History of Bells.

Bells are of peculiar interest to almost every one. Their voices to some tell only of daily duty, of trains to catch, of the return of hours of toil, of the ceaseless flight of time: and to others they speak of devotion, and to others still bells are instruments of heart-stirring music. Recent years have seen the publication of not a few books upon the subject; the last newcomer is entitled "A Book About Bells," and is written by the Rev. George S. Tyack, and published in London by William Andrews & Company, from which we glean the following information regarding the history of bells:

There can be little question that the earliest musical instruments were those of percussion. There are frequent mention of bells in the Old Testament, and among Oriental nations bells, or at least tuned pieces of metal, occupy a large part of attention among native musicians, not only in the past, but even at the present time. This primitive and well-spread discovery of tones producible by blows on resonant substances being thus granted, it may readily be seen that something more or less resembling the modern bell in shape would almost certainly be a very early invention. The Book of Exodus gave probably the earliest mention of bells in its illusion to six golden ones which tinkled around the vestments of Levitical High Priest. There is another reason for them in the words of the prophet Zachariah, who speaks of the harness of horses being adorned with them. Turning from sacred to profane literature, we find small bells spoken of by Euripides and by Aristophanes. Plutarch refers to them in his Life of Brutus and Virgil in his Georgics.

The researches of antiquarians have brought to light facts which indisputably prove the early use of bells. Bronze and iron bells were found by Layard in his excavations of Nimroud and very ancient examples have been met with in various places in the far East; while turning to the far West we have instances of copper bells found in ancient Peruvian tombs. Curiously enough there appears to be no proof that bells were used at all in Egypt. There is no trustworthy evidence of the use of really large bells before the dawn of Christianity, and they owe their existence to Christian influences. The credit of the invention has been given to Paulinus, Bishop of Nola in Campania. Paulinus lived about 400 A. D., but it is claimed the distinction is doubtful and a better title for it is made up for Pope Sabianus, who succeeded St. Gregory in the papal chair 604. In any case, from about that date notices of the use of bells, which must have been more or less of the kind and size now seen in turrets, become frequent. By the year 750 in England the church bell became sufficiently common for orders to be issued to have the priests to toll them at an appointed hour. Literature, and specially poetry, illustrate in a striking way the place which bells have for ages filled in the lives of men.

The earliest bells were probably not cast, but were made of metal plates riveted together. One set, which belonged to St. Gall, A. D. 650, is still preserved at St. Gall, Switzerland, and another one, traditionally associated with St. Patrick, is shown at Belfast. These are made of iron, and are only about six inches high.

Other early examples may also be cited. Bells of this kind are not round, but wedge-shaped, being broad and square at the mouth and rising to a ridge at the top. The names of no very early bell founders have come down to us, and probably the bell founder's art, like others which were exercised chiefly for the furnishing and adornment of the church, was originally practiced almost exclusively by the ecclesiastics themselves. As churches and monastic houses increased in number, naturally the art of bell founding drifted into the hands of a professional class and scattered records of some of its members have come down to our time. The chief centers of the art in England were at York, Gloucester, London, and Nottingham. It is probable that many of the early bell founders had no fixed place for working, but traveled through the country, rearing temporary foundries at various convenient places, and casting there such bells as might be wanted throughout the neighboring districts. In many cases it is certain that the bell founder did not devote himself exclusively to that work, but combined with it some other more or less analogous trade. Often the itinerant bell founders cast their bells directly at or in the churches, for doubtless the conditions of the country in early times made the transport of heavy masses of metal a matter of no little difficulty, so that the founders were glad to work as near as possible to the towers to which the bells were to be raised. In 1483 the importation of foreign bells into England was made illegal, a fact which would imply that the bells at that time were brought into the country in sufficient numbers to affect the home industry. On the Continent Louvain was the seat of a famous bell foundry. Deventer, Holland, was another center of the industry. The French bells were made of iron, while brass was commonly employed in Italy and England, and a foundry in Bohemia has recently turned out bells of steel, but the experiment can only be called fairly satisfactory at best. A church in Scotland has a bell of this metal cast in 1895 by the Vickers, of Sheffield, who have also cast steel bells for a church in Hastings and other places. Glass has been employed for bells of fair size, but the tones of such bells are sweet but not far-reaching. Even wood has been used as a material in bell manufacturing, but the wooden bells which have been found may possibly have only served as patterns for the maker of the bell-frame or for some such purpose.

Bell metal consists of a compound of copper and tin, usually three parts of copper to one of tin in small bells, and four parts of copper to one of tin in large bells. If the amount of tin be increased the bell becomes more brittle, but if the copper be in excess the brilliancy of its tone is damaged. Sometimes small quantities of zinc and iron are added. It is a popular superstition that a bell of specially sweet tone owes its excellence to the presence of a quantity of silver in its composition, but it is asserted by experts that the employment of silver would have precisely the contrary effect on the tone of the bell to that which tradition assigns to it, silver being in its nature too closely allied to lead to permit of use in this case. No less important to the voice of a bell and its material is its shape. Medieval bells were for the most part longer and narrower than those of more modern make. In practice it is found if the bell be too flat the vibrations expel the air from within with an almost explosive force and the sound is loud and harsh. If, however, the opposite error be committed and the height be too great in proportion to the diameter, the air reverberates too much within the bell itself and the sound does not travel satisfactorily.

In casting a church bell the first important work is the construction of the core, which usually consists of a hollow cone of brick erected on a cast iron plate as a foundation, and in diameter somewhat smaller than the interior of the bell. Over this is plastered a specially prepared mixture of clay, intended to bring up the core to the exact size and shape of this interior. The core is baked dry and hard by means of a fire within it. Over this is built up what is called a "thickness," by which name the founders call a second layer of clay of exactly the thickness, shape, and size of the proposed bell. This gives the correct figure of the outside of the bell. This is then dusted over with dry tan, and upon this is constructed the "cope," or outer casing of clay several inches thick. After the cope has become thoroughly dry by means of fire, it is raised with the help of a crane, and the clay which formed the "thickness" is destroyed. The cope is then lowered into its former position, care being taken to make it concentric with the core, then the mold is ready to cast. Where quantities of bells are produced the "thickness" is done away with and a cast iron cope case is substituted. Every part of the bell has a technical name. The hooks for fastening the bell to the wooden stock, which forms the axle on which it revolves in the belfry, are called the "cannons." The loop from which to suspend the clapper has also to be cast. In many modern bells the cannons are dispensed with and the bell is bolted directly on to its stock. This has the advantage of enabling the bell to be turned. The clapper is technically divided into ball or hammer, and the flight or shaft, which is fastened directly into the crown of the bell by an iron staple.

Most ancient and many modern bells bear some motto or device, to which the modern makers add the date and the name of the firm. These, of course, must be impressed in the cope before casting.

In ancient days when the art of bell casting was still retained in the hands of the ecclesiastics, the furnace and the castings were blessed, which must have been a picturesque scene. It usually takes seven or eight hours to heat the metal and it does not take as many minutes to run it into the cope even where the bell is a large one. Then follows a time of keen anxiety in the foundry, specially if the work be one of unusual size and importance. Six days are usually allowed to elapse before the metal is touched. The bell is then put in a temporary frame to undergo the ordeal of testing the tone. It is then carefully finished and tuned. If the notes struck out be too flat a portion of the edge of the bell is cut away, thus reducing the diameter. If it be too sharp, the thickness of the sound-bow is reduced. Nowadays the bell is turned in a specially designed lathe, the bell being secured to the face plate, and the requisite amount of metal can be cut away with the greatest accuracy. Where the bell is to form a part of a chime, it must be tuned so as to accord with the others. The reception and erection of a large bell is frequently the cause of great ceremonies and rejoicing specially where the bell is for a church.

Many of the bells have decorations and inscriptions on them which are very curious. Of this kind was the legend of "Mighty Tom," of Oxford, before its recasting in 1612. The translation of the Latin inscription would be:

"For Thomas' sake
I cry Bim Bom, and no mistake."

Sometimes where there was a chime each bell had a separate legend. A good deal of the poetry is really doggerel as:

"On Sabbath all
To church I call."

Another one:

"The sleepy head I raise from bed."

Inscriptions were found on some of the seventeenth century bells. Among them one in Addington, 1658:

"When you hear this mournful sound
Prepare yourself for underground."

The following lines are met with in a great many places in the different countries:

"I to the church the living call
And to the grave do summon all."

All the bells do not have such lugubrious inscriptions. Sometimes the inscriptions refer to a wedding.

"When men in Hymen's bond unite
Our merry peals produce delight."

At times it is used for secular purposes, resulting in the appropriate inscriptions, as

"Lord quench this furious flame,
Arise, run, help put out the same."

The church of St. Ives has a bell which has the following terse inscription:

"Arise and go about your business."

In addition to the various mottoes, etc., to which we have referred, in many cases we find on the bells the record of ecclesiastical rulers of the parish at the time of their casting which have been of great value to the historian. At Clapham, Bedfordshire, there is a bell in which one word of the inscription is upside down. It reads "God Save the Church," and the word "church" is upside down.

"COLUMBIA" AND "SHAMROCK"—A COMPARISON.

Now that "Shamrock," the sixth British cutter to cross the Atlantic in quest of the "America" cup since 1885, is well on her way over the Western Ocean, it will be of interest to compare her sailing qualities with those of the boat which is certain to be chosen for the defense. "Genesta," "Galatea," "Thistle," "Valkyrie II." and "Valkyrie III."—it is a right royal line with which this Anglo-Scotch-Irish craft is associated in holding her title of challenger; and with her Irish name, Scotch design, and English construction, she is truly representative of the people to whose fostering care the early growth of the sport of yacht sailing and its present popularity are largely due.

We have already pointed out, in former notices of "Columbia" and "Shamrock," that in the dimensions and construction of their hulls there is great similarity between the two boats. "Columbia," though stronger than "Defender," is yet a remarkably light craft, and in "Shamrock" Thornycroft, with his quarter of a century's experience in torpedo-boat building, has produced a hull and spars that are probably an advance over the American boat in the matter of light scantling and up-to-the-limit construction. The continued secrecy as to "Shamrock's" under-water body is no doubt due to a wish to conceal her excessive draught, and it is not unlikely that she will be found to draw as much as 22 feet. This would mean lower lead, less of it, and a nearer approach to the true fin keel than has been shown in any 90-foot yacht since the construction of our own "Pilgrim" in 1893.

As will be readily seen by a study of the beam views of the two vessels there are notable differences in their sail plans. "Shamrock's" mast appears to be stepped about 2 feet further aft than "Columbia's," and her bowsprit is considerably longer, the distance from mast to outer end of bowsprit being from 5 to 7 feet greater in "Shamrock." Her present boom is about the same length as "Columbia's." The gaff, topmast, and hoist of mainsail, on the other hand, are a few feet less than "Columbia's," so that the sail plan is longer on the base line but not so lofty as that of the American boat. She probably carries a larger spinnaker, larger head sails, and a smaller mainsail, the effect of which, other things being equal, should be to give "Columbia" the advantage in windward work and "Shamrock" in reaching and running. Her owner, Sir Thomas Lipton, and her designer, Fife, have both stated that she is to carry a larger mainsail in the races on this side.

A fairly reliable comparison of the sailing qualities of the two boats is obtained by studying the remarkable series of races sailed by "Britannia" and "Vigilant" in 1894, and comparing the results with the performance in America of "Vigilant" against "Defender," in 1895, and "Defender" against "Columbia," in 1899, and with the recent trials in England of "Britannia" against "Shamrock." Of course the value of such comparisons depends upon the boats "Vigilant" and "Britannia" being as fast in subsequent years as they were in 1894. There is no doubt that they were in as good condition, and possibly better. "Vigilant" was improved in 1895 by the removal of 43,000 pounds of lead from the inside and the addition of 53,000 pounds to the outside of the keel, and "Britannia," in addition to the improvements in trim, sail-plan, etc., due to three years of continuous racing, was recoppered, her topsides replaned and carefully smoothed off, and her wooden boom was replaced by one of steel, before she raced "Shamrock."

The "Vigilant" and "Britannia" sailed seventeen races, of which "Britannia" won eleven and "Vigilant" six. This would appear to denote a decided

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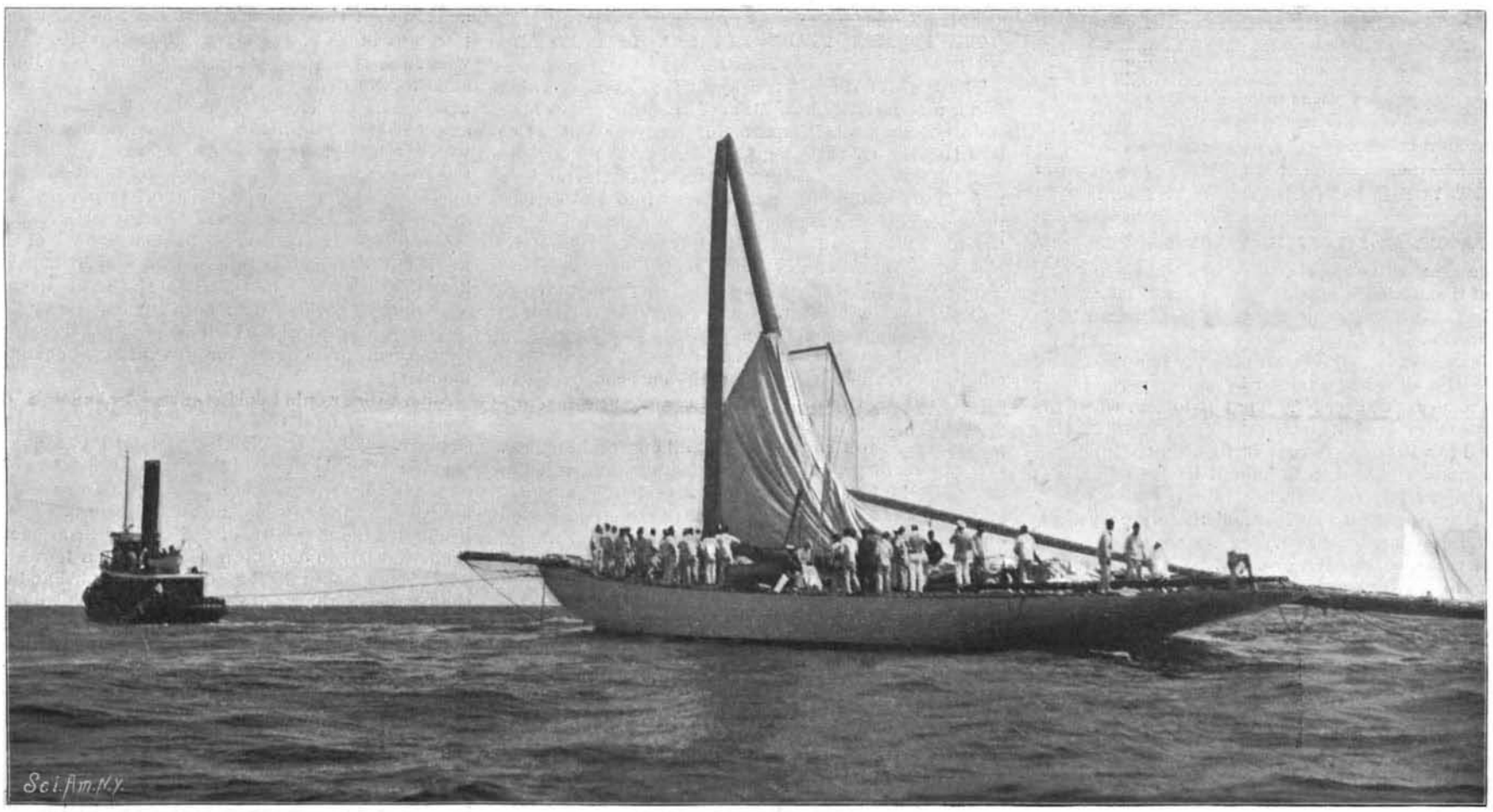

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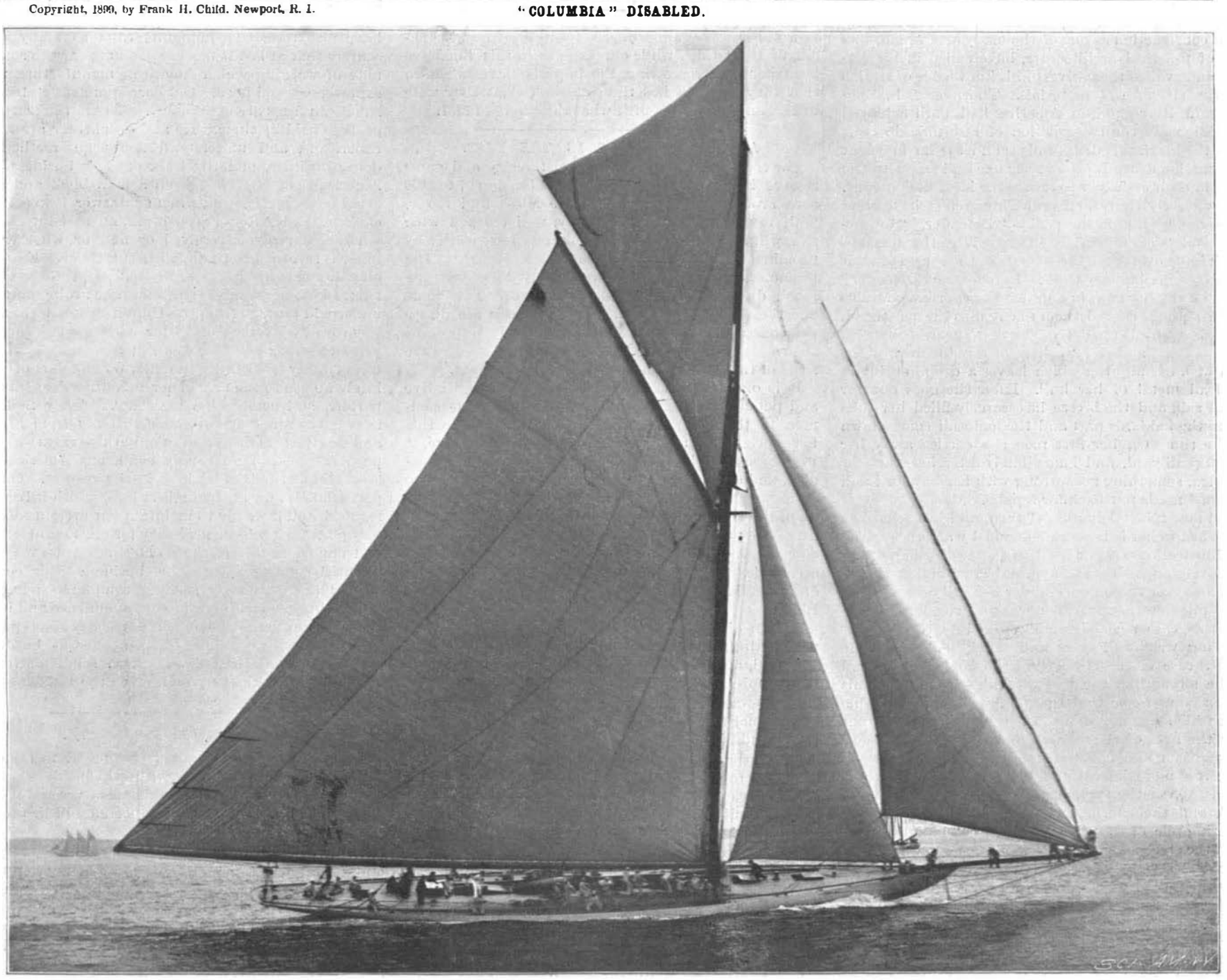
"COLUMBIA" DISABLED.



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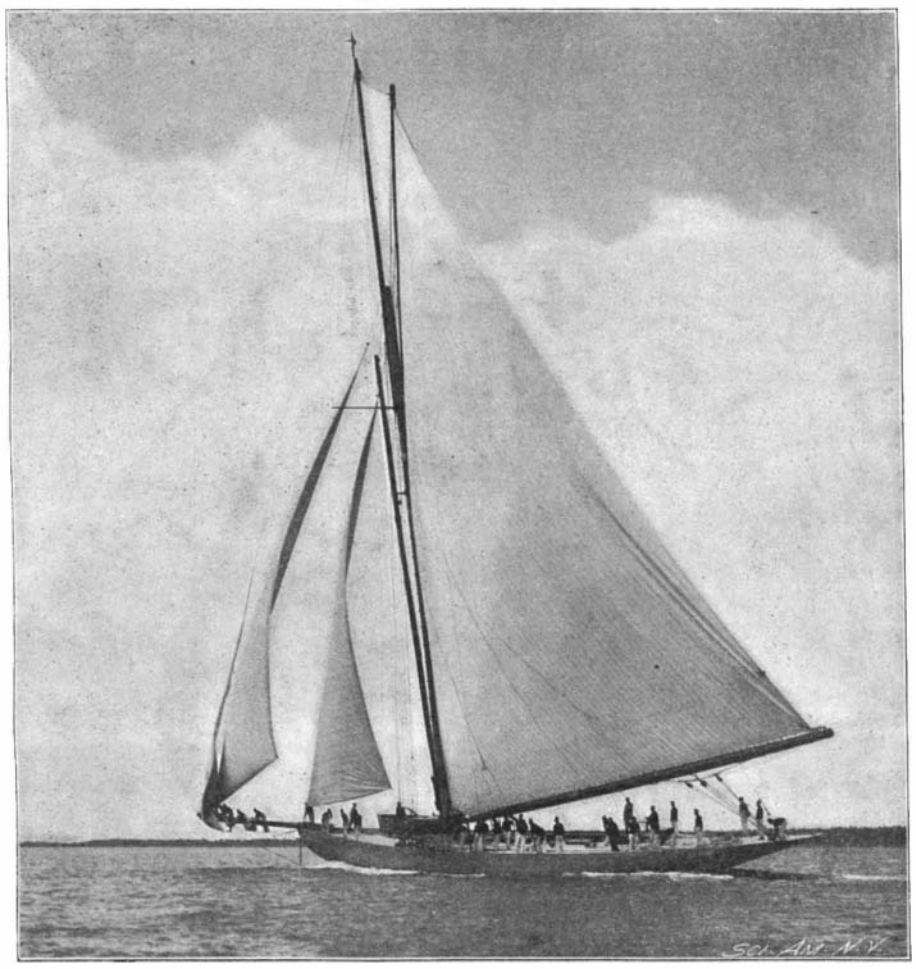
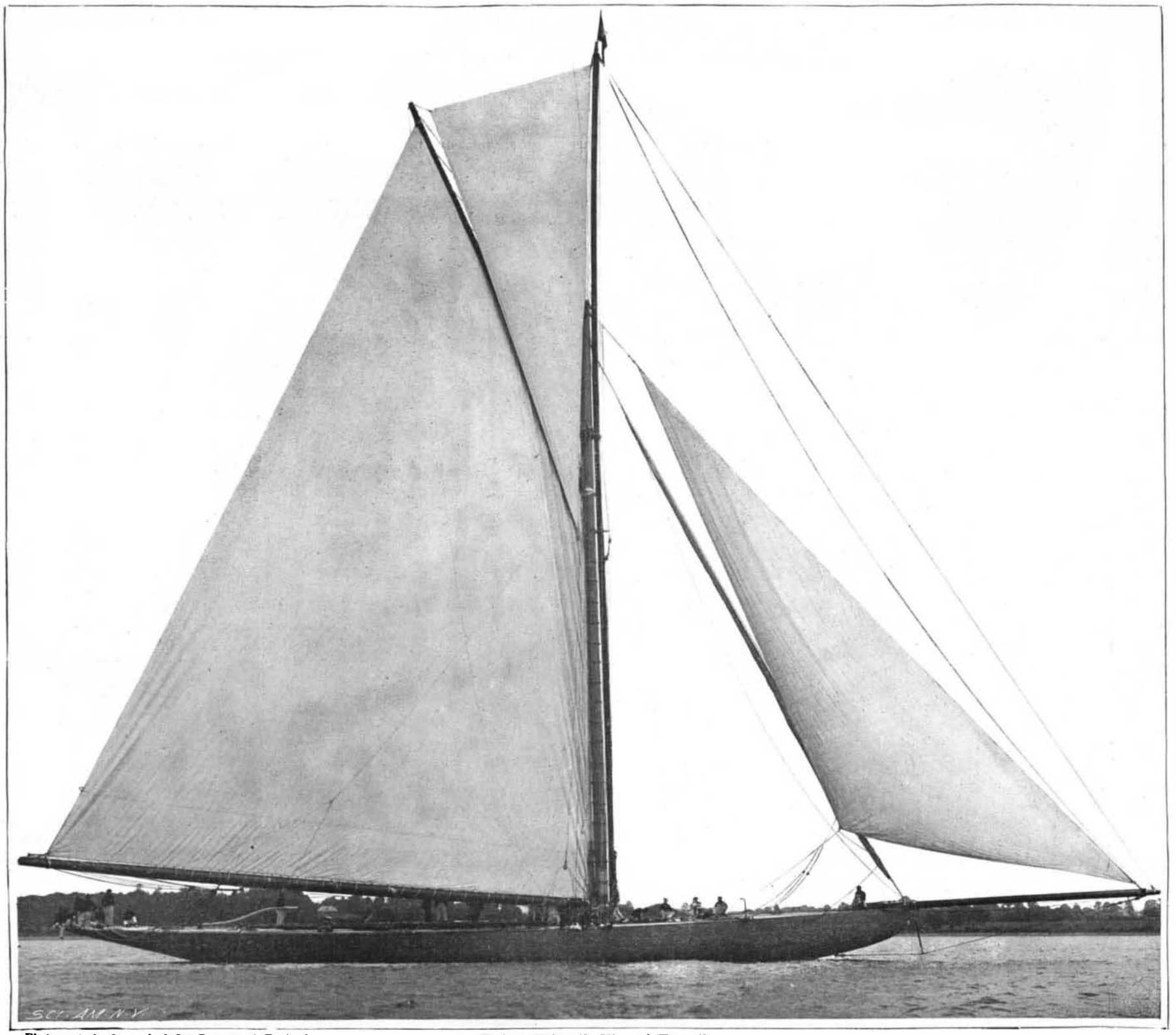
"COLUMBIA" CLOSE-HAULED ON THE PORT TACK.—[See page 106.]

superiority in "Britannia," and in winds of a certain strength she was superior. In races sailed at an average speed of 8 knots an hour or less, "Britannia" usually won, and her wins were larger the lighter the wind; but when the average speed exceeded 8 knots an hour, it was "Vigilant's" day, and the harder it blew, the greater was her margin of winning. Dixon Kemp, the well-known English yachting expert, summing up the season's work, pronounced the boats about equal. That the verdict is a just one is shown by the following results. On a 50-mile course sailed at an average speed of 8·3 knots in a fine whole-sail



Reaching.

Close-hauled.



Photographs by Symonds & Co., Portsmouth, England.

Under Mainsail, Jib and Topsail.

THREE VIEWS OF THE CHALLENGING YACHT "SHAMROCK."

breeze, "Britannia" won by 35 seconds; but over the same course, with a lighter wind, sailing at an average speed of 6·3 knots, she won by 5 minutes 52 seconds. In another 50-mile race sailed at 6·4 knots speed, however, "Vigilant" won by 3 minutes 52 seconds. In a strong breeze, the "Vigilant," sailing at a speed of 9·6 knots, beat "Britannia" by 4 minutes 32 seconds over a 50-mile course, which would be equivalent to 2 minutes 43 seconds on a 30-mile course. Then "Britannia" wins a 50-mile race by 22 seconds, sailing at an average speed of 8·7 knots. "Vigilant's" best win was at the rate of 4 minutes over a 30-mile course, the average speed being 11·2 knots in a strong wind. Other wins of "Britannia" were by 1 minute 27 seconds, 2 minutes 14 seconds, and 2 minutes 4 seconds over 50-mile courses. The results bear out the statement of Dixon Kemp that in the "give and take" of yachting weather the boats are very evenly matched.

In comparing "Shamrock" and "Columbia" through these two boats, we shall take the actual times made over specified distances on the different points of sailing, namely, beating, reaching, and running; and we shall consider only official races, in which the distances and times were accurately known and taken by a sailing committee. Records of informal "brushes" are quite unreliable both as to distance and time.

I. BEATING.—In "Shamrock's" first race, according to the English Yachtsman, "Britannia" started well ahead of "Shamrock," but was worsted by 6 minutes 13 seconds in a beat of 8 knots dead to windward, the distance being covered in about one hour. "Shamrock," owing to an accident to her club-topsail, carried only the jib-headed topsail, shown in our photographs, which were taken during the progress of this race. The "Britannia" carried her large club topsail, and we may reasonably suppose that with her own club-topsail set, "Shamrock" would have gained fully 6 minutes 30 seconds in the 8 miles.

In a race 15 miles to windward and return over the Sandy Hook course this would mean a gain of 12 minutes 10 seconds over "Britannia" in the beat to windward. Now, in beating twice over a stretch of 7 miles to windward during a race sailed on the Clyde at an average speed of about 8·3 knots, "Vigilant" gained 2 seconds on the first round and "Britannia" 7 seconds on the second round; and in other work to windward in races sailed at the same speed as the first "Shamrock"-"Britannia" race, "Vigilant" and "Britannia" were approximately equal. This would show "Shamrock" to be about 12 minutes 10 seconds faster in 15 miles windward work than "Vigilant." In the "Defender"-"Vigilant" trial races off Sandy Hook "Defender" gained on "Vigilant" 6 minutes 33 seconds on a 10-mile beat to windward. This would amount to 9 minutes 50 seconds in 15 miles, the speed of the "Defender" being 7·3 knots per hour measured dead to windward, while the speed of the "Shamrock" to windward in her race with "Britannia" was 7·8 knots. In the recent Sandy Hook trial race "Columbia" beat "Defender" 2 minutes 25 seconds in 10 miles to windward at a speed of 6·1 knots. This would amount to 3 minutes 37 seconds gain in 15 miles, or if sailed at the speed of the "Shamrock"-"Britannia" race the gain would be, say, about 3 minutes 30 seconds in 15 miles to windward.

This makes "Columbia" 13 minutes 20 seconds faster than "Vigilant" or "Britannia" in 15 miles to windward at a 7·8-knot speed, and 1 minute 10 seconds faster than "Shamrock" over the same course under the same conditions.

II. RUNNING.—Now, with the "Columbia" over 1 minute ahead at the weather mark, what would be "Shamrock's" chances of winning out in the 15-mile run to the finish? In the "Vigilant"-"Britannia" races "Britannia" showed a slight superiority in running. In the Clyde race, at an average speed of 8·6 knots, she gained 45 seconds on an 11-mile run; again, in a fresh club-topsail breeze, she gained 2 minutes on a 4-mile run, though on a second run of 4 miles the boats were even. In a strong westerly wind, although "Vigilant" won by 5 minutes over the whole course, the boats took the same time to run 5 miles; and in a race at 8 knots average speed "Britannia" gained 45 seconds on a 3½-mile run. We may fairly consider "Britannia" to be at least equal to "Vigilant" when running before the wind.

Now in the Sandy Hook trials "Vigilant" took 1 minute 33 seconds less than "Defender" to run 10 miles, a gain of 2·20 seconds in 15 miles. This was in a race whose average speed was 9 knots; but in an earlier race "Defender" beat "Vigilant" by 41 seconds in a run of the same distance. A consideration of all their races would show "Vigilant" to be faster on the average than "Defender" in a 15-mile run by about 1 minute and 30 seconds.

"Columbia" and "Defender" have had but few trials with their spinnakers spread. At Larchmont, in two runs over a 3-mile leg, there was in each run only from two to five seconds difference between the yachts, and the various trials show that "Columbia" is on the average about 30 seconds faster than "Defender" in 15 miles on this point of sailing. This would indicate that "Britannia" and "Vigilant" are about 1 minute faster than "Columbia" in a 15-mile run to leeward with spinnakers set.

"Shamrock" gained only 2 minutes 30 seconds on a 15-mile run with "Britannia," the speed being about the same as that in the various races above mentioned. Had she carried her club topsail and not split her spinnaker, she would have beaten "Britannia" by about 2 minutes 45 seconds. This suggests that "Shamrock" is about 3 minutes 45 seconds faster than "Columbia" on a 15-mile run; but the fact that in any race the last boat in a run before the wind has the advantage of a clear wind makes all such estimates of comparative running ability less reliable than estimates of work to windward. However, on the results as found, we see that judged by their actual performances in winds of similar strength, "Shamrock" should win a 30-mile race to windward and return by about 2½ minutes.

III. REACHING.—"Columbia" should win easily on a triangular course, which is made up of 30 miles of reaching or 20 miles of reaching and 10 miles of windward work.

"Vigilant" was superior to "Britannia" in reaching if the breeze was at all fresh. She gained on one occasion 2 minutes in a 10 mile reach, or say 4 minutes on 20 miles. In a broad reach of 61 miles, sailed at the high speed of over 13 knots, "Defender" gained 3 minutes 30 seconds on "Vigilant" or 1 minute 10 seconds on 20 miles. At the 9·2-knot speed of the "Shamrock"-"Britannia" race this would have amounted to about 1 minute 30 seconds on 20 miles, which added to "Vigilant's" gain of 4 minutes over "Britannia" shows "Defender" to have an advantage of 5 minutes and 30 seconds on 20 miles of reaching.

"Columbia" has not shown, so far, much superiority to "Defender" in reaching. She gained 1 minute 33 seconds on a 10-mile reach at Sandy Hook at a 10½-knot speed; but "Defender" at Larchmont was faster by 1 minute 7 seconds and again by 1 minute 40 seconds on a 10-mile reach. "Defender," however, was better handled, and perhaps it would be safe to say "Columbia" is 30 seconds faster in 20 miles of reaching in her present condition. This would show the cup defender to be 6 minutes faster than "Britannia" in the two 10-mile legs of reaching on a 30-mile course.

Now "Shamrock" appears to have proved a disappointment in reaching during her first race, gaining on "Britannia" only at a rate equivalent to 1 minute in 20 miles of broad reaching. If the triangular course contains 20 miles of reaching and 10 miles of windward work, we see that "Columbia" would gain 6—1=5 minutes in reaching and about 45 seconds to windward, winning the race by something under 6 minutes.

Summing up then, we find that a comparison of the yachts on their actual timed performances in official races, where the speed is over 8 knots an hour, "Shamrock" shows a slight advantage over a windward and leeward course, and "Columbia" a decided superiority over a triangular course. So much for work in a fine club-topsail breeze. Unfortunately the work of "Shamrock" in a light wind during a second race was not carefully timed. She appears to have gained about a quarter of an hour over half of a 36-mile course, and Lipton and his captains estimate that she would have gained 30 minutes if "Britannia" had finished the race. We have seen that "Britannia" did her best work against "Vigilant" in light airs, especially to windward, and it was in this very work that "Shamrock" appears to have walked away from the Prince of Wales' cutter. In the absence of reliable figures, we have attempted no estimate of the relative speed of "Columbia" and "Shamrock" in light winds; but the indications are that the security of the "America" cup will be enhanced by the prevalence of strong and steady breezes during the first week of October.

In conclusion it may be said that the above estimates may be entirely upset by the changes in sail-plan, trim, etc., in either or both yachts before the trials take place. When they cross the line on October 3 "Columbia" will have had three months to "tune up" to racing condition, and the improvements in speed which result from lengthy trials against "Defender" should easily reverse the slight advantage which "Shamrock" at present seems to possess on a windward and leeward course. The races will not be much closer this year than before; and the home boat will probably win out by the usual comfortable margin—a conviction which to our mind is strengthened by the fact that since the above was written Watson's "Meteor"—an improved "Valkyrie III."—has beaten "Britannia" by greater margins than "Shamrock" accomplished.

THE hydraulic mining pits in California materially changed the landscape in many places. The Mining and Scientific Press recently had an interesting illustration of the pit of a hydraulic mine in Nevada County, California, which was washed out some fifty years ago, and now it is again covered with a growth of pines and other trees, and patches of brush again dot the once verdureless slopes, and it is probable that in another century these valleys will have again become densely timbered and the high scarp of their upper edges will have become gently rounded. Many of the pines have already reached the height of from 40 to 50 feet.

Dampness of Walls and the Preservation of Microbes.

It is a matter of general interest to know how long disease germs will remain in a contagious condition in a house when the latter has not been thoroughly disinfected.

Some special investigations have been made on this point by M. Vito lo Bosco, a hygienist of Palermo, Italy, says L'Illustration. The investigations were made of the walls of dwellings exclusively, as the floors are generally easily cleaned and disinfected.

The life of the pathogenic germs was found to vary greatly with the different materials of which the walls were constructed, and especially according to their degree of dampness or dryness.

As a general rule, walls covered with stucco or varnish were found least favorable for prolonging the life of the microbes, and walls which are normally dry possess to a considerable degree the power of self-cleansing. The typhoid bacillus, the cholera germ, the diplococcus of pneumonia, when placed on such walls, die after twenty-four hours at the maximum, and the diphtheria bacillus survives only seven days. The tuberculosis microbe only can remain alive for two or three months. On well-dried size, however, it survives even four or five months.

Damp walls, on the contrary, cause the vitality of bacilli to increase, and this to such a degree that the period of life of some under these conditions has not yet been determined. The microbe of typhoid fever, for instance, remains alive three days, that of diphtheria a month, and that of pneumonia from fifteen days to three weeks.

The knowledge of these facts should bring about useful practical applications.

The dampness of dwelling houses appears doubly dangerous, first, in itself, and second, because of the long life which it gives to the elements of contagion and infection.

Contrary to the traditions of the elegance of dwellings, which cause the walls to be covered with tapestry or paper in imitation of it, scientific experience would advise the employment of stucco or good varnish, which are best from a bactericidal point of view, both because they are easily washed and because they possess the property of cleansing themselves promptly and spontaneously of pathogenic germs which become lodged on them.

The August Building Edition.

The August issue of our Building Edition is a beautiful number of this unique periodical. It is filled with exquisite half tone engravings executed in the highest style of the art. The colored cover shows a model cottage at Larchmont, N. Y., and is a handsome specimen of colored work. The New Jerusalem Church at San Francisco, Cal., is the subject of several engravings. It is one of the most picturesque churches in the country. The houses which are reproduced in this number are most interesting examples of suburban dwellings. They are freely illustrated by general views, floor plans and interiors. There are several pages of good reading matter. It is the aim of the publishers to constantly increase the value of this periodical, and those who have not seen copies of this edition in some time should purchase a copy of the August number.

The Current Supplement.

The current SUPPLEMENT, No. 1232, has a number of articles of great interest. "Life of Naval Cadets and Apprentices on the German Schoolships" is a profusely illustrated article. "Bullet Wounds in Modern Warfare" describes the wounds produced by the new bullets from the surgeon's point of view. "Elevators" is the first installment of an illustrated paper on the subject by Charles R. Pratt. A full page engraving is given of "Ships Building for the British Navy." This beautiful illustration gives a most impressive idea of English sea power. "Reduction of Sulphur Ore in Sicily" describes a technical consular report of considerable importance. "Pottery as an Historical Document" is an address by Sir George Birdwood. "Methods of Determining the Frequency of Alternating Currents" is a valuable article on electrical testing.

Contents.

(Illustrated articles are marked with an asterisk.)