulty be the use of a lens for focusing the rays directly on the "electric eye," and furthermore, of providing "electric spectacles" as some one has called them, for the "electric eyes" themselves? It is well known that Hertzian waves can be readily focused by the use of a lens made of pitch, and such an arrangement would cause the "electric eye" to see most plainly those rays sent from one particular direction, while all outside sources of Hertzian waves would affect it to a comparatively small degree. If necessary, these rays might be screened off by a screen of wire or plate-metal.

THE GREAT SUBWAY POWER PLANT.

New York city contains more power plants of unusual size and capacity than any city in the world, and the remarkable thing is that each successful plant that is built exceeds greatly its predecessors. By far the most imposing of these is the generating station which is now being built to supply power for the Rapid Transit Subway. It is located on the Hudson River at Fifty-eight Street, and the building covers a plot of ground 200 feet in width by 700 feet in length. Its enormous proportions must be seen to be fully appreciated; but a fair idea of its size is gathered when we state that it is nearly twice as large as Madison Square Garden in this city. By the time it is fully equipped, it is estimated that its cost will have reached seven million dollars. When the complete plant has been installed and the station is working up to its fullest capacity, the combined power of the generators will reach the great figure of 130,000 horse power. The great coal bunker which will be constructed immediately beneath the roof and extend the full length of the boiler room, will have a capacity of 25,000 tons, or sufficient, if it were completely filled, to run the plant continuously for nearly a month. The coal will be brought to the docks at the river end of the building, where it will be raised by belt conveyors to an elevation of about 80 feet above the street, carried for the full length of the bunkers, and automatically dumped wherever it is required. From the bunkers it will be drawn off by gravity through chutes which terminate above the furnace doors. Here the coal will be delivered into the hoppers of the mechanical stokers, and after it has done its work in the furnaces, the ashes will be automatically dumped at the rear end of the furnace into hoppers, through which it will flow into ash cars, that run upon tracks to the river, where the ashes will be unloaded into scows. A remarkable feature of the building by which, indeed, it may be easily recognized will be the five great smokestacks, each 265 feet in height, and a novel feature in the construction of these stacks is that, instead of the chimneys extending completely down to ground level, they will be carried by massive steel platforms which will extend 40 feet above the floor of the power house. This is done to save a large amount of valuable space which has hitherto been monopolized by the square base of such chimneys. The building is of the usual steel and masonry type. The architectural features promise to be pleasing and appropriate for the size and character of the structure. The exterior wall consists of cut granite up to a certain level, above which it is built of terra cotta and pressed brick, while the interior is lined with chocolate and cream-colored brick for the first two stories, and above that with an attractive shade of buff brick. In spite of the serious delays which have been caused by strikes, it is expected that this, the largest building in the city, will be completed early in the coming year.

ELECTRICITY ON THE MIAMI AND ERIE CANAL.

Both direct-current motors and polyphase alternating-current motors have been used with more or less success for electric canal haulage, not only in Belgium and other European countries, but also in America. Recently electric haulage has been utilized on the Miami and Erie Canal, and this is said to be the first three-phase traction system in the United States. This canal cost with its reservoirs about $8,000,000, the latter including the grand reservoir of seventeen thousand acres, the Laramie reservoir of nearly two thousand acres, and the Lewiston reservoir of somewhat over seven thousand acres. The canal ranges from 4 to 6 feet in depth, and in width from 40 to 60 feet along the line from Dayton to Toledo and Cincinnati. The electric haulage on this American canal is largely due to Thomas N. Fordyce. The total distance is about 68 miles, and a standard single-track road is provided along the towpath of the canal. From five to seven canalboats are hauled by each electric locomotive, the current being taken from overhead trolley lines, the track acting as the third conductor. The trolley wires range in height from 7 to 22 feet, the former being that used under the various bridges in Cincinnati. The feeders are stranded aluminium wire and the trolley wires are No. 0000 G. E. grooved wires mounted on flexible brackets. The current is supplied from the power plant of the Cincinnati Gas and Electric Company and has a frequency of 60 cycles and a pressure of 4,000 volts.

At the Spring Grove substation the current is reduced in pressure to 400 volts, and in phase is transformed by the Scott method of arranging the transformer connections to two-phase. The voltage of the three-phase on the transmission line along the canal is 33,000 volts, and the frequency 25 cycles per second, and to obtain this pressure motor-generators and step-up transformers are employed at the substation. A 300-kilowatt three-phase generator of 390 volts is driven by a 450-horsepower synchronous motor, which is supplied with the two-phase current entering Spring Grove converter station. The 390-volt three-phase current, which then has a frequency of 25 cycles, is raised in pressure by 250 kilowatt step-up transformers to 33,000 volts.

Step-down substations are located along the canal

line about a dozen miles apart, and the current is reduced in pressure from 33,000 volts to 1,090 volts for use on the three-phase canal trolley line. The three transformers installed in the substation are connected in delta, and each has a capacity of 150 kilowatts. The substations are 60 feet long, 25 feet wide and 25 feet high, the basement being 7 feet high, and the main floor transformer room 18 feet high. There are seven Baldwin-Westinghouse 20-ton three-phase locomotives to be used, most of which are now in operation. The drawbar pull is 9,600 pounds starting, the coefficient of adhesion being 25 per cent, the voltage on the trolley line 1,100 volts, and the frequency of the current 3,000 alternations per minute. The motors are of 80 horse power capacity each and are wound for 200 volts, which voltage is obtained by further step-down transformers located upon the locomotive. With the two induction motors operating in tandem the speed is about 4 miles per hour, but with one motor only in operation the maximum speed is 6 miles per hour, and the locomotive will haul a full load 10 hours continuously without a maximum rise of temperature of the motors beyond 75 degrees. The transformers on the locomotives are arranged with proper connections for supplying the required current to the motors when the trolley circuit has a pressure of 390 volts, which is the potential used within the city limits of Cincinnati for absolute safety. F. C. P.

THE HEAVENS IN SEPTEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

It is not an easy matter to impart variety to a long series of descriptions of the starry heavens. The moon and planets, to be sure, come and go, and their changing phases and aspects succeed one another quickly enough; but from year to year the stars are altogether the same.

It is only when their positions are determined with the greatest possible accuracy, and when such observations made at long intervals are compared, that we can show that the stars are not absolutely fixed in space. Even then, the great majority of the stars in any catalogue show no certain evidence of any measurable change of position, although they may have been under observation for a century. But, nevertheless, there are many stars which are found to have a small but unmistakeable "proper motion" among their neighbors, and in a few cases this motion is so rapid that it might be proved from the telescopic observations of a single year.

From the standpoint of the naked-eye observer, even such motions are of no account, as it would be some centuries before any change in the star's position would be noticeable, unless it happened to be very near another star, or in line with two others. The greatest known proper motion belongs to a star in the southern hemisphere, too faint to be seen with the naked eye, which moves over more than eight seconds of arc every year. Even at this rate the star takes over 200 years to travel a distance equal to the moon's apparent diameter. A smaller change than this in the position of an isolated star would hardly be detected by mere eye-estimates.

In general, we can therefore be certain that the constellations appear just the same to us as they did to the Egyptian and Chaldean astronomers, and as they will appear five thousand years hence. There will be a different pole-star then as the precessional motion of the earth's axis will cause it to point in a different direction from its present one, but the grouping of the stars themselves will be unchanged, though their position relative to the horizon will be altered.

Only one or two changes in the starry heavens would be great enough to strike the eye, if we could suddenly see them as they will be five thousand years hence. Sirius at that time will be nearly two degrees farther south than he is now, and Arcturus will have moved toward Spica by about 3½ degrees, so that the configurations which these bright stars form with the neighboring small ones will be perceptibly different.

But by far the most important change will be one in the southern constellation Centaurus. Its two brightest stars, Alpha and Beta Centauri, are now about 5 degrees apart and the line through them points westward toward the Southern Cross. Both stars are above the first magnitude, and are very conspicuous. Now Alpha Centauri is moving westward, at the very rapid rate of one degree in about a thousand years, while Beta, which is really enormously more distant than Alpha, has very little proper motion. Consequently, after about 4,500 years, Alpha Centauri will be almost directly between us and Beta, and the apparent distance of the stars will be but a small fraction of what it is now, while the line joining them will be at right angles to its present direction and the whole aspect of that part of the sky will be different.

But this is exceptional. There are a few stars which move faster but none of them are bright enough to be at all conspicuous. On the other hand, there are many groups of stars, such as the Pleiades, which keep together in their motion, so that they will retain their general appearance for centuries. The principal stars of Orion (except for the red Betelgeuse) form such a group, and their motion is so exceedingly slow that all the observations that have yet been made of them hardly enable us to say definitely that they are moving at all. It is practically certain that Orion will look almost exactly the same after 100,000 years as it does now, and it is not improbable that the constellation could still be recognized a million years hence.

At 9 P. M. on September 15, the zenith is occupied by Cygnus, which any one can easily identify as a large cross of stars lying in the Milky Way. The bright star northwest of Cygnus is Vega, and that nearly south of it is Altair. Below the latter is Sagittarius, whose most conspicuous configuration is the little inverted "milk dipper," on the eastern edge of the Galaxy.

Arcturus is near the horizon, a little north of west, and most of the other stars of Boötes are visible above him. The semicircle of Corona Borealis, and the quadrilateral which forms the central part of Hercules, lie between Arcturus and Vega. Ophiucus and Serpens fill the southwestern sky, and a few stars of Scorpio are on the horizon below them.

On the meridian, below Cygnus, is the small but conspicuous group of stars which forms the constellation Delphinus. Lower down is Capricornus with its pair of double stars, which point almost toward Altair. Saturn is below them on the left, and is far brighter. Jupiter, which is some 45 degrees further east, is brighter still, and cannot be mistaken for anything else, especially as he is very much alone in one of the dullest parts of the sky. The bright star southwest of him is Formalhaut, in the constellation of the Southern Fish.

North of Jupiter—that is, toward the pole-star—is the great square of Pegasus. From its northeastern corner a line of second-magnitude stars runs through Andromeda and Perseus, and points toward Capella, which has just risen in the northeast. Below this line is the oblique triangle which marks the head of Aries.

Cassiopeia is above and to the right of the pole, in the direction of Andromeda. Cepheus is above her, and Ursa Minor and Draco are on the left of the pole. Ursa Major is below them, the dipper being in the only position in which it seems to be right side up.

THE PLANETS.

Mercury is evening star throughout September, but is in an unfavorable position, being far south of the sun. He reaches his greatest elongation on the 7th, when he is 27 degrees from the sun, rather farther than usual. He crosses the meridian more than an hour and a half after the sun, but sets only 45 minutes later. He will consequently be very hard to see, except with a telescope in the daytime. After the middle of the month he rapidly approaches the sun, and disappears from view.

Venus is evening star until the 17th, when she passes through inferior conjunction (that is, between us and the sun), and becomes a morning star. She is, however, not exactly in line with the sun, but is farther south. She will be invisible to the naked eye except during the first few days of the month just after sunset, and the last few days just before sunrise.

Mars is evening star in Libra and Scorpio, but is not now conspicuous. He sets at about 9 P. M. on the 1st, and at about 8:30 on the 30th. At the end of the month he is quite near Antares but both objects are too low to be well seen.

Jupiter is in opposition on the 12th, and is visible all night long. He is in Aquarius, much farther north than last year, and consequently more conspicuous. The markings on his surface, and the changing configurations of his satellites, make him one of the most fascinating of telescopic objects. The most interesting occurrence among his satellites which is visible to us during the month is a transit of the fourth satellite, and a simultaneous occultation of the third, which takes place on the evening of the 10th. Transits or eclipses of one of the satellites are visible almost every night. Their exact times may be found in the Nautical Almanac.

Saturn is in Capricornus and comes to the meridian at about nine o'clock in the middle of the month. He is also a very fine telescopic object.

Uranus is in Ophiucus. He is in quadrature with the sun on the 15th and can only be observed west of the meridian, as he crosses it before dark.

Neptune is in Gemini and is also in quadrature, but on the other side of the sun on the 30th.

THE MOON.

Full moon occurs at 7 P. M. on the 6th, last quarter at 8 A. M. on the 14th, new moon at 11 P. M. on the 20th, and first quarter at 8 A. M. on the 28th. The moon is nearest us on the 18th and farthest away on the 3d, and again on the 30th. She is in conjunction with Saturn on the 3d, Jupiter on the 7th, Neptune on the 15th, Venus on the 20th, Mercury on the 22d, Mars on the 25th, Uranus on the 27th, and Saturn again on the 30th. None of these conjunctions are at all close.

On September 20 there is a total eclipse of the sun, but it is exceedingly improbable that the total phase will be observed, since the track of the shadow is confined to the southern Indian and the Antarctic Oceans. The eclipse is visible as a partial one in the eastern part of South Africa and in Madagascar (where the sun rises eclipsed), and in the southern portions of Australia and New Zealand.

SCIENCE NOTES.

Recent statistics have shown that Germany heads the list as a reading nation, and Russia is falling to zero. In 1893, 23,607 books were published in Germany, as compared with 8,082 in Russia. In regard to newspapers, the inhabitants of the United States are catered to by 22,000 journals, while Russia, with a population of 130,000,000, has only 800. The figures are easily accounted for by the censorship. In Germany the actual number of professional writers is estimated at 12,000, of which number 400 are poets. In behalf of France the assertion is made that she provides the international literature, inasmuch as half the copies of French novels printed are exported, while two-thirds of her historic and scientific works also cross the frontier.

A German scientist, G. Thilenius, has recently brought out some interesting conclusions in regard to the pigmy race, of which some specimens are still met with in the central part of Africa. It is probable that the pigmy races have existed also in Europe, at least in some parts of it. This conclusion is arrived at from the examination of numerous skeletons which have been found in the region of Breslau in Silesia. These skeletons are in a rather bad condition, but it is possible to form a good idea of the height of the individuals which must have existed at least one thousand years ago. Their height is considerably below the ordinary average, being about 4 feet 9 inches, which represents the mean figure for a whole group of skeletons. Similar remains have been found in other parts of Europe not far from the above region; thus Kollman, of Bâle, describes the remains of pigmies which have been found in Switzerland. In this case the average height reaches as low as 4 feet 6 inches. Gutmann has also described the pigmy remains which were found in Lower Alsace, near Colmar. These are still smaller, and the height of many of the specimens is but 4 feet. The pigmy race must be considered as composed of well-formed specimens and not in any way degenerate or pathologic. They seem to have persisted in Europe until a comparatively recent epoch. The pigmies of Silesia appear to have been the contemporaries of the Romans and slave races and to have existed until the year 1000 A. D. At present no specimens are to be found in Europe, and it is only in the central region of Africa that the pigmies are still to be seen.

The British Marine Biological Association has acquired a steam trawler of 200 tons burden for the purpose of investigating the currents and physical phenomena of the North Sea relative to the fisheries therein, in accordance with the International Conference held at Christiania last year. At this congress a comprehensive programme of research was drawn up, to be undertaken jointly by the several powers interested, and it was arranged that the various countries should dispatch specially equipped steamers four times a year, to a specific area in the North Sea, so that simultaneous investigations of the temperature and other physical conditions of the sea over the whole of the area might be made. In the intervals between the periodic crises it was also arranged that special fishing experiments and biological operations were to be carried out. The British government commissioned the Scottish Fishery Board and the Marine Biological Association to carry out the British part of the investigations, and Parliament authorized an award to be equally divided between the two, to defray the cost of the work. The steamer which the British section has acquired has been rechristened the "Huxley," and is 116 feet long, with a speed from ten to twelve knots an hour. The Plymouth laboratory of the Association will be the headquarters of the steamer during the quarterly cruises, and the hydrographic material and the collections of floating life will be investigated there. For the purpose of the North Sea work a small laboratory has been established at Lowestoft, where the fishery work of the North Sea and the investigation of the bottom life will be undertaken. One of the duties of the naturalist on the "Huxley" will be to liberate fishes bearing numbered labels in different parts of the British area. This part of the work is to be carried out on a large scale by all the participating countries, in the hope of throwing light on the migrations and growth of food fishes in the North Sea. The work of the various countries will be published in summary form in annual reports by the International Council.