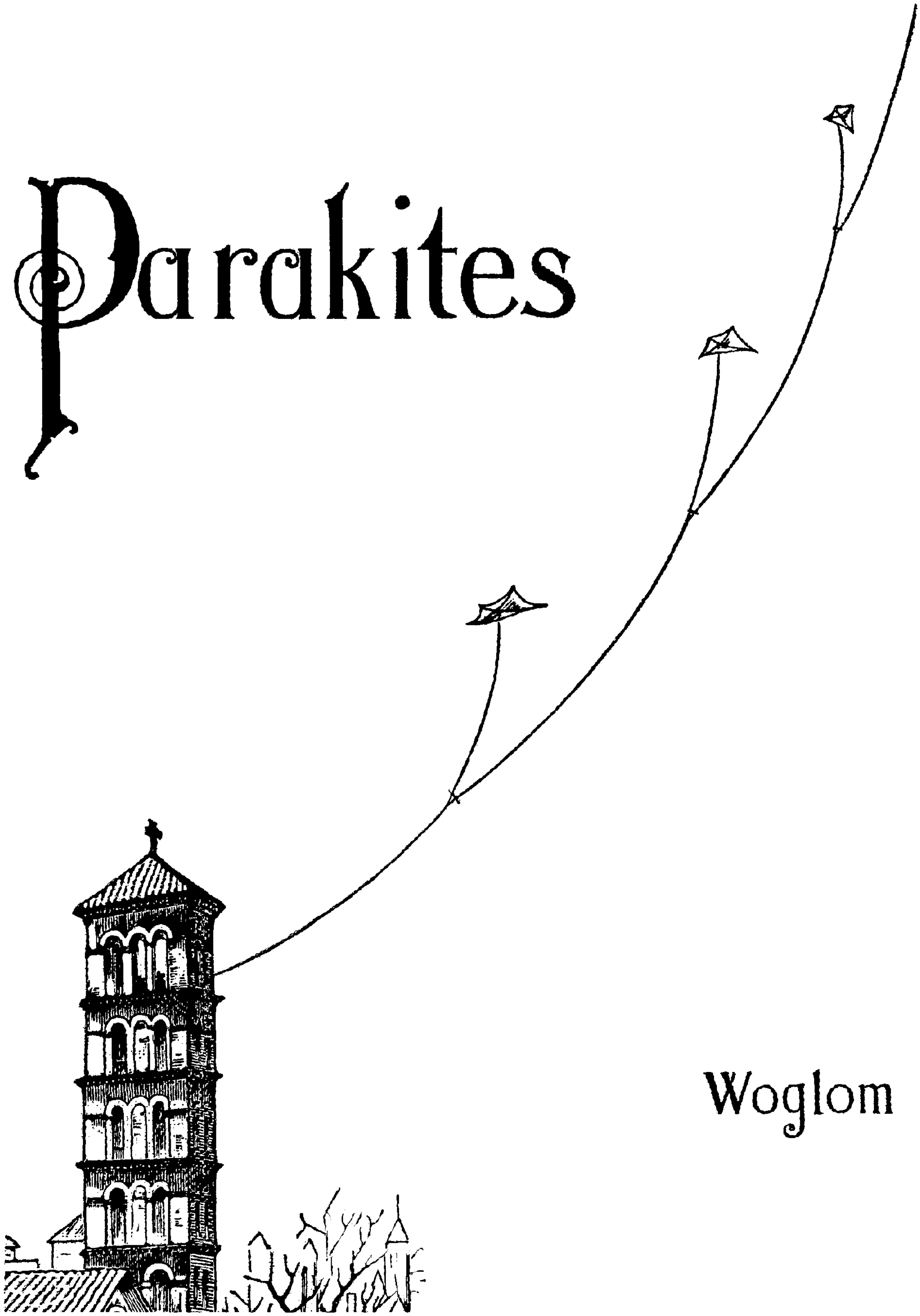
Parakites



Woglom

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D. Dehn / 01-2011

A Chinese Butterfly Kite.

The Knickerbocker Press, New York

PARAKITES

A Treatise on the Making and Flying of Tailless Kites For Scientific Purposes and for Recreation

BY

GILBERT TOTTEN WOGLOM

ILLUSTRATED

" The wind bloweth where it listeth, and thou hearest the sound thereof, but canst not tell whence it cometh, and whither it goeth."

G. P. PUTNAM'S SONS

NEW YORK
37 West Twenty-Third Street

LONDON
24 Bedford Street, Strand

The Knickerbocker Press
1896

TO

GEORGE F. KUNZ

TO WHOM THE AUTHOR IS INDEBTED FOR THE FIRST INTIMATION THAT
THESE EXPERIENCES SHOULD BE IMPARTED TO THE PUBLIC
WITH A DEEP ADMIRATION FOR HIS REVELATIONS AS TO THE TREASURES BENEATH THE CRUST OF THE EARTH
AND WHOSE INDUSTRY THE AUTHOR HAS EMULATED IN THIS STUDY
OF THAT WHICH IS ABOVE THE EARTH
THIS LITTLE MANUAL IS INSCRIBED

PREFACE.

THE purpose of this treatise is to place before the public the result of the investigations and of the practical experience of the writer in the designing and the construction of tailless kites, or "parakites," and in the perfection of methods for the flying of these in various conditions of the atmosphere.

The occasional references given in the daily press to the experiments of the writer have brought to him many requests on the part of investigators who are interested in the scientific possibilities of the parakites, and a long series of further inquiries from correspondents who had in view simply the development of kite-flying as a pastime.

The larger the number of intelligent and persistent investigators and experimenters who are prepared to co-operate in the undertaking on the lines suggested in this treatise, the more rapid will be the development of the art of kite-flying, and the greater the service that will be secured for scientific research.

The suggestions that have come to the author from scientific correspondents show a wide range of interest in the matter on the part of adults, while for young people there is an infinite possibility, not only of amusement, but of study and of thought in the making and flying of parakites. The pastime can be recommended as exercising the muscles from finger-tips to toe-tips and as engaging both body and mind in healthful and attractive out-door exercise.

The instructions given in the text are necessarily technical in regard to the construction of these tailless kites and their management under different conditions of the air, but the author has endeavored to make his directions so clear and explicit in regard both to construction and management that the youngest readers should find no difficulty in understanding them. It is his expectation that the boys will in the near future discard the old tail-burdened kite with its uncertain movements for the scientifically made parakite with its great lifting powers.

The writer is a man with continuous business interests, who has taken up the study of kites as a change of occupation during his leisure hours. He has been referred to as a "scientist," and as a "student of aerodynamics," but he lays no claim to any such scientific repute. He prefers to have his work described simply as a health-maintaining pastime which carries with it suggestions for interesting scientific investigations. While parakites may, as he hopes, make some interesting contributions to the science of aerodynamics, this science must, in its full range, claim the thought and the training of skilled students.

Some of the aerial data herein presented cannot claim to be novel. It is sufficient to say that similar observations by other experimenters have been verified by the writer from the records of many hundreds of flights of parakites, flights in which an altitude of six thousand seven hundred (6,700) feet has been attained and accurately triangulated.

The journals of New York and of other places chronicled with interest the experiment of May 4, 1895, of the suspending of a ten-foot "Old Glory" in breezes with a velocity of nineteen to twenty-four miles per hour, at a height of one thousand feet, during the military and civic ceremonies at the dedication of the Washington Memorial Arch in New York City, an occasion which aroused the patriotic sensibilities of many witnesses and of thousands of others who read later the spirited descriptions. The effect of the carrying of the standard into the air was as of a patriotic courtesy proffered from the Judson Memorial tower across the square to the newly dedicated Washington Arch on the north side thereof.

The long series of letters which have come to the writer from professional and from business correspondents, with renewed inquiries as to methods, materials, and appliances, have induced the production of this treatise. The author finds that it will be easier to give in print rather than in correspondence the information desired.

He has judged it desirable to add, for purposes of comparison, to the record of his experiments with parakites a sketch of Oriental kites and Oriental methods of kite-flying.

If his treatise may have the effect of attracting a wider measure of attention for the attractive pastime and the interesting art of kite construction and kite-flying, the author's purpose will have been fully carried out [*].

New York, June 25, 1896. G. T. W.

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* It is to the credit of the sensible, intelligent men of the current epoch, that not once has the work of either the writer or his sincere colleague, Mr. Edward A. Cole, of Brooklyn, N. Y., been flippantly characterized as "kiting"; mayhap it has been known that the parakites, being generally covered with silk or other textile fabrics, cannot be described as floating paper.

CONTENTS.

ILLUSTRATIONS.

I saw you toss the kites on high
And blow the birds about the sky ;
And all around I heard you pass,
Like ladies' skirts across the grass.
    O wind, a-blowing all day long,
    O wind, that sings so loud a song !

I saw the different things you did.
But always you yourself you hid.
I felt you push, I heard you call,
I could not see yourself at all.
    O wind, a-blowing all day long,
    O wind, that sings so loud a song !

O you, that are so strong and cold,
O blower, are you young or old ?
Are you a beast of field and tree.
Or just a stronger child than me ?
    O wind, a-blowing all day long,
    O wind, that sings so loud a song !

Robert Louis Stevenson.

INTRODUCTION.

ORIENTAL KITES AND KITE-FLYING.

KITES were known and flown a thousand years before the Christian era, and during the development and maintenance of the high order of civilization and of power in ancient Malaysia.

Malaysian influence flowed naturally coastward, from the great islands of the Malaysian archipelago, thence northward up the coast until it swept off" to the Japanese islands.

The likeness between the kite productions of the Javans, the Malayans of the peninsula, the Siamese, the Chinese, and the Japanese, both at present and through the ages in which they have been used in Oriental Asia, points clearly to one and the same origin, viz., Malaysian.

The primal purpose of the kite, if for other than amusement, is unknown. Still a pretty tradition existed among the old sailors of the east-indiamen of the years gone by, that before their time these kites were sent up into the heavens as a religious rite or duty ; that, from the decks of ships passing the Malaysian islands, they were visible as if flown by men in the interior ; that, upon a boat's crew landing on one of the smaller islands of the archipelago, and penetrating the interior, upon the native becoming aware of a foreigner's approach, the kite-flier invariably withdrew his kite from the heavens, as if the flying were too sacred a performance to be witnessed by profane eyes ; that no information could be drawn from the natives as to what or why the kites were ; that occasionally a framework, invariably of bamboo or of bamboo splints, was picked up afloat in the tortuous channels of the archipelago, but invariably devoid of its covering, which had evidently been washed away by wave action, so that no probable inscriptions could be found.

Whether this tradition, which intimates the sending of messages to the gods by these heavenward fliers, has foundation of fact or not, it is an interesting coincidence that the Japanese, who owe some of their energetic national traits to the once powerful Malays, do now, in these days, provide for their boys a rectangular kite, contrastingly bare of ornamentation except a single character or monogram which conveys the idea of a salutation, as "Long Life" — "Greeting" — "Happiness," and the like.

Antiquity of the kite for use in war is indicated by a Japanese record of the use, in Japan six hundred years ago, of structures large enough to swing a man into the air, seated upon such a contrivance as would be suggested by what is now, in marine parlance, termed a "bo'sun's chair," whence he could espy the location, and arrangement of, and the men and warlike apparatus in, an enemy's camp. The chair depended from the tail's end.

"Sometimes huge kites able to sustain a man were flown, and a bird's-eye view of the interior of the enemy's castle thus obtained." *

This quotation refers to events during the existence of the Japanese feudal system, prior to the seventeenth century of the Christian era.

The city of Nagoya, in Central Japan, 250 miles from Yokohama, possesses a fine specimen of the architecture of the sixteenth century in a great castle, formerly the residence of the Daimios, but now a government building.

The finials of its two minarets were two solid golden chimerical fishes (*shachi*), aggregating $75,000 to $80,000 value. They faced each other from the two opposing pinnacles, and as they glittered in the sunlight, prompted and fostered the criminal cupidity of the villains of the era.

A certain band of outlaws conceived a scheme in which a gigantic kite would be sent aloft ; suspended from its tail the most daring of the band would remove and loot one of the massive fishes of gold. The attempt was made, the kite was flown by night, the man was successfully carried up and as safely landed, but — by reason of those fortuitous lacks of coincidency familiar to fishermen the world over — the great fish he didn't get. Both the wonderful flight and the dismal failure became notorious ; the would-be robbers escaped, but some of their heads escaped from them thereafter. As a future protection, iron cages were built around the two masses of gold, but they were finally stolen. It is to the credit of the kite that it demonstrated its lifting capabilities as to the thief, but did not lift the fish.

When other means than the kite were devised to accomplish the theft, gold-plated fishes were substituted ; since then they have apparently been considered "not worth the bait."

The "war kite" — diagram A, — so called from the ancient use of it, is made and flown by adults only, at the present day in Japan. It requires strong winds, is made for such, and will not fly without tail. The size varies from six feet to fifteen feet in height, and proportionally from four to ten feet in width, thus exposing from 24 to 150 square feet of wind surface ; the bridles, seven in number, are indicated by the converging lines. A stout rope on a winch is used when flying the larger sizes ; the winch is anchored by its supports being driven into the ground and lashed as if to tent-pegs.

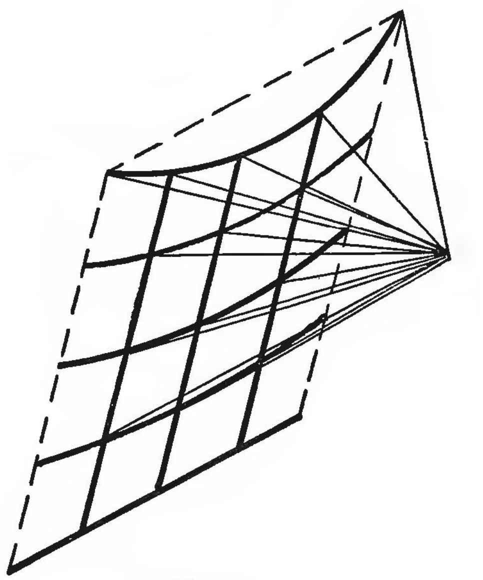
DIAGRAM A.

The southerly of the Japanese islands are the homes of kite-flying, the winds prevailing there being favorable for the sport.

The custom, which prevails in Japan, of giving presents to one's friends and the members of one's family, at their New Year season, — our January 1st, — affords opportunity for the presentation of kites to the boys annually; until they are about fourteen years of age. The frugal boy is as proud of the preservation and consequent possession of a great number and variety of kites as is our summer girl of her varied wardrobe, or our "dude" of his neck- wear.

The children's kites are of the square form in diagram B ; in this and other diagrams the full lines show the framework-slips of bamboo ; the broken lines show the surrounding cord, to which the margin of the paper cover is pasted ; the converging lines projected from the points on the face represent the bridle. They require tails, and fly only in light winds, but will not "dart" as will the form in diagram D.

* *The Mikado's Empire*, William Elliott Griffis — Harper, 1876.

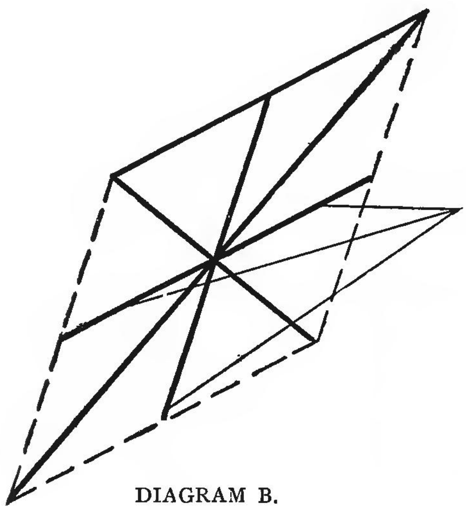

DIAGRAM B.

The translated Japanese expression for a kite is "paper hawk," thus curiously coinciding with our own bird-appellation. The boy's kites are usually covered with paper ; the size of the kite is designated as a one-, two-, or three-sheet kite, the sheets being 20x 14 inches each. Japanese paper is made so arbitrarily as to sizes that the small sheets thus used become standards of measurement. The Japanese undoubtedly excel the world as strong paper-makers ; the soft, tough, pliability is due to the qualities of the fibre of their indigenous shrub, from the stalks of which the paper is made ; their uncolored paper has a pronounced cream tint which is rarely completely eradicated by bleaching ; they prefer the tint, to weakening its tensile strength by the bleaching processes.

The kites represented in diagrams B and C do not dart about the air, as do those shown in diagram D. Such as B and C are sold in their shops. The complicated forms and the tailless varieties are usually made by the fliers themselves, as are A, C, and D. The paper is secured tensely to the framework. The Japanese varieties are more highly decorated than other Asiatic kites ; they are rarely permitted to ascend more than 700 or 800 feet, so that the ornamentation may be seen and admired by the spectators, and are often expensively ornamented with gold and silver paper which glint in the sunlight. Hours are consumed in artistic decorations in bright colors. Adults' kite-flying, in the language of one of my Japanese authorities, "is a luxurious enjoyment." Occasionally the paper covering is oiled in a certain portion of its area, giving it a translucence, and therein is painted a representation of an animal's or a human eye ; the effect is vivid and startling, when the sunlight pierces the translucent oiled surface.

Gravity of demeanor is a national characteristic with the Japanese ; the youth approximating manhood becomes preternaturally grave in his assumption of manliness ; it transmutes from an acquired to a natural habit; but no man or race, or class of men can be continuously grave or dignified ; there must be occasions for relaxation and merriment ; the Japanese relaxation is in his kite games.

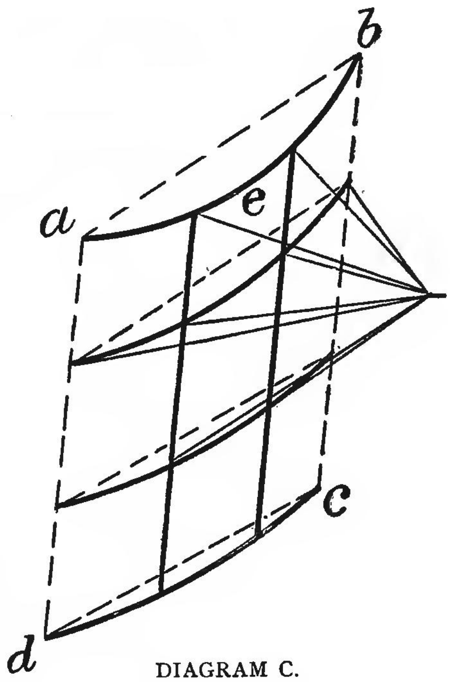

DIAGRAM C.

Most of the Oriental kites rise to a small angle of elevation from the horizontal, say 25 to 30 degrees. Let us observe that angles and distances in the air are deceptive to the untrained eye. Experiments have been exhaustively made in Europe, to test the probability of an observer in a military captive balloon in the air being shot by an enemy at the surface. It has been found less possible for an expert shooter to sight and hit a balloon than for the notoriously poor shot to "hit the side of a barn."

I have frequently invited educated men and experienced mechanicians to estimate the angle and altitude of a specified parakite in the air ; the responses, compared with the facts, were usually marvellous exaggerations, not so much as to the angles as they were to the altitudes. An inclination of 25 degrees is generally believed to be 40 degrees until a clinometer or a transit instrument proves it otherwise. When we learn of extraordinary heights having been attained by kites observed by travellers or writers or inexpert fliers, we may safely take their statements " *cum grano salis* "But wild geese are shot on the wing at greater heights." Yea, but the gunner is always experienced as well as expert ; he does not as a rule hide his light under a bushel ; it is well exposed.

Diagram C shows a favorite form and construction, built by adults and presented to boys ; it is the humming, buzzing, or musical kite. Being a two-sheet kite (28 x 20 inches), it is ornamented by one large picture on its convex front. The middle-two uprights are crossed at right angles by four other bamboo splints as shown, the four of which are bowed progressively more from that at *d c* to that at *a e b* by strings drawn respectively and tensely in the direction from *a* to *b*. On the one string from *a* to *b* a strip of tough paper is pasted by its upper long edge, the lower edge free to vibrate in the wind ; thus is produced a low-toned hum ; if, transverse of the length of the strip, it be clipped into small sections, the humming tone is sharper. A very thin flat strip of bamboo, substituted for the *a b* bow-string, produces a buzzing sound ; a thin strip of sheet brass, or a like strip of whalebone (whale's-beard, as termed by the Japanese) gives out a musical tone, higher or lower according with its tension. Additional strips on the second and third transverse bowed stick produce three harmonious tones, simulating the sound of a steam siren; the wind striking these thin, paper-like strips edgewise, causes a rapid vibration as if in an aeolian harp. These kites require tails.

Nowadays in Japan, the kite-flying by both adults and children is practised outside of the cities ; the police regulations forbid it in the narrow city streets.

In June, whole families repair to the mountain sides, picnic fashion, with their rugs and mattings to be spread upon the ground ; the. men and boys indulge in delightful frolics in their kite games ; the wives, mothers and sisters (the latter embrace — no, include — the sweethearts) become enthusiastically interested in the successes of their favorite champions and favorite kites. If the "unattached" lady finds it difficult to choose a kite as her champion or favorite, feminine taste substitutes itself for feminine intuition, and the most brilliantly or most artistically decorated kite is chosen. Woman is woman the world over. It is whispered that small sums of money have been seen to pass from one set of delicate fingertips to another pink palm after the victors have been quasi-officially announced.

The kite outlined in diagram D is much used in the kite games, — battles, fights, wars, sports, contests. It is thus they have been variously termed by the native gentlemen as well as American travellers and residents in Japan, who have cheerfully spared valuable time to impart the information sought to be herein conveyed to the reader.*

The national sport, the kite battles, — which we shall speak of farther on, — requires a quick acting, as it were nervous kite. Such is this form (D) when tailless or when delicately balanced by an attenuated tail which causes the kite to oscillate. It is comparatively simple in build for use with a tail, and is thus made by boys ; only by experts can it be made,

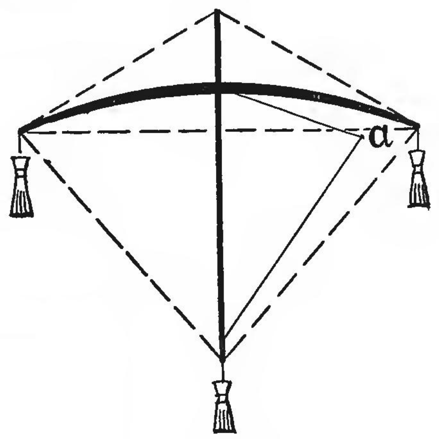

DIAGRAM D.

* " The books " rendered but a pittance of record to this author ; what is here shown, is intended to be as if seen through the eyes of these eye-witnesses.

If not so seen by the reader, it is because the writer has not written it as seen-. If the reader could have witnessed the brightening of the eyes of these educated gentlemen while they recited what they had seen and themselves done, the reader would the better realize the task assumed and encountered in the effort to reproduce their fervor in cold type.

The reader and the writer are jointly under obligation to the following-named friends for help generously rendered : —

Mr. Tozo Takayanaga, of New York City, author of *Sunrise Stories*. (Scribner's Sons).

Mr. George E. Saulnier, of Brooklyn, N. Y., who, by relays, travelled 6,000 miles, coastwise and interior, in the countries under the Malaysian influence from Java to Japan.

Mr. Chen Fo Lee, a native of the province of Canton, China, now of Messrs. Lin Fong &; Co., N. Y. City.

Mr. Melville L. Smead (Messrs. A. A. Vantine & Co., New York City), who for many years lived in Japan, acquired the language, conformed with the mode of living, and adopted the dress of the Japanese.

Captain John R. Mortimer, Commander of the old " Black Ball line " packet-ship *Isaac Webb*.

Mr. Kimma Fukushima, a native of southern Japan, now of Kan Ko Ba, N. Y. City.

Miss Mary Louise Stillman, Librarian of Young Women's Christian Association Library, N. Y.

Mr. Arthur Guiterman, of the *Jeweler's Weekly*, N. Y. City.

Mr. Samuel Sondheim, now of N. Y. City, during seven years a resident merchant in Yokohama, Japan.

and made to fly, without tail ; it is the tailless variety most used in kite battles in Japan. Expert fliers manipulate the cord, by "catching" the kite when deflected from an upright attitude in the air, and quickly withdrawing the cord, or suddenly surging several feet of it into the air, so that the kite is caused to dart in any desired direction for attack upon competing kites.

This form is greater in width than height. The transverse stick is cut tapering from its middle to each end. From the crossing point it is bowed downward in the plane of the kite ; the paper covering is placed flat and tense on its frame. Its bridle is placed as shown by the two lines converging at *a*. Paper tassels are attached where shown.

The Japanese have their kite-clubs with quite large membership rolls. One, prominently mentioned, is the "Shiyen Kwai", which holds assemblies annually in January for consultation and to competitively decide upon new designs. Prizes for beauty of design and decoration, and for perfection in build and accuracy in flight, are competed for at the meetings which are protracted for several days. The club meetings are in Tokyo, and the flights are held in its suburbs. Here assemble the young men who are studiously grave at the age of twenty or more years, but who relax and again become as children while flying kites.

The "Festival of the Cherry-Bloom" (Japan's national flower) is a season for the national sport. A thousand kite-fliers at a time may then be seen beside a mile of roadway, with the young gallants on ponies dashing up and down the road to witness the wonderful varieties of form and the comparative skill of the aged and youthful exhibitors.

Old men, up to a ripe eighty years, after their tiring efforts in raising their pets into the heavens, and too feeble to stand unremittingly, are attended by servants with chairs, which are so placed that rest may be had between the flier's short detours, politely made, that contact may be avoided with his neighboring flier's kite or cordage.

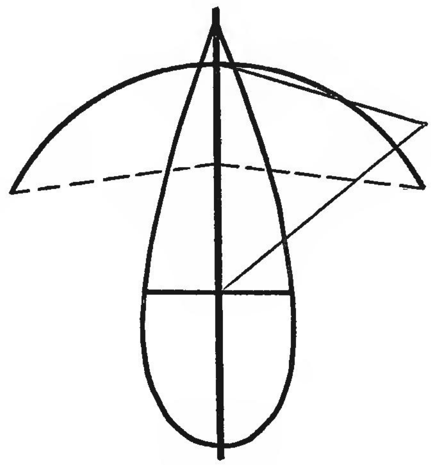

DIAGRAM E.

When travelling through a sparsely inhabited section, the rider will see ancient, mummy-like Japanese sitting by the roadside, perhaps upon a bamboo-pole support, contentedly flying and watching his kite hour after hour.

The whole month of March is appropriated for kite-flying festivals in and about Nagasaki.

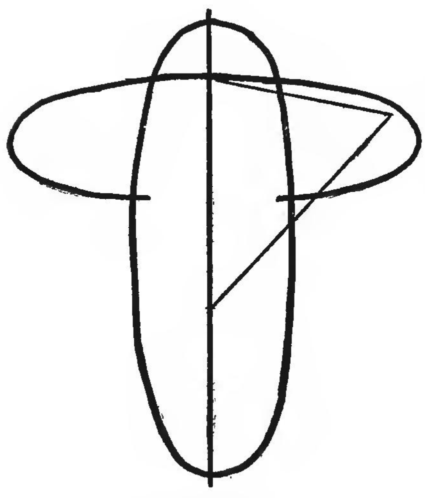

DIAGRAM F.

In China the middle and upper classes indulge in the pastime in a desultory way ; it is not with them a national sport as with the Japanese and with the natives of the countries south of China. The poor are too poor to spare the necessary time and materials.

The Canton-Chinese designation of the kite is "jee yu." In the mountains of the province of Canton the individuals fly variform kites in gangs of occasionally as many as ten. The flier dismisses a leash of three, united by three lines of a few feet in length. At the junction of the three ends of these lines he attaches a single line, which is dismissed a few feet farther in the air. Then raising another separate leash of three, — similar in arrangement to the first, — he ties the joined ends of the second leash to his main-single-line, and dismisses the second trio, the first trio being in the air beyond and above the second. He repeats the

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Prof. William F. Vroom, Teachers' College of the City of New York.

Yoshimura Hideyasu, merchant in precious stones. No. 24 Water St., Yokohama, Japan.

operation as many times as his stock of kites and his stock of patience will allow.

He heedfully chooses kites which have been proven side wise fliers, so that they may not foul each other ; if a fresher wind attacks his exhibit, his painstaking is ineffective ; they will swirl into a confusion of entanglement which would exasperate any but a Chinaman. He must devote hours to disentangle the all but inextricable snarl, — but time is cheap in China.

In such displays many of the "butterfly" and diagram F kites are used. The view of a swarm of these in a favorable wind is indeed a suggestively sweet treat. As they erratically sway about in the air they revive the homely vision of flies around a molasses barrel.

Photograph A is of one of these butterfly kites.

The Chinese design many forms for both men and boys. The simpler, such as the eagle, the butterfly, the fish, the flower-basket, are sold in the shops, and some of them find their way across the sea. The hundreds of more complex shapes are made mostly by experienced adults. The unsymmetrical forms, simulating living and mythical creatures, invariably require tails.

The boys' kite — diagram E — is 28 inches high and wide. The paper covering is applied with a certain fulness so that the windward side is concave. It is flown tailless in light winds, but with tail in fresh winds. The same description applies to diagram F, except that it is usually 20 inches high and 14 inches wide.

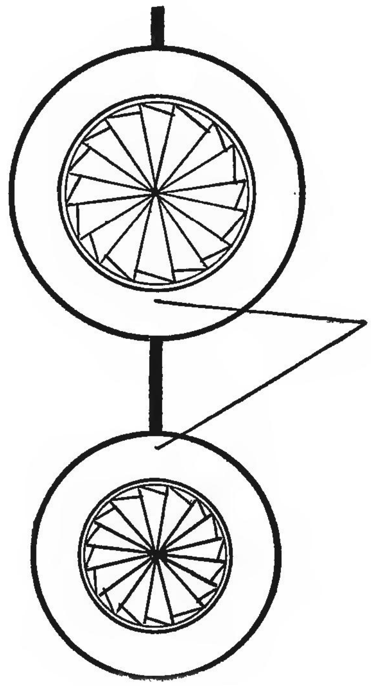

DIAGRAM G.

Diagram G is of a men's kite, is heavy and adapted to such strong winds as will rotate the two "windmill" wheels on the faces of the two disks. called the wheel kite, and will fly only with tail.

The fish kite * for boys— Diagram H— is a hollow paper-fish, attached to which, across its wide-open mouth, is an upright of bamboo. The wind blowing clearly through, from the head to and through the tail of the fish, as it passes through the gradually constricted interior, keeps it afloat at a low angle. An accurate adjustment of the short bridle shown is an essential to its successful flight in variable winds. Beginning at the tail, the fish may be rolled up and around the bamboo.

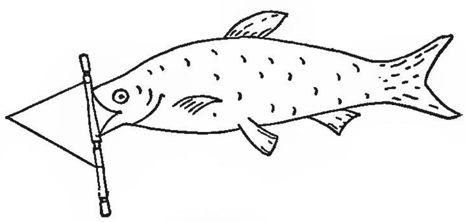

DIAGRAM H.

The cordage used in China for kite-flying is made from the long staple fiber of the bark of the cultivated shrub "mar." It grows in bushes four feet high ; from the fiber of this, and a species of bastard hemp, an endogenous leguminous shrub, the wood is separated by rotting it away ; from these fibers are made most of the Asiatic cords; the finest grades are made from "ramee," a shrubby perennial which supplies an exceedingly strong fiber ; the name is Malayan. The pineapple cord is more expensive ; the fiber is shorter, but it is between the other two in strength. Pineapple cord is used mostly in southern China.

* That quaint wind-vane or " fly," humorously dubbed the " duff-bag " by sailors, is a marvel of stability as a wind indicator. It is wonderfully, functionally, like this fish-kite. The " duff-bag " is made from bunting, through which the wind percolates while also passing through, from its large, hoop-distended entrance to the smaller hoop-distended exit, and is thus sustained almost horizontally. Does not this imply, to scientific kite-fliers, an operation of the wind similar to that which sustains the Hargrave cellular kite in the wind ?-

On Festival Days the boys erect in the courtyard of their homes a great bamboo pole, from the top of which is permitted to fly, as it were a flag, the largest fish-kite of the family ; this represents the eldest son of the family. Beneath it, — decreasing in size as each fish respectively belongs to and represents the successive additions to the family tree, — are exhibited the small fry. Japanese family pride is conserved by an occasional display of nine or ten of these scion-like fish-kites swaying about in the wind, all well supported by the parent bamboo stem. (In the Japanese literary vernacular, " conserved " and " parent" are the "pivotal" words in the preceding sentence ; no other diagram accompanies it.)

Throughout Siam the .system and customs as to kite-flying are similar to those in Java, of which we shall next speak.

The Javanese more generally than the Japanese gamble on the results of kite competitions and kite battles. They fly to heights of 700 to 1,200 feet for display.

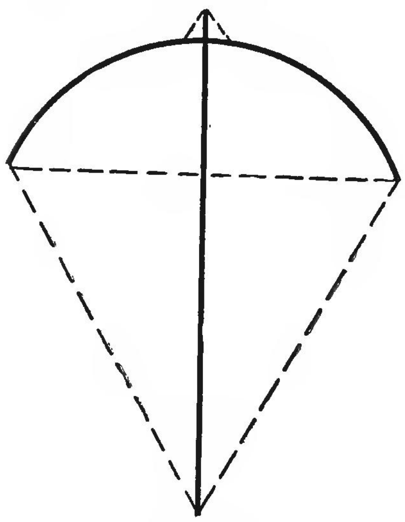

DIAGRAM I.

The several Javanese communities have each their kite structures peculiar to themselves, and hold contests during which to test and decide upon individual building ability, and skill in manipulation. The general forms of their kites are as in diagrams B and C, supplemented by the form in diagram I. The kites of years ago in this country, — now seen only in our old school-books and illustrations, — are reproductions of the Javan kite I, which is flat when made, but becomes bi-concave in the wind by the down-pull of the elastic transverse bow stick. Another Javan form is shown in diagram J, the bow of which inclines forward, to the windward. Most of the Javanese kites are so poised as to require no tails. They differ little from the Japanese except in such details of their construction as emphasize the indolence of the Javanese. They (the kites) are seldom decorated but with dirt.

The kite battles are peculiarly Asiatic. They are contests in which the individual peculiarities of kites used, the shrewdness, perseverance, and tact of the contestants, and their expertness in designing and constructing are all severely tested. A sportsmanly spirit pervades wherever the battles take place, whether prearranged or spontaneous, in that a peaceably inclined kite is never attacked. If one enters the field with an armed and equipped kite, one is presumed to be thus armed for battle, and therefore is a proper subject for challenge. If one is flying a peaceful kite which looks warlike, the flier, upon assuring a would-be challenger of its peaceable character, is passed by, though with a wistful glance, as if it were a crime for such a dashing looking kite to be peaceful.

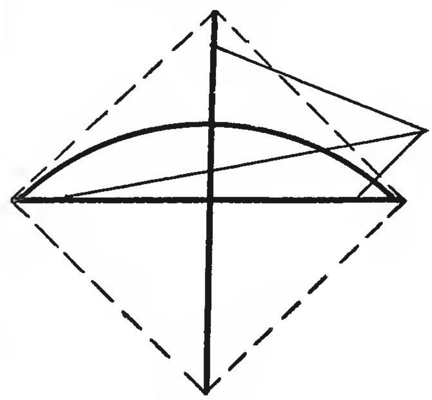

DIAGRAM J.

The boys as well as the men have their battles, both individually and as aggregations. Neighboring cliques of boys are each ready to "knock the chip from the shoulder" of the other clique, and cause the others' kites to bite the dust.

The men are pitted against each other, district vs. district, village vs. village, community vs. community. The battles sometimes are the causes of lifelong feuds between ill-natured or pugnacious individuals.

The weapons which arm the battle-kites are of two varieties : one is connected with the cord or rope, the other with the tail.

The first-named weapon is distributed along one hundred yards of the cordage, beginning a few yards from the kite ; the cordage is liberally saturated with a sticky gum, which, before it can dry, is thoroughly charged with glass pulverized finely for thin cord of small kites, and with coarser, sharply edged or pointed fragments of glass for the rope of larger kites.

The second and more effective weapon is made by either shreds of glass chipped perseveringly out of the sides of glass bottles until several are secured having the curve of the bottle's side, and with a sharp edge on the inner side of the curve, sickle-like, or the same form may be simulated in any scrap of metal which will take and hold a sharp edge.

Now a shred of bamboo a few inches long is transversely pierced at its middle by two piercings which cross each other. A knife blade then successively passed through and slightly twisted therein, causes two splits at right angles, each extending from the middle towards, but not to, the ends of the bamboo.

In these two slots are placed two of the double ended metal blades, or four of the sickle-like glass blades, with their four ends projecting sidewise from the bamboo. The stick is then served with, or bound by, cord so tightly wound around it as to seize the blades firmly in the slots or splits. One or two of these instruments are provided and attached to the tail, one at the bottom end, the other half-way up, and with the keen edges invariably upward. The ends of the sticks are tapered and so snugly secured to the tail that the finest cord cannot be slipped in between the stick and the tail.

We are now an Oriental armed and equipped for the battle. We shall not fly our kite higher than with two hundred feet of cord, for with a short radius the kite will dart through the air, and respond to our handling of the cord more quickly than with a longer radius.

We have provided ourselves with stout leather finger-cots for each index finger, that the friction of the cord, running out over our fingers, may not burn them.

We find a fellow Oriental who acknowledges that he has "cutters," and who suavely assures us that he will be delighted to spoil our cord with his cutters, and, with the delight and right of victory, spoil our kite, for to the victor belongs the spoils (that is about as nearly as we can in Anglo-Saxon approximate to the untranslatable, *double entendre* capabilities of the Japanese language). His kite is named "Ko-chicu" ; our own is "Yan-kee," both of the variety designated in diagram D.

We stipulate that our battlefield shall be within certain limits. With our backs directly to the wind, exactly to the right and left of each other, and fifty feet apart, each warily dismisses his kite into the air in a fresh breeze ; Ko-chicu flies at a slightly higher angle than Yan-kee; each tail is so light, adjacent to its respective kite, that a serpentine curvature is imparted to the tail as it responds to the oscillation of its kite. Ko-chicu, as he sways to the right toward Yan-kee, is given a twitch of the string, whereby his sway is protracted into a huge circle so dangerously near to pitching over Yan-kee's cord that the latter is gently withdrawn, and in response Yan-kee glides up the wind higher than Ko-chicu. Before Ko-chicu has resumed his position after the dive, Yan-kee's cord is run rapidly out — slipped over the index-finger ; he drops on the left (far) side of Ko-chicu's cord. We quickly seize our cord and run swiftly to the right and forward (diagonally). Then we stand, and, working our hands as rapidly as an electric engine, we pull Yan-kee towards us, with intent to get our glassed line in place atop our antagonist's line, then to continue our quick in-pull and thus to saw across his naked line. Our opponent, divining our purpose, runs backward until he has brought his section of glassed cord up under, and in contact with our own glassed section of our cord ; we are checked ; it is diamond cut diamond ; Yan-kee and Ko-chicu foul each other. With a laugh of disappointment we amicably change sides, he now on our right hand, and the lines and kites become parted again.

Now furtively watching the other, each walks backward to get to windward of the other ; while doing so we, without being perceived in the act, have gathered from our ball of twine about forty feet of it, and darting backward twenty feet and diagonally to his rear, we discharge the whole forty feet during our backward-run. Yan-kee drops beyond and on the left of his line ; we momentarily stand to right and rear of our wily antagonist, alert for our next move, for we have temporarily out-manoeuvred him and have crossed the lines. Yan-kee has flown over (beyond) and fallen below the level of his line, our line atop his. We nimbly pass forward, but less rapidly withdraw our line as we progress : — thus we feint that we intend to saw his line ; he runs backward that he may bring his glassed section of line mayhap again in contact within our own like section, and spare contact with his bare cord, while we now, as quickly as our hands can be made to pass each other, pull in so that Yan-kee may come close beside his line and at the same time be slid upward on the wind.

Coincidently with this upward impetus we catch Yan-kee as he oscillates to the right ; a lengthy jerk swirls him in a curve over to the right side of Ko-chicu's line, but Yan-kee's tail is now on the left side of Ko-chicu's line. The tail quickly follows into contact, and we vigorously pull in. When Yan-kee feels his taii caught on Ko-chicu's cord, he pitches with head towards the ground and pulls his own slipping-tail over the enemy's line, our pull assisting, until it is caught by our first set of cutters. If the wind be fresh enough, the down-pull of Yan-kee causes his cutter to sever Ko-chicu's line. If not fresh enough an additional pull on Yan-kee's cord, or better yet, a dashing run in a right angle with Ko-chicu's line, will counteract any diminution of our advantage sought to be acquired by our enemy, who is running backwards in an effort to lessen our pull and the accompanying grip of our not-yet-effective cutter upon the line.

We nimbly run and jerk. Our cutter does its work by severing his cord ; away swirls his pet and champion ; the victory is ours ; we felt it coincidentally with the ecstatic "jumps" of our line as the cutter did its duty.

Our antagonist now owns only the cord below the cut of our cutter ; all beyond that is our spoil. (Incidentally, there is nothing unusual in the writer or teller of a story being the victor ; it is the story-teller's habit.)

Our late antagonist smiles, "shows his teeth," pays his bet by the surrender of his kite — if no other wager has been made — and trudges phlegmatically towards his home ; we proudly and deliberately gather in our kite and our spoil.

This brief outline of a match-battle may suggest to the reader the excitement and enthusiasm attendant upon battles engaged in by large bodies of men from competing communities. In such battles the victors, in order to be victors, will have cut away or destroyed a majority of their antagonists' kites.

The form of kite from which the "parakite" is an evolution is the general form of the Asiatic kite, substantially a square, whereof the two diagonals are respectively horizontal and vertical with a convex windward side, the convexity produced by a third transverse member which is curved upward as well as to the windward face.

Diagrams D, I, and J are the general forms from which has been evolved the Woglom parakite, which flies without tail and will not fly properly with one.

The reader shall now be told how to build it with confidence, and fly it in safety in every condition of wind or weather.

BUILDING AND FLYING OF PARAKITES.

SECTION 1. *Wind velocity at great heights*. — Observation and experience have shown that, though the atmosphere at great altitudes is rarefied — more attenuated than at the surface, — its velocity is greater ; the atmosphere in motion — the wind — constitutes the capacity thereof for sustaining, immersed therein, kites, captive aero-planes, or parakites. Inasmuch as the writer's study and constructions have had great altitudes constantly in contemplation, much thought has been bestowed upon constructions rigid enough to withstand the increasing wind velocity as we approach the greater heights, and at the same time sufficiently light that they may be safely lifted thereto through the lower-velocitied winds at the surface. [1] The obstacle had to be surmounted. The conception of the requirements therefor, came from observing two or three double-frame parakites built for flight in high winds ; the additional rigidity gained by, as it were, interlocking two frames of the conventional arrangement of the frame pieces, — instead of using only two crossed extender members, using four, — gave the desired results (see section 51).

By the use of as much material as would be the solid content of *two* stout sticks, — distributing this solid content into *four* sticks arranged coincidently in pairs, spread apart (52) and trussed to resist the strain where experience taught it was most requisite, — thus has been developed, and susceptible of further development, a system of construction such that, instead of as formerly a high wind distorting and "blowing down" (47), this form goes the higher the harder it blows.

These studies have been pursued during many flights, conducted not only in wind and weather favorable for kite-flying, but through winter months as well, during most of which flights the leader, either of black or red silk, was visible and watched carefully through a powerful binocular glass. [2]

The leader, — its distance above the second parakite being 800 to 900 feet,— which was

1 On Saturday, November 15, 1894 the wind velocity at 250 feet above the surface of New York City was 40 miles per hour, coinciding with observer Dunn's record, but at 1,500 feet altitude, by estimate from the pull of the parakite " Storm King," it was 50 miles. He doubted that any kite could be maintained in that gale, which is now one of record, but verified the estimate of 50 miles from records of Sandy-Hook and other neighboring coast observatories which showed 51 miles' velocity at the same time, the parakite being in what they term the " Sandy-Hook " currents, which, with the wind from N. to N.E., are deflected — drawn down — towards the ocean's surface at Sandy-Hook.

I have reached the conclusion, which was one of the deductions made by Dr. Berson in his balloon excursion of December 4, 1894, as recorded in the Journal of Aeronautics and Atmospheric Physics, viz. — that there is much greater wind velocity at and beyond an altitude of one mile, than at the earth's surface. His is a deduction from the facts that at the surface it was substantially a calm ; after ascending 9,150 metres, he descended to a point 310 kilometres and 5 h. 17 min. from his starting-point.

He must therefore have been moved at the rate of 16 1/2 metres per second by the upper currents alone. (A metre is 39.37 inches.)

2 In fresh winds I have observed varying effects of wind thrusts on the flexile surface of parakites, as if one volume or streak of atmosphere in motion had a higher velocity than other adjacent or contiguous streaks. In the same winds, small kites are nervous, flitting and perform vagaries which set one to reflecting upon why the same winds should so variously affect parakites similar in all ways but in size. If, while flying, we could instantaneously transmute a 72-inch flier into three 24-inch fliers, the three would forthwith become erratic fliers. We may educe that, of the three small parakites, each does not expose sufficient surface to equate the varying energies of the thrusts of contiguous streaks of wind.

May not these varying thrusts be the result or causation of electric or other fluid attraction or repulsion, or both, which, as they charge and discharge their fluid contents one volume or streak into another, thus continue and protract the movement of a storm by the electric or other energy imparted by their own friction one with another ?

If a fact in small volumes, why not in the masses which go to compose storms ? Would not this admission be in consonance with the fact that most of our continental wind-storms come out of the northwest, which is the locality given by some scientists for the "Magnetic" Pole?

constructed to fly nicely in winds prevailing at the surface, indicated by its change of form under wind pressure (figure 11) and its resultant behavior that the wind velocity beyond 4,500 feet altitude increased five percentum over the velocity at the surface.

The obstructions met in early parakite construction, as recited before in this section, it was necessary to remove ; as above indicated, they have been substantially removed. [3]

SECTION 2. *Two-fold function.* — The parakites must in their build comprehend two requisites, viz. — to be of such construction that they may be practically lifting aëro-planes after they have been projected to their positions in the air, to the altitude they are intended for ; at the same time they must combine in themselves the inherent qualities of a kite as ordinarily understood, by which the aëro-plane element in them may be lifted to the height where the aëro-plane element becomes useful ; — the kite function is an essential element in their construction ; it is but a transitional function in their flight (33 and 38).

SECTION 3. *Silk covers in brisk winds.* — For several reasons China silk is preferable for parakite covers in brisk winds ; it has wonderful tensile strength and durability (19). When a parakite is on its ascent and in its transition through its kite function, — usually at an elevation of from 30 to 45 degrees from the horizontal, — the wind exerts its greatest energy (38). At such crises, in winds of from 40 to 50 miles velocity, tough paper has been burst and blown entirely free from the frame, leaving fragments only at each corner of the parakite by which, applying to the reel its highest-speed gear, it has been possible to safely land the remains. In a similar position a silk cover is pervious to the wind ; in addition to its strength as a fabric, the wind — when projected against its surface at the parakite's position of most resistance (30 to 45 degrees) — is sifted through its fibrous structure ; thus the strain upon the twine under such conditions is reduced to a minimum ; then when the parakite has risen above its crucial elevation, its angle of inclination becomes more acute to the wind, which therefore lifts the now aëro-plane by impinging it as if it were covered with a less permeable fabric.

SECTION 4. *Attention to details.* — Exactitude is essential in each and every detail, from the selection of the wood for the frames (43-44) throughout the construction and covering (50), the proper bridle (17), the place on the bridle whereat to attach the flying-twine (65), the nice discrimination in choosing of the parakites adapted to varying wind velocities (67), the elimination of defective parts of the cordage, the security of every knot (16) — in fact, "everything depends on everything." When flying a train of a dozen of these sometimes playful parakites, with the strain upon the lines cumulatively increasing with each one added, — which strain must be carefully noted in order that the twine may be supplied which will withstand the strain,— when thus engaged one does well to bear in mind the adage that "a chain is no stronger than its weakest link" (25).

SECTION 5. *Personal supervision.* — The writer's parakites, appliances and apparatus are all made by himself as much as practicable, or under his immediate supervision by skilled artizans in his business employ, for he has faith in the aphorism attributed to Benjamin Franklin, the pioneer scientific kite-flier, that " if a thing is to be done, send ; if it is to be well done, do it yourself"

SECTION 6. *Colors.* — Interesting optical effects are produced by the various hues for coverings ;— for instance, black is the most readily distinguishable at all heights, even until the flier

3 May not what is termed Atmospheric Electricity be generated by the friction of one stratum of atmosphere moving at a greater velocity than that upon which it superimposes ? Here is a proposition which the fact of the existence of some such potentiality in the atmosphere may, if affirmatively shown, be accounted for.

If Static Electricity exists, it must have an origin ; does not the greater velocity of the upper strata of atmosphere generate atmospheric or static electricity by the friction of one stratum of atmosphere in motion upop the slower-moving stratum immediately beneath it and interlocked with it ? Hence "lightning out of a clear sky" as one stratum discharges into another its electric fluid ? Such function is paralleled by the discharge of electricity from one cloud or mass of clouds into other clouds or masses.

Lightning from a clear sky is not what is commonly known as heat lightning, for which we have known no better cause to attribute it than to heat. The above is the most probable cause for its being. Furthermore, if we eliminate the supposition of heat as its cause, we may assert a probability that so-called heat lightning is discovered only by deflected vision, for heat lightning, known as such, is never seen except at approximately the horizon. Beyond and above the horizon and out of our vision, flashes of lightning are, as to their light, shown on the under-sides of clouds, which clouds are within our vision and thus show a broad, diffused light, — the reflection of the concentrated flash of light on an enlarged cloud-surface, — our vision helped to some extent by terrestrial refraction.

is but a pin-point to the unassisted eye ; white at one thousand feet becomes indistinguishable except that if of silk its sheen may be descried in sunshine, or if against a backing of dark clouds. The same sheen obtains and adds to the distinguishableness of silk coverings irrespective of hue. Light blue against a clear sky, at from eight hundred to one thousand feet, becomes a Nile-green ; at greater heights it transmutes into white, and as such fades from view as it goes higher. Dark blue in cloudy skies becomes as if black ; sunshine restores its color, but a little darkened.

Cherry red against a blue sky displays a corona of its complementary color,— pale green,— as if a fringe at the margin. At great heights it becomes darker to the eye, but lights up to itself in a ray of sunshine. Light green fades out of the vision even sooner than pale blue. A buff-paper covering having been given an application of washing-blue which did not permeate the paper, displayed a solid green tint against sunlight by which the buff and blue were blended into green.

SECTION 7. *Frame-preservation.* — It is not a bad idea to give all parakite frame-sticks a light coating of shellac varnish before uniting them. Thus treated- the frames will better retain their forms during and after immersion in the varying humidities of the atmosphere. It is well to give a coating of varnish to any material with which glue has been used in construction, for thus is precluded any possibility of damp air attacking and softening the glue. In wet-weather structures (20) this treatment is imperative. Orange-shellac dissolved in ninety-five per cent, alcohol, until of the consistency of syrup, affords superior varnish. Much of that merchandized as shellac varnish is freely adulterated by inferior gums — notably rosin — which give but ephemeral protection to that to which it is applied.

SECTION 8. *Slipping of silk covers.* — China silk coverings sometimes slip over the upright frame-member ; thus a greater area of silk is on one side than on the opposing side ; — this throws the parakite temporarily out of poise. It will happen when a flier sways to one side in a light wind, thus permitting the fulness of the silk to drop somewhat more to the downward side of the parakite. An inexperienced experimenter would become disconcerted by the vagaries of a parakite thus thrown out of balance ; not knowing how to rectify an erratic course in the upper air, one might lose a favorite flier (Sections 9-10-11). For mild or fresh winds what is known in the paper trade as "rope manila" paper is the best by reason of strength of fibre. For brisk and high winds closely woven China silk is the better, as in such winds the silk will be firmly kept in its place on the frame by the wind pressure, and less liable than in light winds to be thrown over from one to the other side. An experimenter would better familiarize himself with the movements peculiar to these structures when covered with paper before attempting the use of silk coverings. When silk is used it is well to first learn by test if each kite is structurally correct ; if found to be so, then attach the silk at its axial line by a touch of paste here and there to the upright, below the transverse frame-stick.

SECTION 9. — At heights of five hundred to one thousand feet a steadier movement of wind currents is found than in the swirling currents, close to the earth's surface, caused by the deflection of wind driven against the many projections — buildings, woods, bluffs, hills, rolling grounds, and the like. If, affected by such currents, a parakite starts upon a continuous straight course downwards, it may be broken in its course by giving it freely and suddenly from six to ten feet of cordage and as promptly arresting its flow ; the fresh grip of the cordage will doubtless shock the silk into its place — the parakite will right itself and again dart upward. Their movements are sometimes quite abrupt when near the surface ; when in unsteady winds they need close attention as would a nervous horse ; otherwise, if properly constructed (4) they will stand as steadily as a church spire.

Very reliable parakites will be at times borne downwards, unaccountably so unless we place the responsibility therefor on a downward current of wind. M. Mouillard (in *L Empire de V Air*, L. P. Mouillard, Paris), a keen, conscientious observer, claims that soaring birds *actually rise*, and progress against the direction of the wind, without flapping the wings. Dr. S. P. Langley, who requires no introduction to American scientists, has intently watched the movements of the turkey buzzard (*Cathartes aura*) soaring on rigid wings in a 35-mile wind, *rising* and *falling* slightly in its course, while keeping, as a whole, on one level, and to his trained and critical eye there was not only no flap of the wing, but not the quiver of a wing-feather (*The Internal Work of the Wind*, by S. P. Langley). A. Lawrence Rotch, Director of the Blue Hill Observatory, in the Aeronautical Annual for 1896, observes : " . . . kites have demonstrated the existence of strong ascensional currents," and on the same page (109), that instruments on the Eiffel Tower in Paris "showed the existence of both upward and downward currents." Octave Chanute, the widely known engineering expert, states on page 70 of. the same interesting book, that, while studying the flight of the gulls of San Diego, Cal., at fifteen to twenty feet distance, "In one or two rare instances the birds were seen both to rise and to advance in a straight line against the wind simultaneously, and this is the hardest manoeuvre to explain mathematically," he naively comments.

In extracts from a prize thesis on natural and artificial flight by Hiram S. Maxim, the renowned aerial investigator and experimenter, on page 34 of the said annual, he draws this one of several conclusions, "that there is a constant interchange of air taking place, the cold air descending, spreading itself out over the surface of the earth, becoming warm, and ascending in other places."

The dreaded "Mistral" of the Mediterranean Sea, with no more warning than its actual presence, descends like a shaft of Arctic chill. These authorities all concur in that there are wind currents that ascend and that descend ; surely if they do the one they must also do the other.

In this City of New York, in the writer's experience on many occasions, and especially in winter, with a single parakite almost in the zenith, the recording spring scales showing an increase' of pull thereon, the reel has been permitted to run freely, and it could be accounted for in no other way than that the cordage seemed to be sucked up into the air to the extent of 1 800 to 2000 feet by a parakite which, under normal condition, would sustain but half the quantity ; thereupon the horizontally blowing wind nearer the surface carried the cordage in a curve to the leeward until the wind friction thereon apparently dragging the parakite out of the ascending air column, it became necessary to relieve the parakite of the pendent weight of the cordage by withdrawing it until a re-correlation was established between its lifting energy and the weight of pendent cordage.

All these citations are testimony to the fact of respectively upward and downward winds. The downward, otherwise unaccountable, drift of a parakite proven structurally accurate in normal winds, may be reasonably attributed to a downward current, not necessarily vertical. This theory, acceptable to the mind of the writer, after its acceptance seemed to be verified repeatedly by critical observation of the behavior of such favorite, perfected parakites under the conditions named. Their construction being such as to fit them to the wind, they must, being passive therein, conform with and respond to every departure from the normal of the impinging wind ; later herein (Sec. 75) we shall generalize from these data.

SECTION 10. *Checking a " Dive."*— In train-work a parakite will occasionally swirl against the main cable, upset itself, and pursue a straight downward course ; it may, for otherwise inexplicable reasons, adopt such a course when upset by an aërial eddy ; if not baffled it may continue its course until either arrested by its restraining attachment to the main cable, or, if the pennant line be of sufficient length, until it reaches the earth. Such a straight-down dive will be invariably arrested by smartly seizing the main cable ten or fifteen feet back from the experimenter's grip, and suddenly surging the said "bight" often or fifteen feet into the main line ; this quick relaxation disconcerts the parakite. In the time it has taken up the slack bight, — the covering having been meanwhile shocked into normal distribution upon the frame, — it will have resumed its upright position, and will dart up again. Displacement of the covering, by which its poise is disturbed, is the only reason to be presented for such aberrations.

SECTION 11. *Checking a " Swirl "* — The device in Section 10 is to counteract a straight dive. If there be the least curve to a dive, the parakite will continue in the circle of which the initial curve is an arc ; if at sufficient height when it starts, it will complete the circuit and resume its position. The same device will check it at any time in such a circuit. The parakite should not be suddenly nor briskly pulled when in other than a substantially upright position.

Section 12. *Kites and parakites.* — The term "kite" as applied to the contrivance flown in the upper air is identical with the appellation of "a rapacious bird of the hawk kind, distinguished from hawks and falcons by having a forked tail and by the length of its wings. . . . It is remarkable for gliding through the air without rapidly or frequently moving its wings, hence called *glide*." Webster further defines kite as "A light frame of wood covered with paper, for flying in the air, for the amusement of boys." Inasmuch as "kite" has been the name for a toy, and the contrivances herein discussed are but casually for the amusement of boys when they (the contrivances) are raised by maturer people (or by the youth of either sex), it has seemed proper to distinguish therefrom these "parakites," using the Greek prefix in its purport of *beyond-the*-kite — an advanced kite ; this appellation is adopted here notwithstanding that large birds have instinctively claimed them as of their sort, or at least of the (bird) kite-sort, by their so frequently hovering around the parakites as if studying quaint specimens of ornithology. Further warrant for a qualitative name other than that defined by Webster, is that the parakite is at its best when "covered with" other than "paper."

Section 13. *Parakites interest the birds.* — Large birds are amusingly interested in the flights of these parakites ; they hover about them, apparently prompted by acute inquisitiveness ; none has ever alighted upon one or attacked it, though at times their menacing mien has prompted a vivid vision of the comparative possibilities of a twine-entangled bird being pulled down from the upper regions, or, mayhap, a certain parakite operator being translated hence — a not impossible subjective fulfilment, by a bird, of Hosea's prophecy, xi. 4 — "I drew them with cords of a man."

On October 6, 1894, when flying a train of five, of which the uppermost was 1,800 feet high, a large silver-tipped eagle came suddenly out from the higher air and swooped 'round and 'round the leader ; at first it seemed, in the westering sunlight, like a huge silver ball swinging in an immense circle. The train was gently withdrawn a few hundred feet until a powerful marine glass revealed his identity as he followed downward ; he visited from one to another, seeming rather undecided what to do about them. In a few minutes, apparently having learned that he knew nothing about them or their digestibility, he rose upward and soared eastward out of view.

Another experience was with one of the stork family. He came across from the New Jersey side of the Hudson, and drove straight for the queer creature he had discovered. Apparently he was determined to go right through it, but changed his mind ; he swerved around it, under it, and over it ; through a glass he could be seen cocking his eye at it in a most comical manner. He started away several hundred feet, took a second thought, returned, and made a second attempt to solve the ornithological problem. He finally swayed off in the direction whence he came (from the W.S.W.), and surely with a mystified air, for he had evidently run across a new specimen which his storkship could not classify.

On March 9 and 16, 1895, appeared, high above the leader, flocks of geese driving steadily and rapidly against a stiff northwest wind ; in each event the usual "V" formation was held until the flock reached a point directly over the train, whereupon it re-formed, as it were, "company front," — in a line transverse to its course against the wind, — hovered for approximately five minutes, and then disappeared upwards.

The uniformity with which most of the large birds emerge into the view from still greater heights than the parakites, however high, is remarkable.

Small birds, a few hundred feet up, frequently alight and rest awhile on the cable, if it be no smaller than the size of telegraph wire.

Section 14. *Deterioration of twine.* — Twine used for flying, when wound on spools directly from parakites in flight under a strain of a minimum of 20 or 25 pounds on the reel which rotates the spools, — and thus left for several days or until again used, — is deteriorated in tensile strength by its tension continuously existing while on the spool and intensified by humidity. This tension tends to slip the fibres past each other ; the elasticity of the twine becomes exhausted by the tension when thus wound, and unable to react under the pressure and constriction of superincumbent layers. The greater the initial elasticity, the more rapid the deterioration when subjected to such strain (24).

Section 15. *Strains upon cordage.* — In flights to great altitudes, one essential is an exact knowledge of the strength of the cordage in use ; cordage dealers can give but little satisfaction in that direction ; we must do our own testing of the maximum tension which the twines we use may be subjected to before they will break. We must avoid all the wind friction possible to be avoided on the twines ; therefore we will use the smallest sizes consistent with the strain to which they are to be subjected. Altitude is to be sought, not horizontal distance. The winds blowing in a substantially horizontal direction, if the cordage is. one whit stouter than requisite, the wind attacks the cordage unduly and tends to drive the whole outfit horizontally, thus decreasing the angle of elevation-from-the-horizontal. Cordage should never be exposed to strains beyond one third of its breaking strain

Figure 1.

Fig. 2

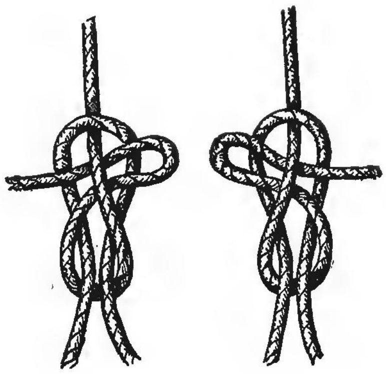

Figure 3.

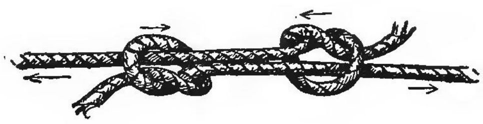

Figure 4.

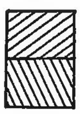

Fig. 5

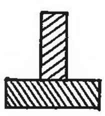

Fig. 6

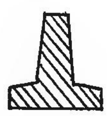

Fig. 7

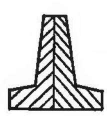

Fig. 8

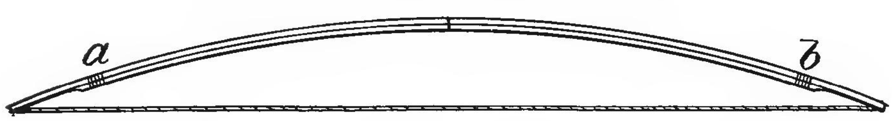

Figure 9.

and seldom, beyond one fourth. The seventy- five per centum remainder of its tensile strength must be reserved for the contingency of sudden gusts, which may increase the strain three- or four-fold (25).

SECTION 16. *Cordage knots.* — A knotty problem to solve has been the best knot for uniting flying twines. A "flat knot" (Fig. 2) is apt to be "upset" ; a "bowline knot" (Fig. i) under great strain may cut the single strand — shown back of the upper-end loop of the knot ; — both knots are safe in other respects, the "bowline knot" being especially adapted to uniting *varying sizes* of twine, and in attaching them to the bridles. (64) (Figs. 3 and 16a). [4] For the lengths of cordage subjected to high tension I have found the "surgeon's knot " (Fig. 4) to be most efficient ; if I remember aright it was first suggested by Dr. Alexander B. Johnson of this city, a whilom experimenter with captive aeroplanes. I use no other knot for like purposes. It is made by laying beside each other, inversely, the two ends, lapping say three inches. Now, with *one* end take a "half-hitch" around *its* contiguous standing part ; again, with the *other* end take a half-hitch around *its* contiguous standing part ; then grasping the two standing parts on either side the now two half-hitches, and drawing apart the two standing parts, the two half-hitches will be inversely brought into contact (as indicated by the darts in Figure 4) and the knot will be "set." Its safety under strains is that it does not compel any sharp bend in the twine.

SECTION 17. *Knotting the bridle.* — When the point on the bridle has been established (65), at which the best poise of the parakite has been obtained, the "whip-line" (Fig. 16-*b' b"*) should be so bent on to the loop (*e*) of the bridle (Fig. 16-*c' c"*) as to preclude any possibility of it slipping thereon. For this a modified bowline knot has been found most effectual (Figs. 3 and Fig. 16-*a*). The end of the whip-line being looped into the bowline knot, it may be readily pulled out for change of position when experimenting for the proper place for the whip-line. It is well to keep the end thus looped when the said position (*e*-Fig. 16) has been established (4).

SECTION 18. *Knotting the whip-line.* — The term "whip-line" (Fig. 16-*b' b"*) is used to designate a bit of cordage — somewhat stronger than that which constitutes the bridle — about eighteen inches long, the end opposite to that which is attached to the bridle having a long loop therein (Fig. 16-*d*) to which by a "bighted" bowline knot (Fig. 3) may be tied the flying cordage. By the same form of bowline knot (Fig. 3) the flying cordage may be attached to the whip-line loop (Fig. 16-*d*) and removed therefrom without disturbing the attachment at the poise-point of the bridle (Fig. 16-*e*). The best form of knot for this loop-end of the whip is shown in Fig. 16 at *f* it is in fact but a completion, without the toggle, of the partially completed loop suggested (Fig. 22) for attaching pennants to cables. The double bight (Fig. 22 -*c' c"*, which in the cable knot — Fig. 24 — is "toggled"), in the whipline loop is pulled through, the loop (*b*-Fig. 22) following it ; then the knot is to be firmly set as in Fig. 16-*f*.

SECTION 19. *Crinkled-paper coverings; percaline.* — During experiments to discover the best material with which to cover light-wind parakites, — after China silk had been sufficiently tested to show its usefulness in fresh winds, — the idea presented itself of preparing rope manila fiber paper to simulate the pliability and elasticity of the China silk. It was found — after a sufficient area of tough paper had been prepared for one covering — that, by crushing it all together in a mass, gently rubbing it against itself as would a laundress when hand washing a piece of cloth, and thereafter smoothing it out, a much improved quality was imparted to it — a softness, elasticity, pliability, as of an old bank note, was effected.

Paper which will not withstand such rubbing and crinkling has not sufficient durability for

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4 On February 22, 1895, at an altitude of 3,600 feet, a black silk parakite — " Realie " — was "leader" of blue silk " Racie," 700 feet below the former. The twine parted at a "jammed" bowline knot in the main cable close to "Racie"; thereupon the latter, acting as a ballast to " Realie," converted the latter into a free ballasted aeroplane, and as such it floated off eastward over and across the East River, — the nearest shore of which was i miles distant,— and reached Brooklyn. "Racie " caught on the top of a high building, thus, making " Realie " again captive, and she was thus seen flying in the air on the fourth day thereafter by Edward A. Cole, of No. 190 Van Buren Street, who communicated the fact to me. Four and three quarter miles is a conservative estimate of the distance covered by the fugitives.

covers. [5]

Smooth paper imparts a quick, nervous action, while the crumpled paper produces the graceful, easy flight and movements characteristic of textile fabrics.

For large [six feet and more] brisk-wind parakites the close-woven, fine-textured "percaline" of various colors is a satisfactory covering ; if containing an excess of dressing or size it is well to have it washed out first ; it will thus be also shrunken (3).

All woven fabrics should be fitted to the frames with selvages and warp transverse the frame. The woof's slight excess of elasticity over the warp helps the twin concaves (62) in high winds. Coverings with the warp and woof diagonally on the framework, will stretch out of truth ; they should never be thus applied.

SECTION 20. *Wet-weather parakites.* — Except in drenching rains these parakites may be flown if properly prepared. I have demonstrated their good qualities even in considerable down-pours, by paper coverings saturated by brushing carefully over with melted paraffine wax, with the precaution of papering the framework with the fold-over margin from rear to front face, — the reverse of the method of folding over the edges of fair-weather fliers (59).

The wisdom of this precaution will be apparent when we consider that the rain as it falls upon the upturned back of the structure, would flow towards the edges and under the pasted fold-over, thus disintegrating the paste. The covering should be pasted on the frame before paraffining ; paper after paraffining cannot be enduringly pasted. As no two bodies can occupy the same space at one and the same time, the paper where charged with paste will not be, as to that space, -charged with the paraffine ; all the covering being otherwise filled will be impermeable to water.

For wet weather the spruce or other wood frames should have a thin coating of shellac varnish (7).

Fishing line is best for repeated flights in wet weather ; it is doubtful however if any other than an enthusiastic investigator would tolerate the investigating tendency of the water which runs down the line to one's hands, thence down the upheld arms and ticklingly trickles elsewhere lineally an inch (?) within the *outer* skin of one's waterproofs.

SECTION 21. *Measuring cordage.* — A kite-flier should have knowledge of not only the strength but of the length of each variety of his cordage. It is tedious to measure a thousand or two thousand feet of twine.

An expeditious method is to ascertain its length by weight, i. e., weigh the whole ball, skein or hank ; cut off and weigh twenty feet ; the whole weight divided by the weight of the twenty feet unit of length gives the number of twenty feet lengths in the mass ; that number multiplied by twenty gives as a result the number of feet in the mass.

A more formidable formula which I have adopted, determines length of twine with marvellous accuracy, as follows : Weigh the mass of twine by ounces of avoirdupois weight. Cut off exactly twenty inches. Weigh that by diamond scales and weights down to 1/64 of a carat, which is troy weight. Convert the carat weight into troy grains by multiplying by four ; state the result in a whole number — decimally, if any fractions of a grain. Dividing that by twenty gives the troy weight of one inch.

The weight of the mass in avoirdupois ounces will be converted to troy grains by multiplying by 437.5, the number of troy grains in an avoirdupois ounce. That result divided by the weight of the one inch obtained as above, gives a result in inches, which divided by twelve is the number of feet in the mass.

SECTION 22. *Unwinding ball-twine.* — Parakite-fliers (but we don't mind if incidentally other good people who use twine learn a kink from us) may spare themselves the annoyance caused by the kinking of twine and its accompaniment of snarl, by the little quirk of breaking out a ball of twine from its inside, having first seized the inner end of the twine and passed it to and out of that

5 Search for paper of considerable tensile strength discovers so much of it to have been adulterated by wood-pulp that the question presents itself whether legal papers of record thus adulterated, when filed away, may not break apart as if chips when the attempt is made to unfold them after many years of storage.

end of the ball's core which is opposite to the end at which the twine-end was found. Now when drawing it out for storing in other form — either by winding on stick or spool — each inner coil from around the core automatically counteracts one complete twist with. each coil as released.

SECTION 23. *Spools for handling twine.* — For the storage and dismissal of great quantities of cordage nothing is so convenient as spools turned from rock maple, the grain lengthwise the spool. My own are six inches long in the clear, with the "drums" three to four inches in diameter, and thick flanges five to six inches in diameter. Each will hold from 2,500 feet of twine of 20-pounds test, to 400 feet of twine of 275-pounds test.

An interesting fact is that when these spools (which a simple device transmutes into a drum in a reel) have been filled with twine, which, as the spools are rotated in the reel framework, draw in a train of parakites having a pull of from twenty to fifty pounds, so great a crushing force is generated that a spindle which runs freely into a seven-eighths inch hole through the spool, and upon which it revolves when the twine is being run off it, the said spindle becomes so pinched by the cumulative strain around the three-inch maple cylinder, that a deal of force is required to remove the spindle from the hole into which it freely slipped when the spool was void of twine. One will at once realize an illustration of the principle upon which is constructed the wonderful "Brown segmental wire-wound gun."

SECTION 24. *Windlass for heavy work.* — This great strain, which is referred to in section 14 as causing deterioration of the cordage, induced a consideration of means by which to avert that danger ; the result was a windlass of considerable power, around the drum of which three or four turns take the strain directly from the main cable, assisted by the reel behind it and tributary thereto. The transposable spools of the reel, as they receive the twine from the windlass, now merely require a strain on the cordage, as it goes to the spool, sufficient to — in marine parlance — "take the slack" from the windlass.

SECTION 25. *Measuring the pull on kite-lines.* — An always necessary apparatus with cautious operators is an accurate spring scales (Fig. 25) of a capacity of eighty to one hundred pounds. As each parakite is dismissed a few hundred feet, its pull upon its main line should be observed on the scales so that twine shall always be provided which will have a surplus of sixty to seventy-five per centum of its tested breaking strain. Care should be exercised that no section of the main line may be overloaded, for all beyond that section will be jeopardized in a gust (15).

The metal hook of the scales should be "served" (Fig. 25=*b*) with fine soft twine to which has been applied — after the serving — a coating of naturally prepared glue (55), which will cause the serving to adhere to itself and to the metal hook, and provide a softer cushion for the tense kite-line than would be the bared metal of the hook. The scales should be well secured to some fixture adjacent to the operator, with the hook-end free to swing in any direction.

An expeditious way to make a pull-test is to grasp the main line several feet outward from where it is belayed, apply the nigh slack (Fig. 23=*a'*) of the twine to the hook near its end (*a"*) and take four or five turns of the twine over itself and backwards as it lies along the hook ; by this means it becomes so "jammed" by the superincumbent turns, which lead thence to the kite-line (*b*) with the strain thereon, that it is held firmly whilst the test is being made ; it is as readily unwound from the hook thereafter.

SECTION 26. *Self-registering spring- scales.* — A handy form of spring-scales for measuring the pounds of strain upon cordage is that known by the makers as "sportsman's scales," cylindrical in form, thus avoiding protuberances, and with the spring within the cylinder. The maximum strain should guide the operator for the obvious reason that it is the maximum strain that sunders the cord. That the maximum may be learned without the necessity of continuously watching the scales, a simple self-registering device may be added by the operator's own ingenuity — viz., a ferule (Fig. 25-*a*), not necessarily of metal, may be loosely fitted around the cylinder at that side of the pointer against which the pointer will press when the spring is subjected to a strain. Between the outer face of the cylinder and the inner face of the ferule will have been inserted a wrap of soft fabric — flannel or velvet — just enough in thickness to retain the ferule by friction without requiring much energy to move it up or down on the cylinder. This ferule, moved down into contact with the pointer, will be pushed up by it to the maximum-strain point and left there. The pull will be read at that edge of the ferule which was in contact with the indicator (see Fig. 25).

SECTION 27. *Belaying- and friction-cleats.* — A convenient adjunct to cordage is one or more — for small work brass, and for large work locust or other hard wood — cleats, as fixtures adjacent to the operator, over which the cordage may be run out, relieving the hands from abrasion, and to which the cord may be belayed. Soft-wood cleats are too readily cut into by the attrition of great lengths of cordage passing around them under tension. Of whatever substance, the cleats should be of good size and nicely rounded ; attached at four or five intervals crosswise of a four-by-twenty inch wood strip, it may be strapped to any convenient fixture.

SECTION 28. *Why twine twirls.* — All twine free in the air in considerable lengths is subject under strain to be automatically revolved in places. The extent of this revolution or twist varies conjointly with its elasticity and the tension to which it is subjected.

Thread made from three strands of twisted flax fiber, becomes "laid," and the strands united by their joint automatic effort to react from the initial twist which was given to the three strands of fiber ; this automatic action results in the thread having a twist or "lay-up" which is the reverse of the initial twist. If now, as is requisite in the production of cable-laid twine, three strands of the said thread be uniformly twisted' in a direction continuous of that twist which automatically united them into the thread, the now three strands of thread will, when laid side by side, again twist and unite themselves into "cable twine" — the twist of which is again the reverse of the twist of the thread. It is thus apparent that the twist of ordinary laid thread or twine is the reverse of cable-laid twine. For example, if a length of the thread described be united to a length of the cable twine described, the twirling of the one will untwist the other.

Experimenters with trains of kites (39, 40, 41) are aware that each succeeding kite or aggregation of them requires serially increasing strength of twine. When a plain-laid thread or twine has been used in dismissing the upper kites, and it is intended to add the cable-laid twine, the latter by reason of its excess of inherent energy will discharge its twist, or its untwist, into the adjoining twine of smaller diameter ; likewise as the kites go higher and larger cable cordage is employed, the larger will act similarly towards the smaller twine, with the distinction that in the latter case it will merely equate the twist of the two varieties of the cable twine, whereas in the former instance the twirl of the cable twine will either twist more firmly, or untwist, the plain thread, according as the cable twine came from the maker's hand with an artificial twist, i. e., greater or less than it would automatically assume when inert.

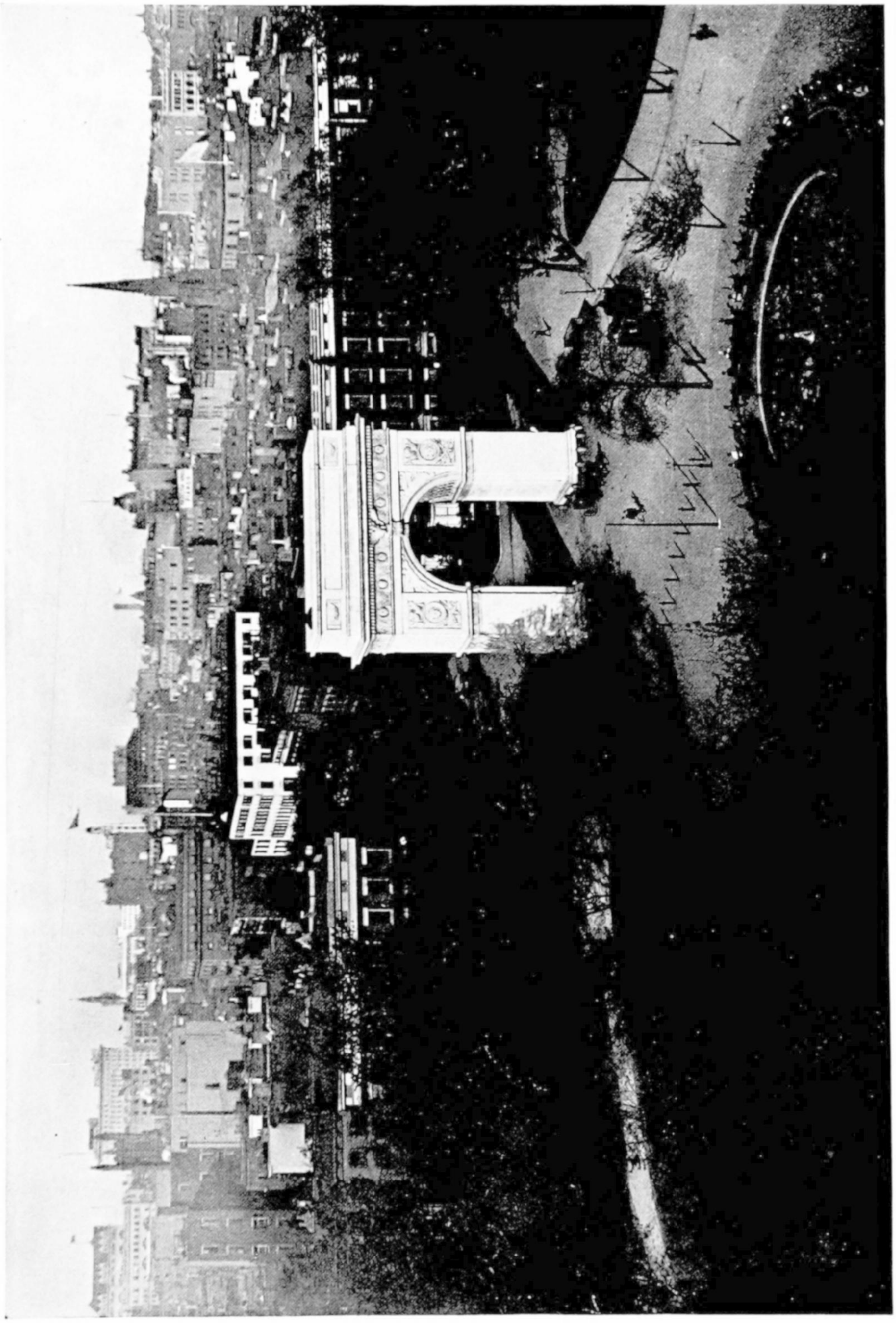
SECTION 29. *To stop twine twirling.* — This tendency is most annoying when the junction of two varieties of twine approximates to the junction of the pennant line of the individual parakite with the main line, which by its twirling will weave the pennant line around itself in bothersome vagaries.

To counteract this annoyance a simple device, which we will call a "spreader," may be made as follows :

Conceive a right-angled triangle (Fig. 15) ; in that form a piece of cordage of suitable strength will be passed through holes bored closely to each end of a thin spruce stick, with loops (*c* and *d'*) tied on the outer-side of the triangle ; the knots thereof (*a' a"* and *b' b"*) will "stop" the cordage there ; at the same time they will maintain the twine (*e*) linearly in contact with the said stick. Thus the twine and stick are jointly the "perpendicular." Of the now two free ends (*f' f"*) — after having been passed through the holes at *a'* and *b"* , and each again knotted at the reverse end *a'-b'* of each hole — one (*f'*) becomes the hypothenuse, the other (*f"*) the base of the triangle ; knot together the two free ends at *g* (the lower acute angle), and continue them into a third loop (*h*) knotted by a flat knot (Fig. 2) at the side of the loop (*i*).

To apply this spreader, the main-line to the upper parakites will be attached to the loop *d*. The main-line to the operator will attach to the loop *k*. The pennant-line to the branch parakite will attach to the loop *c*. When the newly added parakite, hanging pendent, has been towed upward and outward by the dismissal of the higher parakites to a greater height, the pennant will be "boomed" — spread — away from the main-line. If the spreader is of proper length the pennant line attached at *c* can never but cross the main-line, of which *k, f, d* is an inserted section. The draft of the branch parakite upon the upper end of the spreader at *c* is such that the twirling tendency of the main-line is neutralized.

It is only when, without the use of a spreader, the newly added pennant casually lays along the



Bird's-Eye View North-eastward from Washington Square, New York City. Washington Arch in Foreground. Produced on and from a Glass Negative in a Camera Attached, at an Altitude of Two Hundred Feet, to the Cable of a Train of Five Woglom Parakites.

main-line in the air that the main-line can, by its fractional contact, seize and twirl the pennant-line around itself

SECTION 30. *A simple "Spreader."* — A simpler and equally efficient spreader (Fig. 18) may be contrived by the use of a spruce stick of say 3/8 x 1/2 inch, and nine to fifteen inches long, having a shallow groove (Figs. 21) whittled around, close to each end.

After the toggled loop a has been tied in the cable *b b b* and then the pennant-line *c* bent into the loop a by a. bowline knot (Sec. 18 and Fig. 18-*d*), now in the direction of the fliers aloft, and at a suitable place (Fig. 18-*g'*) on the main-line, — say fifteen inches from the toggled knot, — place one end of the spreader and secure it there by a clove hitch (Figs. 21) around that end ; the opposite — top — end of the spreader will be surrounded likewise by a clove hitch taken in the pennant-line at *e"*, say thirteen inches from its junction with the main cable. Nothing better than the clove hitch can be used for this purpose ; the cordage surrounds the rounded groove in easy curves, and the tension seizes it there snugly (Figs. 21). The relative angles and sides should be in the proportions shown, to be most effectual as a preventive of the pennant-lines being whipped around the main-line (29). Several of these should be in readiness, of various lengths and thicknesses, using no more material than is essential for the work to be done by them. If nicely smoothed and varnished, some wind friction may be thus saved, they being to some extent passengers.

SECTION 31. *Need of caution.* — The safety of the parakites depends entirely upon the security afforded by the cordage ; that is the writer's justification for what may appear to the reader to be unnecessarily detailed information as to experiences with cordage. A successful kite-flier should be cautious, for the winds regard a valuable train of parakites no more considerately than the boy's two-cent kite.

Many a good ship has been lost by carrying sail a few minutes too long. The good sailor does not wait until emergencies present themselves ; then it is too late to meet them with all the details incident to, and the time requisite for, shortening sail ; nor does he carry sail to the point of overstraining or carrying away his spars or rigging. Experience has taught him that when the strain even threatens to enter the realm of reserve strength of his materials, it is time to reduce sail. His knowledge of the strength of his spars and cordage is an important function in his seamanship.

Piano wire presents its merits perspicuously to a parakite-flier. Its storage on spools by which it may be practicably dismissed to and withdrawn from the upper air, makes it apparently desirable for use as main-lines ; the minimum of wind resistance which its diminutive size presents, as compared with its strength, lends an additional feature of attractiveness. But as there is only one of each of us kite-fliers, and we may be useful on the earth, it is unwise to risk an untimely entrance into the great hereafter ; the volume of atmospheric electricity which may be accumulated during, and discharged at its lower end by, an exposure of several thousand feet of steel wire in the atmosphere — which is one vast generator — is too dangerous an elemental force to be trifled with, in comparison with the innocuous, non-conducting flax twine.

SECTION 32. *Measuring altitudes.* — A home-made clinometer (Fig. 17) is a convenience for ascertaining the angle of elevation of the parakites or of the cordage, and especially when triangulating for altitude of a " leader." It may consist of a semi-disk of stout tar-board attached at its diametric line to a straight, rectangular stick thirty-six to forty-eight inches long ; a plummet-line knotted at its upper end through the middle of the diametric line, with a common lead sinker at the lower end of the line, will, by the position of the plummet-line as a radius across the said semi-disk at the degree marked thereon, indicate the angle of elevation from the horizontal, when the stick is, as it were a rifle, aimed at the parakite. The graduation and the figures in ink, and the whole coated with shellac varnish, will make a durable and tolerably accurate, even if rude, instrument.

To ascertain trigonometrically the altitude of a parakite or the leader of a train, the simplest method is by an assistant placing himself at B, Fig. 19, directly under the top-most parakite (C, Fig. 19). It is difficult to realize if one is exactly so situated ; accuracy may be attained by the assistant having a bit of cord to which may be attached any small weight. Suspending these as a plummet held aloft by one hand, glancing up the cord from time to time, the point B will be found on an imaginary base-line over which the parakite is perpendicular. The base-line extending horizontally from B the assistant, to A the operator, will be measured after the two have at a pre-arranged moment coincidentally ascertained by the plummet the point B on the base-line, and by the clinometer or transit-instrument the angle (C A B) of elevation of the parakite (C).

The angle C B A is manifestly a right angle, and whatever the angle C A B is determined to be, its complementary angle A C B will be the difference between it C A B and ninety degrees.

The proposition therefore is :

"The angles and one of the legs given, to find the hypothenuse and the other leg" of a right-angled triangle.

For example (see Fig. 19), given the base AB 625 and the angle A 48° 5', to find the hypothenuse A C and the perpendicular B C.

We should possess a table of logarithms and of logarithmic sines and tangents.

Making the hypothenuse radius, AB will be the sine of the angle C, and C B the sine of the angle A ; then,

TO FIND THE HYPOTHENUSE.

As the sine of the angle C (41° 15')	9.81911
Is to the base A B (625),	2.79588
So is radius	10.00000
	12.79588
	- 9.81911
To the hypothenuse A C (947.9)	2.97677

TO FIND THE PERPENDICULAR.

As the sine of the angle C (41° 15')	9.81911
Is to the base A B (625)	2.79588
So is the sine of the angle A (48° 45')	9.87612
	12.67200
	- 9.81911
To the perpendicular B C (712.7)	2.85289

Making the base radius, B C will be the tangent and A C the secant of the angle A ; then,

TO FIND THE HYPOTHENUSE.

As radius	10.00000
Is to the base A B (625),	2.79588
So is secant of the angle A (48° 15')	10.18089
	12.97677
	-10.00000
To the hypothenuse A C (947.9)	2.97677

TO FIND THE PERPENDICULAR.

As radius	10.00000
Is to the base A B (625),	2.79588
So is tangent of the angle A (48° 15')	10.05701
	12. 85289
	-10.00000
To the perpendicular B C (712.7)	2.85289

If we have not the tables of logarithms, or if we prefer it, we may solve our example by Gunter's scale. In working such cases by Gunter, always suppose the hypothenuse radius, where it can be done, being the simplest of the three. Radius on Gunter is either eight points on the line of sign rhumbs, four points on the line of tangent rhumbs, 90° on the line of sines, or 45° on the line of tangents.

TO FIND THE HYPOTHENUSE.

Extend the compasses from angle C 41° 15' to radius, or 90°, on the line of sines, and that extent will reach from the base, 625, to the hypothenuse, 947.9, on the line of numbers.

TO FIND THE PERPENDICULAR.

Extend the compasses from angle C 41° 15' to angle A 48° 45' on the line of sines, and that extent will reach from the base 625 to the perpendicular 712.7 on the line of numbers.

The example given and demonstrated, both for the hypothenuse and the perpendicular, is simple ; it is only suggestively presented here.

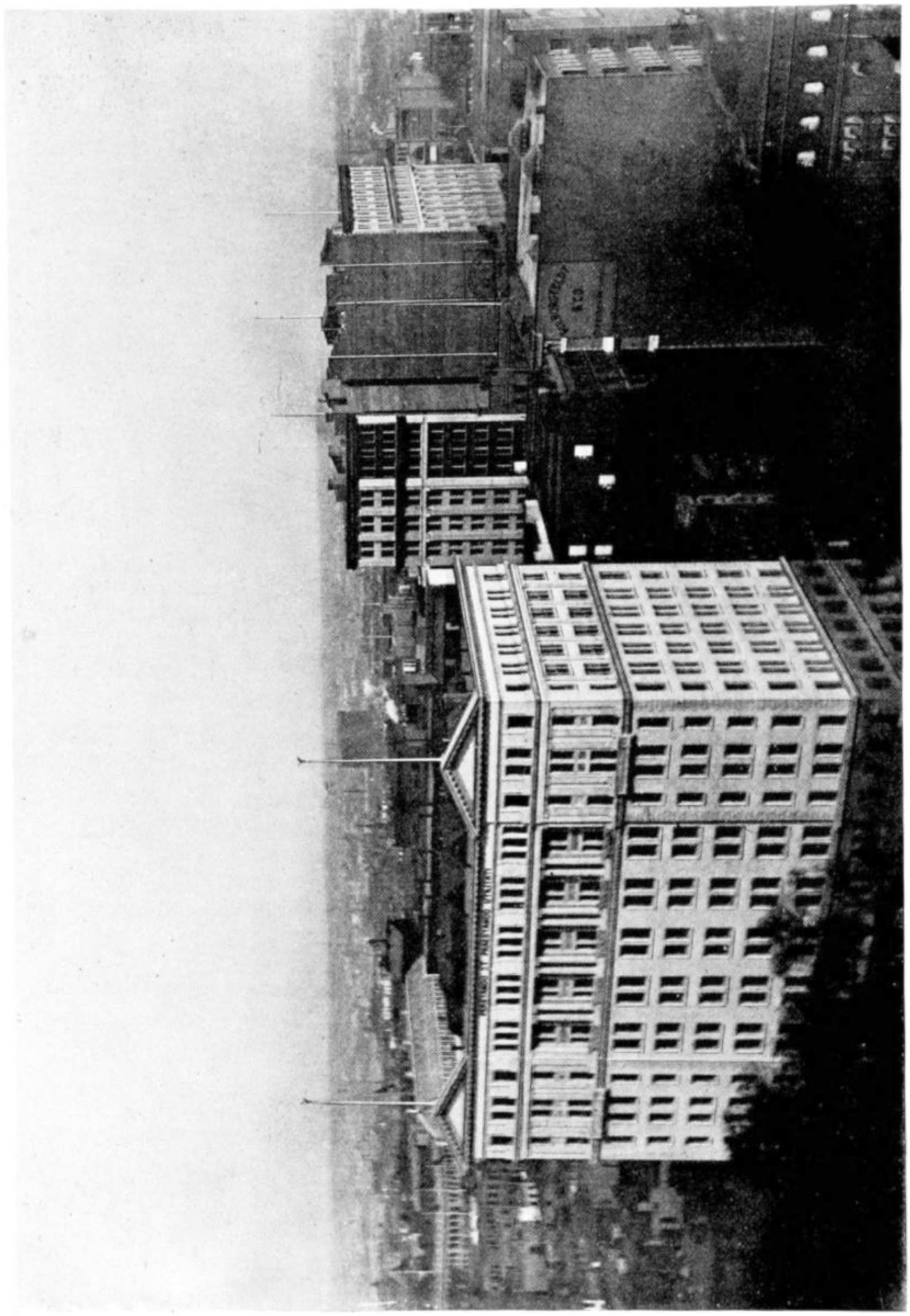
A difference will be observed between the hypothenuse and the length of cordage served, the latter — due to its sag — being in excess of the former ; the perpendicular is our objective.

SECTION 33. *A puzzling paradox.* — Whilst the parakites are on their ascent (38) it will be observed that the pull gradually decreases after having passed a point about forty degrees from the horizontal. Upon reaching a high elevation the minimized pull is remarkable. The parakite has now become poised almost horizontally as to itself, and the cordage which holds it captive is almost vertical except as the horizontally-flowing wind blows the cordage into a curve, concave to the experimenter.

If two persons, each grasping an opposite end of a ten-feet length of chain which weighs say ten pounds, are separated nine feet it is evident that each person will exert the same amount of energy to support the chain in a horizontal position. If now one person, designated "X," lifts his end of the chain so that his point of seizure is forty-five degrees higher than the opposite end held by the other person designated "Y," it is evident that X will exert a greater amount of energy for the support of his end, held at forty-five degrees elevation, than is exerted by Y at the original horizontal position at which each first grasped the chain. Further, if X now lifts his end to a position vertically, and the full length of the chain, above the point at which Y holds his opposite end, it is again as evident that X now exerts an energy sufficient to sustain the full weight of the chain.

Applying this similitude to the parakite shows that — Y representing the experimenter and X representing the parakite — the lifting capacity of the parakite is disclosed by its energy in supporting the weight of the cordage — pendent from itself and extending therefrom down to the holder of the opposite end of the cordage — plus the pull recorded by the scales. A seeming paradox is thus explained ; if a train of parakites shows a pull of say twenty pounds, and to the cordage thereof a body is attached to be lifted into the air, it would seem that the said body would add to the pull proportionally to its weight ; but such is not the fact If the actual energy — the train of parakites — is flying at an elevation of more than forty-five degrees, the excess of the said actual energy over the potential energy of the spring-scales (to which the earth-end of the cordage is secured) will be shown by the scales to be indicating an equated smaller strain than would be anticipated as a result of the addition of the weight of the said body to the cordage.

Frequent and invariable is the truth that, given an uniform wind velocity, if a weight be then added to the cordage and dismissed into the air, the pull at the earth will be not proportionally increased ; the weight is, as it were, a pendulum ball which is merely steadied or guyed by the cordage therefrom to the earth. Its support is afforded by the parakites aloft.



Bird's-Eye View of a Section of New York City, E.N.E. from Washington Square. Produced by George E. Henshaw on and from a Glass Negative in a Camera Attached, at an Altitude of Five Hundred Feet, to the Cable of a Train of Eight Woglom Parakites.

Section 34. *Large photographic camera in the air.* — On May 25, 1895, were sent up eight homing pigeons weighing, with the basket which contained them, eight pounds. It was secured to the grating of a framework gaff weighing one pound, and which was attached to the cable of a train of five parakites which pulled forty-two pounds. When nine hundred feet high the pigeons were liberated, the raising of the basket-lid having been done by a subordinate cord pendent from the main cable. Instead of circling upward, as is their habit when freed at ordinary levels, the birds spirally soared downward for a few hundred feet and, getting their bearings, started for their homes — the lofts of Darius C. Newell, at the foot of West Nineteenth Street, New York City.

After the nine pounds dead weight had been located pendent from the main cable, and all dismissed with sufficient cable to reach a vertical of nine hundred feet, the strain upon the self-registering spring-scales, which held the whole outfit, registered but three pounds additional to the strain before the nine pounds were sent out on the cable (33 on apparent paradox).

That experiment was to test the pull requisite for lifting a certain weight, to prove the efficiency of the gaff which had been- built for carrying a photographic camera, and to prove the possibility of tripping the camera shutter without fouling the tripping cord, which was looped by clips and aluminum-wire pendants to the main line. Within the rings, at the upper end of each of the wire pendants, the cable twirled at its own sweet will under the varying tensions due to varying wind pressure. It was a successful test of all the appliances exclusive of the camera, all of which had been completed before these tests.

This lifting and supporting capability has now been utilized by the writer for the practical purpose of suspending above the metropolis the photographic camera, in which were placed and exposed therefrom glass 6 1/2 x 8 1/2 plates. With the co-operation of Mr. George E. Henshaw, an expert amateur photographer of New York City, many very fine bird's-eye views have been secured, void of the aberrations and photographic mendacities apparent in the experimental attempts theretofore made within the knowledge of the writer. [6]

By the first expedition of the camera, on September 21, 1895, at three o'clock and thirty-five minutes, were secured (it is asserted with confidence in the accuracy of the assertion) the first aerial photographs from glass plates taken on the Western Continent ; the writer is ready to be corrected if he misclaims conjointly with Mr. Henshaw to have taken these the largest kite-line photographic views in the world.

These feats were impracticable of accomplishment without the use of the windlass referred to in Section 24.

Section 35. *Suspending objects in the air.* — The greater the number of parakites flown in a train, the less the fluctuations in the angle of elevation and the less vibration of the cable.

When it is desired to suspend an object in the air pendent from the cable of a train of parakites, it is well to have a considerable space intervene between the nearest parakite of the train and the suspended object The reasons for the comparative immobility of the main-line of a train, as contrasted with the swaying of the pennant line extending to an individual parakite, are that the pennant line must accord with the movements of its own captive parakite, lateral, vertical, or otherwise ; *per contra*, the movement of each parakite is equated on the main line to which it is tributary, and not only as to movement is it equated but as to its lifting and pulling capacity, for each, as disposed at intervals up the line, will be immersed in successive air strata perhaps varying in wind velocity, all of which variations become medial in the angle of elevation, stability, and pull.

Section 36. *Parakites gliding "Up-hill."* — It will be observed in any wind sufficient to float a train or single parakite, that the withdrawal of the cordage causes the parakites to glide

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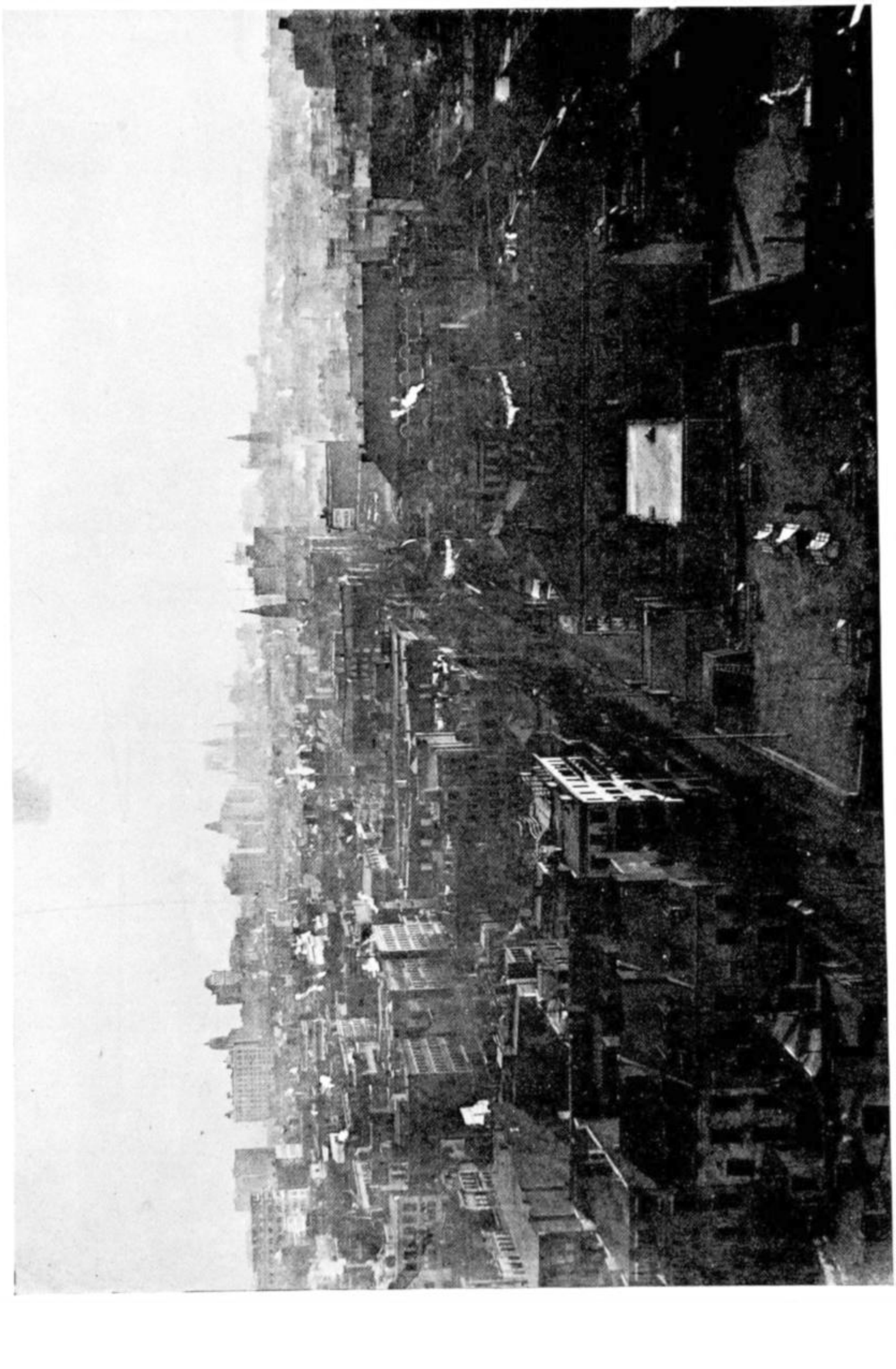
6 The few specimens of aërial photography shown herein were reproduced, without diminution or enlargement, directly from the plates which were exposed in the camera in the upper air.

Numerous tests have shown that a pull of seven to eight pounds is requisite to lift and sustain one pound in the air at one thousand feet or less.

The author's spare time and opportunities have not been sufficiently ample for fully developing the possibilities of this branch of kite-flying ; however, the indications of a mercantile value will be clear to those who may adopt it whether for pleasure or profit.

upward on the wind and assume angles of elevation from the horizontal in excess of that attained by the same structures in fixed captivity, i. e., with the cordage belayed or held.

SECTION 37. *Knots easily untied.* — Mention has been made of the "Toggle." It is an expedient which saves time and risk. When a loop (*b*-Fig. 24) is to be tied in the cable for attaching a pennant line, the loop (*b*-Fig. 22) when partially formed will have the toggle (*a*) pushed through, as indicated by the sketch of the knot completed and set (Fig. 24), and by the sketch showing the toggle by dotted lines (Fig. 22) with the same knot loosely formed. Without the use of the toggle the knot would be firmly set and difficult to untie ; the toggle upon being pulled out permits the ready opening and loosening of the knot ; it assists as well to give the cord easy curves which are less liable than solid knots to overstrain and sunder the cordage.



BIRD'S-EYE VIEW OF A SECTION OF NEW YORK CITY, S.S.W. FROM WASHINGTON SQUARE. PRODUCED BY GEORGE E. HENSHAW ON AND FROM A GLASS NEGATIVE IN A CAMERA ATTACHED AT AN ELEVATION OF SIX HUNDRED FEET, TO THE CABLE OF A TRAIN OF EIGHT WOGLOM PARAKITES.

Section 38. *How does the parakite fly?* — Ascending from the surface of the earth to its greatest elevations from the horizontal, the parakite describes an arc of a circle of which the restraining cordage is a radius. Assuming that the wind flows horizontally as it primarily reaches the parakite, the angle by which its bridle fixes it 'holds it in the position relative to the wind' of a yacht's mainsail when "reaching" — with the wind "broad upon the quarter," or approaching the yacht from abeam to an angle abaft thereof.

It will be understood in this simile of the yacht's mainsail that it moves relatively to the wind in an arc of a circle the plane of which is horizontal, whereas the parakite is propelled in an arc the plane of which is vertical (2).

As the parakite in the wind glides up the arc of which the restraining cordage is radius, it advances towards a point which is midway the lower terminal of the arc (the horizon) and the upper terminal thereof (the zenith) ; then passing that midway point it secondarily assumes the position, relative to the wind, of a yacht's mainsail "close hauled" or "on the wind," and persistently aiming to "point up" close to the compass-point from which the wind comes to the yacht.

The yacht-sail has the advantage of the parakite in this simile, in ,that the main-sail sheet will be trimmed in as the yacht traverses the horizontal curve while luffing closer and closer to the wind ; the bridle of the parakite is the equivalent of the main-sail sheet ; but the bridle being beyond one's reach for the purpose of trimming it to the wind, it is obvious that the function of trimming must be comprised in the form and curves of the parakite itself, to enable it to fly "close to the wind" — i. e., to attain and maintain a great angle of elevation.

This much, inclusive of Sections 2-63 and 56, is written in attempted elucidation of and in reply to the oft-repeated question as to why these structures steadfastly fly in the air minus a tail.

Nowadays yachts' sails are carefully designed as propellers of the hulls ; the center of wind pressure of each sail, as well as that of all sails combined, is accurately located relatively to the hull they are intended to drive through the water. The sails are to be immersed in one fluid, the air ; the hull is to float in another fluid, the water. The parakite is wholly immersed in but one fluid, the air ; yet it is propelled through, and at the same time in, the same fluid. [6]

A scientist has ventured the statement that there are not logarithms enough in the tables, nor in calculus — even imaginary calculus — is there sufficient science to locate the center of wind pressure theoretically upon one of these parakites.

An unprofessional member of the community may therefore be condoned the attempt in such emergency to exhibit by comparison and simile some of the "rule of thumb" principles involved in poising and flying these peculiar aero-planes. How do they fly ? They *do* fly ! The "how" is not in apparent evidence in the "present state of the art."

Section 39. *Starting a "Train- Flight"* — When ready to fly a train of parakites, the first one, dismissed as a "leader," should be as stout as possible, even with much manipulation, to raise to a height of seven or eight hundred feet. (See Section I, as to velocity in upper strata.)

If in a brisk wind, the second may be dismissed as suggested later herein for the third one of the train ; if in a light or uncertain wind, the second will be dismissed on a separate pennant line of about seventy-five feet of cord of such strength only as will safely hold the said second parakite ; when afloat to the extent of that pennant line the lower end thereof will be attached to the main

6 "Granted," says the reader, "but the holder of the restraining cord at the earth is to the parakite as is the hull with its keel or center-board in one fluid to its sail in another fluid."

Aye ! Just that necessary equilibration is what must be considered by aero-dronomists (if Dr. S. P. Langley will pardon the use of a term derivative from a word of his coining, viz.: " aero-dronomics," air-running, in his paper on " The Internal Work of the Wind," read before the International Conference on Aerial Navigation, at Chicago, in Augst, 1893), and its supplement must be found, else their solution of the problem of aero-dronomics is yet in the far future.

The water as to the hull is the equilibrant of the wind as to the sail, and propulsion is effected over that surface of the earth which is under the water. The gravitated operator and the gravity of the cordage are as to the parakite, jointly, the equilibrant of the wind as to the parakite, and the latter is propelled above the surface of the earth or water.

What shall be the equilibrant of the aero-plane, the rigid-winged structures, *et id genus omne*, when the fluid, in which it is immersed, itself moves over the surface at a greater velocity than the speed capability of the aero-dronomist's structure? Shall it be surface friction by a cable pendant ? Even that is to be availed of only when going leeward.

cable as indicated in Section 30, Figure 24. If now, upon testing by the spring scales (Fig. 25 and Sec. 25), the pull is sufficient to lift and support the third as a dead weight, that end of another pennant line, which in *flight* will be the *lower* end, will be tied to the main cable with or without a spreader (Figs. 15 and 18, Sees. 29 and 30). The main line will be veered out with the pennant line trailing from it until the pennant is nearly all in the air (having care that the loose end does not elude one's grasp), when the third flier will be tied to the pennant-line's end, the parakite swung free in the air, and the main line rapidly veered out ; thus the third flier will be lifted upward, and outward. When properly facing the wind it will be caught by it, and darting upward as an arrow from the bow, will find its place above the main line, where it not only supports itself, but contributes its excess of lifting energy towards lifting and "springing" the main line upward.

SECTION 40. *Spacing the train.* — The pennant lines give to each parakite a free radius of about seventy-five feet upon which to gyrate. It will be apparent to the investigator that if the pennants are bent to the cable *within* seventy-five feet of each other, each filer so adjusted is liable to foul the pennant of its neighbor next above it on the cable. The spaces between the pennants should exceed the lengths of pennants used. A fluttering tendency by a tributary parakite may be neutralized by a few additional feet of pennant line.

SECTION 41. *Methods in train flights.* — Successive parakites of the same rating (67) to any number may be thus sent aloft. The pull should be noted after each parakite has become well set in its place so that for each successive flier cordage of greater strength may be used to withstand the cumulative strain upon the cable. (4 and 15 as to permissible strain; 25 as to scales.) Theretofore stable fliers will at times display vagaries incipiently ; a few minutes' exposure to the wind will set the covering and cause a resumption of normal stability (9).

For evident reasons the sizes of parakites should be progressively greater as each one is sent out in a train. Each has not only its own work to perform, but must also help to increase the angle of elevation of the main line. (15 and 32.)

It is desired at times to steady the cable of a train, or the twine of a single, either for withdrawal by hand or especially if the cordage is withdrawn by a reel. For the latter the twine should be served directly between the flanges of the spool. A "snatch-block," oviform, five and a half inches long, with a two or three feet whip attached to some convenient fixture, is a great convenience. Whatever the variations in the trend of the parakite-line, its run through a snatch-block directs it to the hand or the reel. A thorough search failed to find ready-made blocks suitable for such use ; the alternative was to make them, as can be done by any man handy with tools. A two-inch brass or iron sheave out of a window-sash pulley will do, if finished smoothly. With the sheave let into the inner sides of the cheek-pieces it is impossible for even the thinnest twine to slip between the sheave and either of the cheek-plates of the shell. , The snatch-block enables one to cast the bight at any place on the cordage, through the aperture in the cheek-piece, and thus into the peripheral groove of the pulley. The strain upon the cordage maintains it in the groove. A sketch of a practicable form of such block is shown in Figure 20.

SECTION 42. *Choosing kites for particular winds.* — In gusty winds it is sometimes difficult to select a uniformly rated (68) train which will meet the varying wind-velocities successfully. If the parakites are stout enough for the gusts, they may be too heavy for the intervening light winds ; if light enough for the light winds, they may be too light for the gusts. If we are to maintain a train in such a fickle wind we must offset its fickleness by our trickiness. We will send up such fliers as will alternate in their ratings, one adapted to the gust, the next following for the intervening light wind. Thus when the heavy parakites drop for lack of wind, the intermediate light fliers will sustain both them and themselves ; when the light fliers are driven down by the gusts, the heavy — higher rated — parakites will do the lifting for themselves and for their weaker brethren and sisters. A simile for a lecture on the golden rule is here apparent ; as this is but a manual for kite-fliers we refrain from sermonizing. The plane of their thought is always adequately heavenward.

SECTION 43. *Ready to build a parakite.* — Having discussed appliances, methods for flights, and the requisities for the construction of parakites, we will now show the system of building ; first, as to the material in the frame, — the form of the material, — the adjustment of it ; secondly, the guys surrounding the frame ; thirdly, the method of covering ; fourthly, the

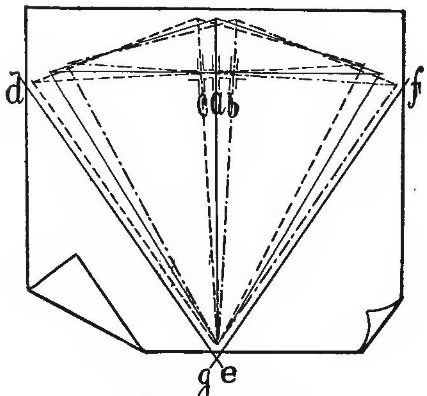


Figure 10.

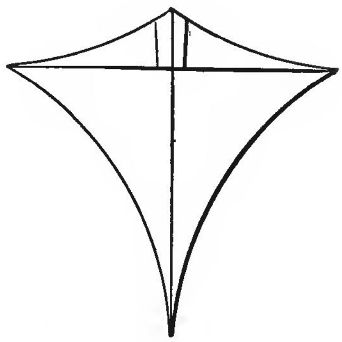


Figure 11.

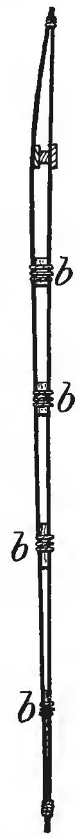


Figure 12.

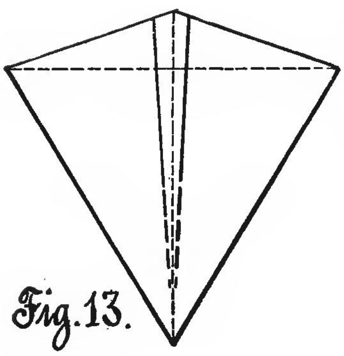


Fig. 13.

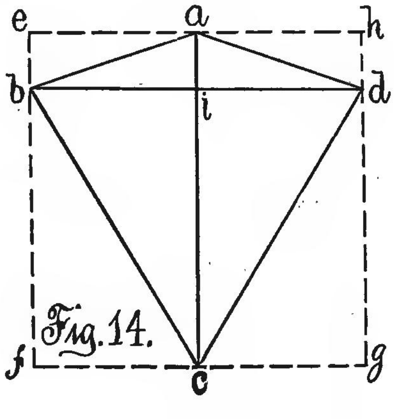


Fig. 14.

arrangement of the bridle.

In an advanced form of parakite aluminum will doubtless be used. The only present impediment to its use may be the peculiar quality which differentiates it from steel in springiness ; aluminum will spring as will steel, but to a lesser extent. When it has reached that maximum angle of spring and it is attempted to widen the angle, aluminum suddenly "gives way" and fails to resume its pristine form ; the relative disposition of its particles seems to have been disturbed. Steel may be used in large parakites with success. In the present state of the art of parakite building, wood would be the most expedient.

Section 44. *Selecting frame-material* — White-wood or clear white-pine, may be used in belts of country where spruce is not indigenous ; both are amply pliant. Spruce is not quite so flexile as white-wood, but it will not sunder as sharply nor as suddenly as either of the former two. If of young timber, or if from the interior of the log, with the sap layers and pith layers closely grown, it is superior to both. The fiber should be straight and absolutely clear, to insure an uniform curve. The bendable quality in frame-material is desirable especially for the bow member. It will be found that spruce shows a wonderful additional strength and pliancy if the bow member be so cut from the log that the "annual" layers lie in the plane of its bow-curve, especially so if the wood be "slow-growth" spruce, in which the resinous layer is conspicuous. Authorities on strength of materials claim that a properly set floor beam, in which the "annual" laminae are vertical, will bear approximately one-seventh more weight than if the lamination be horizontal. True curve, and stability thereof, may also be had by the use of two laterally glued sticks, as indicated in Figure 8, the annual layers of each of which so placed as to meet symmetrically at the union of the two sticks in an acute-angle, thus A ; the apices of the acute angles should be toward the convex curve of the bow. Cutting the ends with a keen blade will clearly expose the trend of the layers. When (54) that is so bowed that the tension member, *i. e.*, the bow-string or wire extending from end to end of the bowed member, is, as to its middle point, ten per centum of the bow-member's length off from the middle of the convex bow or arch, thus bowed the best results in steadiness and easy movement are attained in flight. If less bowed the structure, though otherwise true, will oscillate on its upright axial-line, spilling the wind from either side with each semi-oscillation. A parakite adapted to light winds may be occasionally adapted to fresh winds if the transverse member be slightly more than ten per centum bowed. This will produce a more acute Λ form in the covering along the upright member, and insure stability by, as it were, a "fin-keel." Inversely, a structure bowed for fresh winds, and barely able to float in a lighter wind, may be helped in the lighter wind by slightly relaxing the bowstring. The two frame members will be of equal length, but not necessarily equal in other dimensions. Some of my truest fliers have the transverse bow-members much stouter than the upright, as has been the fact in parakites which have been flown accurately in thirty- to fifty- mile winds. [7]

Section 45. *Arranging the frame-members.* — Thirty-six inches and upwards are the most satisfactory sizes to construct ; below thirty-six inches the action of the structure will be erratic in the wind, unless made with microscopic exactness (Sec. 2).

At a place on the upright frame-member seventeen per centum of its length from its top end, place and lash the exact middle of the transverse or bow frame-member. Each of these "places" should be marked by a pencil-line around the respective members. With a stout twine or wire from end to end of the transverse member, stretch the bow member tensely (54) until its middle is ten per centum of the length of the transverse member from the middle of the convex arc of a circle which the latter member describes. That convex arc (the front of the bow frame-member) will be, and will be at, the front of the frame. The two frame-members will thus form as it were a Roman cross (Figures 11, 13, 14), the transverse frame-member of which will be convex as to the face of the parakite.

7 The centre of gravity of these fabrications bears but an insignificant relation to their wonderful poise in the air ; the proper adjustment of the parts which accommodate the twin centres (62) of wind pressure and deflection equipolliently on each lateral semi-surface of the cover is the' desideratum rather than a gravity centre. The latter may be found by equilibrating a flier on a pencil-point ; it teaches us nothing.

SECTION 46. *Light-wind frames.* — The frame-sticks may be of many forms of cross-section. Quite rigid, light frames may be made if sticks rectangular in their cross-section (one dimension greater than the other) are bended against the greater dimension, *i. e.*, the curve made in the plane of the greater dimension. Of course while the desired curve is being given the stick tends to buckle, but the two frame-sticks being firmly bound together at their crossing, their tendency to buckle will be further resisted by temporary guy-strings stretched from and attached at four points thereon respectively, a few inches within the ends, until the guy-lines proper shall have been permanently fixed at the four ends of the frame-members ; then the temporary guys will be removed.

SECTION 47. *Brisk-wind frames.* — Parakites for brisk or high winds perspicuously require stout frame-members, especially the bow-member. That member is pressed upon by the wind against the covering along its entire length ; being held against that pressure only at one point, its middle (*g*-Fig. 16), its lateral halves, projected free therefrom into space, must by their own respective unassisted rigidity resist the wind pressure on their respective lateral halves of the parakite. The upright member is helped at two points (*g* and *h*, Fig. 16) whereat the bridle is secured, and therefore needs less bulk of material as compared with the bow-member (44).

If the frame be too light for the wind in which the parakite is being flown, it will be evidenced by being blown out of form, consequently out of normal poise, will be "blown down," and will appear as shown in Fig. II. When subjecting the bow-member to the conventional ten-per-centum curve, if the said member be of wood, the strain to which the outer, convex side of the member must yield is frequently more than the limited elasticity of the fiber will withstand without being rended. Such disasters are avoidable by the following contrivance : For this one frame-member provide two sticks, one of which is the length required for the proposed parakite, the other perhaps four inches shorter. Each such may be, for example, 3/8 inch by 2/8 inch ; placed in contact by their 3/8-inch dimension they will equal a stick 3/8 inch by 4/8 inch (Fig. 5). That one only of the two sticks which is of the proposed size of the parakite will be temporarily bowed on the 2/8-inch dimension ; thereupon, first having marked the middle of each stick, apply glue to the one broad face of each stick, and bring them into contact by their glue-smeared faces, causing the two middle marks to coincide. Apply a spring clothes-pin a few inches to one side of the mark, and another at the same distance on the opposing side of the mark ; apply others successively and alternately a few inches apart to the full length of the shorter of the two sticks. When, after a few hours, the glue will have become set, the two will have been securely united, and when dry will maintain the curve in the plane of the greater dimension of the now 3/8 by 4/8 inch stick, without buckling. Close to each terminal of the lap serve with twine coated with glue (55 and Fig. 9, a and d).

SECTION 48. *Composite frames for "all-round" winds.* — Lightness conjointly with inflexibility being admitted requisites, both have been found conserved by the form of stick presented in Fig. 6. The substance of this stick is practically edgewise, but the tendency of the edgewise material to buckle is resisted by the flanges at its bottom when the stick is bent. Such may be made of two flat sticks, which, when glued together, one side to one face, will produce this conformation ; it may also be produced when sawed entire from a stick of proper size, by a small circular saw in a lathe revolving over a table, the bed of which is set to a slight angle with the plane of the saw ; we may thus saw both the "back-bone" and the flanges thereto on a bevel as in Fig. 7. When the sticks are to be crossed for a frame, the two flat faces of the flanges of the two sticks will be adjusted in contact. The "back-bone" will be the front of the bow-stick, and the upright will have its back-bone towards the back of the parakite. This form, though somewhat troublesome to make in small quantities, will be found to be remarkably stiff for the volume of wood used. Very true and steady fliers have been made in this form, sawed from a stick composed of two sticks so glued together that the union of the two is in the plane of the back-bone as in Fig. 8.

The use of compounded sticks is the means of equating any irregularity of grain which might become evident if either stick were bent alone.

Section 49. *The wind searches out defects.* — Incidentally, if, after a frame is finished and guyed, the bow-stick curve be not one side an exact counterpart of the opposing complementary side, time and bother will be saved by condemning it and substituting a true one for it. Time will be wasted, after having covered it with the utmost nicety, in persuading the parakite into the path of rectitude ; its covering will not hypocritically cover up its untruth (4).

Section 50. *To remedy errors.* — If, notwithstanding the above caution, a new parakite persistently bears to one side, note that the bearing or swerving to the *right* side, as viewed in flight, may be due to that side being too much curved relatively to the opposite side. Upon withdrawal, if the eye detects evidence of the correctness of this presumption, attach one end of an extra guy to the *left* end of the transverse member, loop and knot the opposite end of this guy snugly around the transverse member at a point just beyond the crossing, and slide the loop outwardly along the right side of the said trans- verse member until its tension causes a curve in the left-hand half of the bow-stick, which must be the exact counterpart of the curve of the right half If this does not correct the irregularity of flight, its behavior may be attributed to error in covering, presuming that the verge-guys have been equitably applied. It is well to measure *them* first.

As a rule, if one lateral half of a parakite is built more flat either in frame or covering than the other half, the flat side will drive the structure in the direction of its opposite side.

Section 51. *Frames for gale-parakites.* — Several sixty-inch parakites weighing from one to one and three-eighths pounds each have been successes as gale-parakites, made of four 3/4-inch spruce sticks ; one pair composed the upright, the other pair the transverse, the four sticks alternating in their superincumbent positions at their crossing ; the two pairs were reciprocally interlocked. After the pair composing the bow-member were properly bowed (45) they were unified close to their ends by a few clinched wire-nails which maintained the curve and relieved the tension-member (44) of some strain.

Section 52. *Parakite frames for vari-velocitied winds.* — Many parakites adapted to light winds have proven equally satisfactory for high winds (1), when they were constructed with light frames but united as shown in Section 51 and Figure 12. Struts (*b*) were inserted a few inches apart, fitted snugly between the pairs of sticks, and served with glued twine around the sticks and struts, binding them together. Longer struts, conforming with the gradually constricted bow-stick, were inserted, extending respectively six or seven inches (*a* to *c*, Fig. 6) on each side of the crossing. This trussing stiffens the bow-stick to resist the strain where it is greatest in high winds.

Section 53. *Verge-guys for frames.* — The guys constitute the verge of the frame, extending from either end of a frame-stick to the next stick-end ; at all of the ends they will be secured, completing the verge of the parakite, retaining each frame-stick in its position relatively to the other. The guys are also the media for securing the covering to the frame. They may be of flax twine for short-lived parakites, but wire is more conducive to durability ; fine piano wire is satisfactory but for its liability to rust ; copper wire serves well, but the best is the tinned picture wire composed of several braided fine wires, and known as the "Hendryx braided wire picture cord." Number 0 is useful on small sizes for all the guys ; for medium sizes No. 0 for the lower pair of guys, and No. 1 for the top pair, which are called upon to bear the greater strain in strong winds. For the larger — 7 feet to 10 feet — sizes. No. 3 should be used all around the verge.

Section 54. *Applying the guys.* — These guys — the upper (*a b* and *a d*, Fig, 14) and the lower (*c b* and *c d*) respectively in pairs — should each of the pair be of the same length with exactness when in place in order to result in a true frame. The *transverse* stick having been marked as to its *middle* (45) and securely tied (55) rectangularly to the *upright* at its proper percentage *mark* (45), the permanent bow-string should, not until now, be applied (44 and 45) ; thereafter attach the four guys. Conditioned upon the latter having been paired and applied with exactness, and the middle of the transverse member as accurately placed, the guys will define two pairs of superficies, each unit of which pairs, laterally and respectively located on either side of the upright (*a c*), will be identical in form and area. The lower guys should maintain the ends *b* and *d* of the transverse frame-member at equal distances from the lower apex *c*, and should be measured with exactitude to ascertain if such be the fact before applying the covering.

Section 55. *Twine ferules.* — Where "serving" with twine is suggested, the twine should be tensely wound ten or twelve turns around the materials desired to be held in close contact, the ends well secured, and a saturating coat of glue applied to the twine (7). When the glue has dried it compels the twine to "hug" even more closely than would a metal ferule ; without the glue, the twine when exposed to alternating dryness and humidity becomes relaxed and loses its grip.

Section 56. *Functions of the covering.* — When attaching the covering it must be so disposed that surfaces equal in area of exposure to the wind and identical in conformation will result on each side of the upright frame-member, so that the completed parakite shall poise and equilibrate in the moving atmosphere, though without a ballasting tail, and though held captive by a bridle attached only at two points, and those two points in a line coincident with its axial line ; the structure is held only in a plane which is a right angle with the face of the structure ; the two lateral halves being thus free to oscillate, nicety of measuring, adjustment of the covering and of its conformation, are requisite to stability in flight.

The upright with its covering receding on either side form an acute "V" the apex of which is at the front. The wind as it strikes this edge is divided and directed thereby towards the lateral halves ; its dispersion equipolliently towards the two sides, gives the flier steadiness. The aero-physical function performed by this "V" form, is duplicated by the twin, laterally spread wind-vanes, which are the favorites for steadiness of pointing in the estimation of scientific wind and weather observers.

Section 57. *Preparing the covering.* — Experience with and study of these fliers have taught that a certain depth and location of concavity as to the coverings, supplemented by other novelties in construction, are indispensable. Now as to the methods of applying the coverings to assuredly effect such results : we prepare a large enough expanse of covering-material (3, 19, 20), say two inches longer than the upright frame-member, and ten per centum of, plus two inches wider than, the length of the transverse member. The "inches" will provide a one-inch peripheral margin for pasting the cover to the guys ; a smaller margin may be used safely — see Figure 10. We place the lower apex of the frame at the lower edge of the sheet of covering, with an inch margin, and mark its place on the sheet ; the frame will be placed with the convex face of the bowed transverse-member in contact with the said sheet. We place a temporary weight, a book perhaps, on the apex, thus to hold it where placed ; with the upright member upon an imaginary line midway of the width of the sheet, at *a*, Figure 10, we mark thereon the crossing-place of the two frame-members for use later on. Presuming that the constructor is at the lower apex, now, with the said lower apex as a centre and the upright as a radius, we move the top part of the frame to the right hand until the crossing is five per centum of the length of the frame from the initial mark (*a*) ; there, at *b*, we mark its location on the sheet ; again, with the same centre and same radius, we move the top part of the frame over to the left until the crossing-place has passed to a place again five per centum beyond the initial mark (*a*), and there (*c*) we again mark it. We now have three crossing-marks, the outer two of which (*b* and *c*) are equidistant from the inner mark (*a*).

Section 58. *Attaching coverings to lower guys.* — We proceed to attach the covering first to the lower pair of guys — with the crossing now located at c, the lower apex at its mark on the sheet, and the lefthand end of the transverse- or bow-stick "rocked" to its place an inch from the left-hand edge of the sheet ; we now cut away the surplus of the sheet on a line (*d e*) parallel with, and an inch (or less) from the guy-line which is stretched from the lower apex of the frame to the left-hand end of the bow-member.

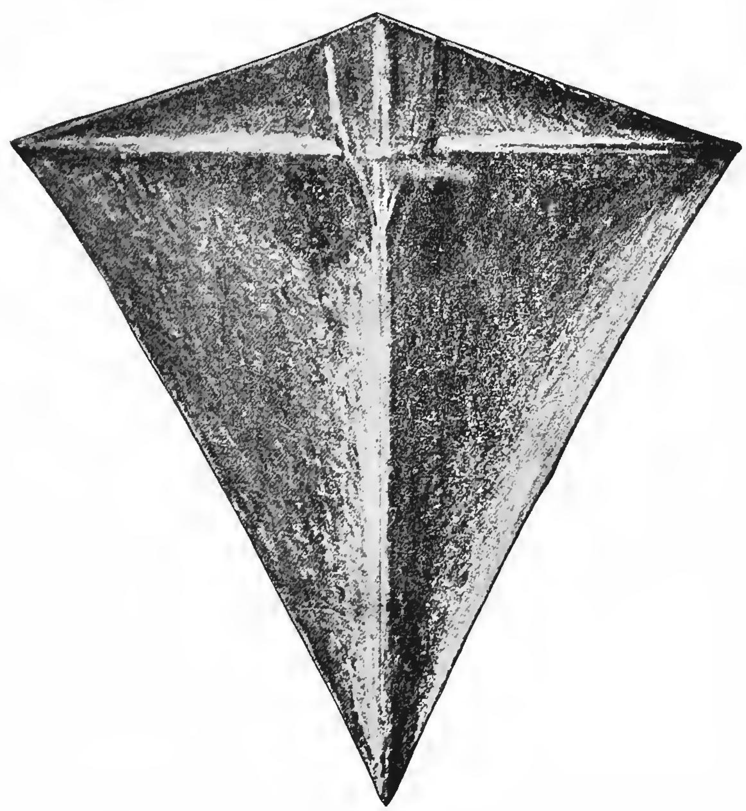
Section 59. *Attaching coverings.* — Outside of the guy, and coincidently to the guy itself, we apply a strong paste to the entire length of the margin, turn it over the guy, and deftly bring the pasted margin in contact with the opposing face of the sheet ; with a strip of paper laid between the hand and the now turned-over margin, we smooth it into close contact with the now back of the covering. Whilst doing this a weight or an assistant "rocks" and holds down the bow end into contact with the sheet of covering.

SECTION 60. *Attaching coverings.* — If during this or the next operation we inadvertently displace the frame, we replace it by the marks on the sheet.

Again, transfer the crossing over to the place indicated by *b*, maintaining the lower apex of the frame at its mark, and the right-hand end of the bow will be rocked down to its place an inch from the right-hand edge of the sheet. By cutting away the surplus of the covering material by the line *fg*, and further duplicating on this side the operation performed upon the left side, we will have united the covering to that section of the parakite which is below the transverse or bow-member.

Upon lifting the structure clear, with the frame superimposed upon and attached partially to the covering, the top part of which is pendent from that part of the frame, we shall observe that the covering has a fulness laterally, which is ten per centum greater than the length of the bow-stick against the front of which we are to further arrange the top part of the covering.

SECTION 61. *Attaching coverings at top guys.* — We will next, first on one side and then on the other, of the upper apex of the frame, cut away the sheet to the one-inch margin parallel with each upper guy, beginning at the ends of the bow and terminating at a point, on each upper guy, distant five per centum of the length of the bow-member from the upper apex. Beginning at the outer end we paste this margin over the guy on each side respectively towards the upper apex. We now find the fulness all comprehended in the "twice five per centum" space at the upper apex. That fulness will be disposed of by flattening it into a box-plait, the margin of which will be pasted over the guys upon either side of the upper apex. In this final operation, before pasting down the ends of the box-plait, we will take the precaution of seeing that the plaits on either side of the upright, as viewed from the now back of the parakite, are alike in contour of successive cross-sections thereof; these successive imaginary cross-sections successively diminish and disappear near the lower apex.



THE WOGLOM PARAKITE, SHOWING THE BOX-PLAIT FULNESS OF ITS COVERING, DISPERSED INTO TWIN CONCAVES ON EITHER SIDE OF THE UPRIGHT FRAME-MEMBER.

SECTION 62. *The twin concaves.* — When the completed structure is in the wind (see photograph), the box-plait is thereby dispersed proximately below the bow-member ; the concavity on either side of the upright frame-member, it will be observed, partakes somewhat of the form of that minor portion of an ovoid which would be cut off by a plane bisecting it a space from and parallel with its long axis ; devoid of technicalities, the twin concaves (foot-note page 30) are each as the inner side of that third of an egg-shell which might be sawed off lengthwise from an egg.

SECTION 63. *Why ?* — Why this twin form of concavity in the wind causes the parakite to be poised without artificial ballast in the form of the tail usual with the ordinary kite is a lovely problem presented for solution to the professors of atmospheric physics, aëro-dynamics, aëro-nautics, aëro-dronomics, or any other "-ics" competent to solve it (see Sec. 38).

SECTION 64. *Begin modestly.* — An adventurer in parakite construction will do well to use in his first venture frame-sticks of which a cross-section is a square. Having learned the necessity for a martinet-like precision in his measurements and building, he will be the better prepared to compass the less simple systems of construction.

Having built our parakite, we will perfect it by attaching its bridle. The term "bridle" (used in the sense in which in boyhood — at least in the writer's experience some half-century ago — we used the term "belly-band") is appropriated herein by reason of its analogy with the mariner's bowline-bridle device for flattening the "luff" — the weather edge — of a square-sail. To those acquainted with its form and function, the propriety of the appellation will be obvious.

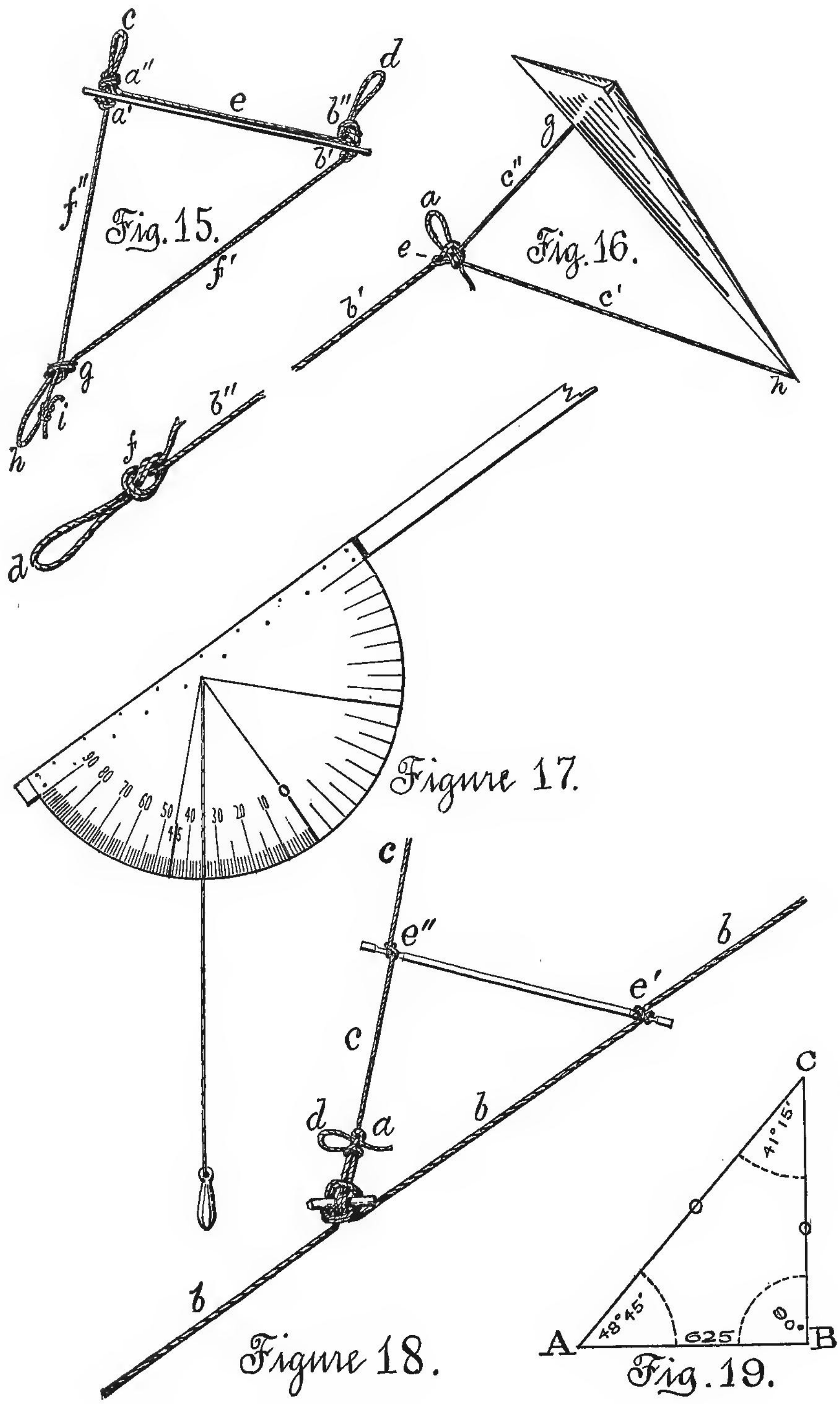


Fig. 15.

Fig. 16.

Figure 17.

Figure 18.

Fig. 19.

Section 65. *Adjusting the bridle.* — The bridle (Sec. 17 and Fig. 16.) of such length from *g* to *e* that it may not swing over either end of the transverse frame-member, should be by one end attached, through a puncture in the covering, to the frame at its crossing (*g*) and by its other end at h, approximatelv a half inch above the lower apex. The whip-line (*b b"*) of about eighteen inches length may, by a bowline-knot (Fig. 3 and Fig. 16*a*), be attached by one end to the bridle, rectangularly over a point proximately four per centum of the-length-of-the-upright below the crossing. The exact longitudinal poise-point will determine itself, after a flight or two, by varying that point of attachment as little as 1/32 of an inch, until exact equilibration is maintained ; if too high on the bridle, the parakite will twirl erratically ; if too low, it will "wag," its lower apex being its centre of radial oscillation.

Section 66. *The portable parakite.* — The writer has in contemplation a system of construction by which these parakites may be readily folded or rolled up, and upon being again spread resume their original delicacy of adjustment so essential to their accuracy of poise and flight; though complex as compared with the fixed construction herein outlined, and therefore more expensive, their readiness of adjustment for use, and their compactness for transportation to where they are to be used, are at once apparent. Every purpose for which the fixed parakites are adapted will be, and in fact have been, proven to be, as surely conserved by these "rolling-up" structures, with the additional quality of being useful in many ways impracticable for the fixed structures. Notably is the latter the case for use on ship-board or as an amusement for yachtsmen. Four or five of them, adapted to as many wind velocities, may be compactly stowed in a tin case, which case will be out of the way under the back edge of the mattress in the captain's bunk and always ready to be flown by the use of flag halliards or the log-line, if no special other cordage is at -hand.

The pastime afforded by their flight in fair weather, under varying conditions of wind, will be an agreeable means for acquiring proficiency in handling and flying them. That proficiency may be utilized when, if a vessel has been blown on a lee shore, a line may be sent ashore attached to a light float or spar, towed there by the cordage attached to a flying parakite. Thus communication with the vessel from the shore by life-saving apparatus may be effected by devices familiar to seafaring men. Instead of a life-saving crew having to project their apparatus to the windward, the endangered ship sends it line of communication to the leeward by a parakite, which will withstand a sixty-mile gale when immersed in it, and will "get there" without in such emergency running the risk of an entangling tail to defeat its mission.

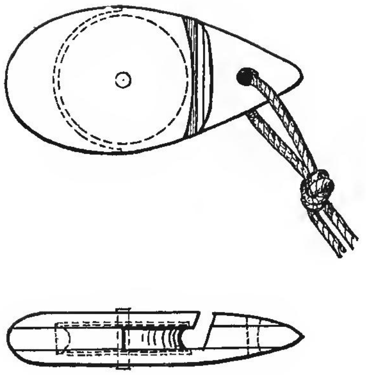
Section 67. *Naming and rating.* — The writer's parakite outfit at this time of writing numbers over one hundred. Each one has a distinctive name indelibly written on the frame-stick near its lower end. Thus may be individualized and remembered to some extent the characteristics of each, as it were his or her personality and attributes. If a functional quality of parakite be required during the dismissal of a train of them, an assistant readily produces "Lady Alice," "Dainty," "Dick," the "Deacon," "Coquette," or "Dorothy," and as readily as the writer is able to recall their good qualities and adaptedness.

That is practicable with a limited progeny, but when a family numbers a hundred or more the family nomenclature may at times puzzle the head of the family to recall it with certainty ; experience thus teaches. With "so many children that" I "didn't know what to do," the expedient presented itself of giving each one a "rating" — but only in the sense of its capabilities in various winds.

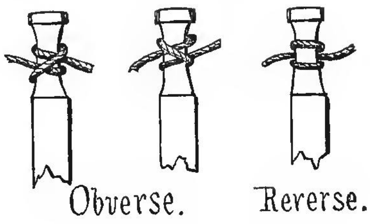
Conditioned somewhat upon the equivalency of frame and cover as to their respective weights, a tolerably accurate system is here presented for computing the relative weight and area ; thus is given to each parakite a "rate" by which, regardless of size, it may be compared with another.

The applicability of this rating scheme will be evidenced when one has projected a leader for a subsequent train of parakites. If the leader shows itself to be well adapted to prevailing atmospheric conditions, its own rating will quite accurately indicate what should be the rating of each subsequent flier of progressionally larger size ; we thus avail ourselves of a predetermined and marked theoretical rating which is rarely found at fault as a practical rating, unless indeed a flier has an abnormally heavy covering on a light frame, or vice versa. Expressed as a theorem, the weight in ounces — or in ounces and decimal fractions, thereof — divided by half the square of the height (69) of the parakite,. and carried to four decimals, will be the per centage of weight to area.

SECTION 68. *Examples and rating.* — For example, "Henshaw," a dignified high-wind flier 51.75 inches in height weighs twelve ounces ; the square of 51.75 inches is 2678 square inches, of



Figures 20.



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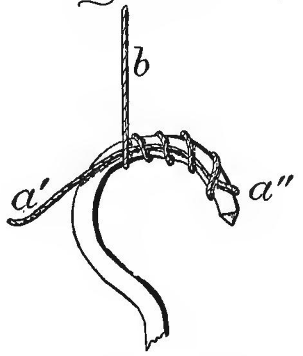


Fig. 23.

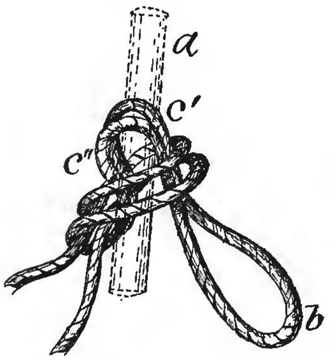


Figure 22.

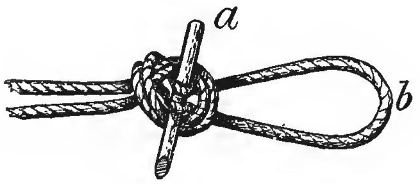


Figure 24.

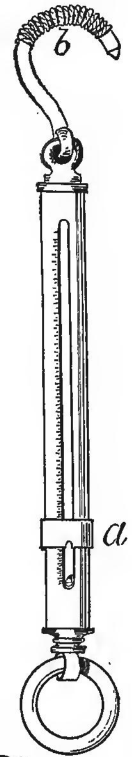


Figure 25.

which the half is 1339, which as a divisor is contained in the dividend 12 (ounces expressed 12.000) .0090 times, therefore 90/10000 is Henshaw's rating, and marked "90" on the frame-member for reference.

"Captain Cole," 60 inches, weighs 16 ounces, which expressed decimally 16.000 and divided by half the square of 60 (60x60/2),which is 1,800, produces the quotient .0089, and is expressed 89 on the frame as Captain Cole's rating and which is fit for brisk winds.

"Cecil," 72 inches, weighs 20 ounces, — decimally 20.000 — which divided by 2592 (72x72/2, which is 2592) gives quotient .0077; Cecil rates 77, and is a fine high steady flier in fresh winds.

"Realie," a parakite which will climb faithfully upward on a wind below six miles velocity per hour, is 43.375 inches high, weighs 2.25 ounces, and rates .0024.

"Libby," a dream in pale blue China silk, 37.25 inches and 2.25 ounces, rates .0016 and will recline gracefully and quietly on a zephyr as if enjoying a post-prandial siesta.

The "Bride," a spruce creation robed in a virgin-white silk conventionally cut and plaited (61), is 54 inches tall, weighs 7.5. ounces, and, though rated but .0051 by reason of her frame having been designed by her maker as per Section 46, she, when pressed by fresher winds than her rating would indicate for her, will float modestly serene, without flutter or vagary.

"Baby," l0 feet high without its shoes on, weighs 4 1/4 pounds and rates .0094. All by itself, this little darling, robed in bright red percaline, after we had persuaded a boy weighing 58 pounds to hang to its cable, lifted him ten feet above the sod of the Guttenberg Race Course, N. J., on March 14th, 1896, when the wind blew 28 miles per hour. He was returned to earth only because he howled his protest against going further heavenward just then.

This "Baby" exposes 50 square feet of wind surface. When rolled up in its own robe it is a bundle ten feet long and four inches in diameter.

SECTION 69. *Area of a parakite.* — The theorem involving the method of obtaining the area of a parakite may be proven by construction ; see Figure 14, page 29 ; *A-b-c-d* is a sixty-inch parakite ; *a-c* equals *b-d* therefore, of the rectangle *e-f-g-h* which bounds it, the sides *e-h* and *e-f* are equal. It is therefore a square, and the square of 60 inches is 3,600 square inches.

The line *b-c* bisects the rectangle *b-f-c-i* into two equal parts ; the same is true of *d-c* as to the rectangle *i-c-g-d*, of *a-d* as to the rectangle *a-i-d-h*, and of *a-b* as to the rectangle *b-e-a-i*. Therefore each of the four outer right-angle triangles is equal in area to its respective contiguous inner right-angle triangle, and the sum of the areas of the outer four must be therefore equal to the sum of the areas of the inner four.

If now we divide and separate the sum of the outer four from the sum of the inner four, the residuum will be the inner four which compose the parakite, an area equal to the half of 3,600 square inches.

As a proof, dividing 3,600 square inches by 144, the number of square inches in one foot, we have 12 1/2 square feet area, which is the half of 25 square feet, which is the square of five linear feet which equals 60 inches, which was our starting-point, the height and width of our parakite. [8]

Though these parakites are concavo-convex and, therefore, expose greater surfaces than their plane dimensions, we will all understand that we have considered the structures as plane surfaces, only for the purpose of rating them.

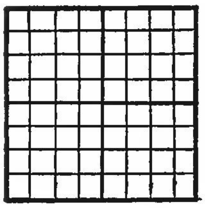
SECTION 70. *"Inbreeding" of parakites.* — As a means of still further improving upon the capabilities of these structures, we may use a system for what may be termed "inbreeding." As each structure is completed, a record will be made of its name, details of materials, and of its build ; when an improvement or adaptability is noticed in the flight of one as compared with one of former build, we will again use in later creations the details in which said improved fliers differ from less

8 A valued, Government-official, correspondent has objected to this formula because it applies only to parakites ; but the two diagonals (the upright and the transverse members) being equal in the parakite, it does therefore apply to the parakite.

If it is desired to compute the area of a structure having its two said members of unequal lengths, the area would then be half the *product* of the two diagonals. For the parakite, the area is half the *square* of the height.

successful creations. The result will be that, after a few further adventurings, such improvements will be effected as to cause a patronizing smile over one's earlier structures. [9]

If a parakite of a certain size and rating is desired to be reproduced in a larger size, the tendency is to use too much material in the frame. To obviate this tendency I have used the following expedient by "construction," with pronounced success :



Provide a bristol-board card on which shall be drawn in fine ink-lines an exact square inch, which shall be subdivided into square eighths of an inch, as shown.

Now if we wish to produce an eight-feet kite on the design of a successful seven-feet kite, whatever the form of cross-section or sections of the upright and transverse respectively may be, we sketch it, or them, on a bit of "tracing," or white tissue, paper, lay it, or them, on the above chart, and note how many square eighths are contained within the confines of the sketches respectively of the upright and transverse member. We may have used a stouter transverse than upright (Sec. 44) ; therefore, for simplicity of demonstration we will assume that the said two members are of like cross-sections, say as "Julius," a seven-feet red silk-covered fine flier in winds of from 10 to 28 miles velocity per hour. (Julius rates .0068.)

The cross-section of his frame is of the form shown in Figure 7, page 15, and contains 22 square eighths ; we have an 84-inch frame member in one kite, and want a 96-inch equivalent frame for a new one. (Section 44 recites that the two frame members in one structure will be of equal length.)

Now stated in "proportion" :

84 : 22 : : 96 : the desired number of square eighths.

The product of the two "means" (22x96) is 2,112, which divided by the "extreme" (84) gives the result 25 12/84 = 25 1/7 square eighths of an inch ; then by placing another bit of tissue or tracing paper upon our chart we outline a duplicate, in form, of the cross-section of Julius's frame-member, but in size containing substantially 25 1/7 square eighths of an inch ; to the said form and size of cross-section we conform the two frame members, and build our new parakite ; it will rate slightly less than "Julius," because the same fabric used as a covering is not proportionally heavier. If we wish to prove the accuracy of our demonstration, the product of the means (22 x 96) will be found to equal the product (2,112) of the extremes (84x25 1/7).

The same system is available to reproduce a smaller like "rater" ; for instance 4 feet (48 inches), thus :

84 : 22 : : 48 : 12 4/7 square-eighths-inch section, of which the proof is 22 x 48 (1,056) = 84 x 12 4/7 (1,056).

If the upright member of our model be of smaller cross-section than the transverse or bow-member thereof, the same formula applied will produce the required cross-section for the upright, member of the new, larger or smaller, parakite.

SECTION 71. *Discarding silk cordage.* — Silk cord has been repeatedly suggested for use in parakite and other flying to great heights, for the reason that its great strength contrasted with its bulk saves much wind friction. Silk cord would be desirable if it were durable under the conditions prevalent in parakite flying. Its advantage of lightness and strength do not compensate for its

9 The writer would feel guilty of ingratitude did he not herein express sincere appreciation of the encouragement, sympathy, practical hints, and the counsel of Captain Isaac Cole, of No. 190 Van Buren Street, Brooklyn, N. Y., late shipmaster, now a fellow jeweller in the writer's native city, as well as to his son, Edward A. Cole, both of whose ideas apd assistance have availed in many difficult flights, and both of whom have faithfully cooperated to forward and improve constructions for this fascinating pastime.

My most complete and finely-constructed reel was built under Capt. Cole's supervision, and is prized far beyond its intrinsic value, which is not a little. It was made in friendly emulation as to which of us could construct the most complete reel ; as a reward for my prompt acknowledgment of its superiority, he as promptly presented it to me ; money could n't buy it, but it is at the service of fellow investigators who desire to see it as a model for other reels.

ephemeral strength.

The varying tensions in free silk cordage when exposed to all the vicissitudes incidental to flying parakites in every condition of wind, seem to cause the fibers of differing elasticities to slip longitudinally ; they lose their relative pristine positions in the cord and thus lessen its tensile durability ; the fibers do not felter as do vegetable fibers.

When withdrawing the silk cord of a flying parakite it seldom reaches the operator in the same form, or in the same angle of spiral twist, manifest when it was dismissed ; the strands become unlaid, they, both severally and jointly in the cord, kinking exasperatingly ; it has become in parts unfit for use a second time, and cannot as a whole be subjected to near the breaking strain shown in its initial test. Trials have been made by the writer of respectively the unwashed silk, charged with its natural gum, and that which had the gum washed out. The two differ in no respect other than above except that the gum-silk has somewhat the better initial strength.

Its most objectionable feature is that knots which are the most reliable in other cordage are unreliable in silk cord. Mayhap we may learn a lesson from dress-makers and tailors who use silk thread for sewing seams the stitching of which maintains a fixed strain upon the silk, but who never use silk with which to sew buttons on garments ; the working of the buttons would slip and loosen the silk thread with which they are sewed.

Undoubtedly silk fiber will bear a greater test strain than any other known cordage fiber, but the detrition by even slight friction debilitates it. The raw cocoon silk lacks that cohesive and feltering quality which causes other cordage fibers to gain in strength by multiplication and twisting; it is as it were six first-class individual oarsmen, who may be outrowed in a race by six individually inferior oarsmen who have been better trained in crew-work.

SECTION 72. *The "Signal-phabet"* — Co-operation between the operator and his assistants in train flight necessitates an intelligible system by which, when widely separated, communication may be had.

"Woglom's Signal-phabet," devised by the writer, will be found of considerable utility ; it is shown in Figure 26, and needs but a modicum of comment here to recommend it to others than, as well as to, kite-fliers. The forms of the letters require but little memorizing, for each form of letter is obviously simulated by the respective positions of the arms.

The Signal-phabet may be used on shipboard where the body may be exposed only from the waist upwards above the rail, for only the arms are utilized. No paraphernalia are required other than one's two arms, so that wherever the body is, there the signals may be made, and read at considerable distances with the unassisted eye — and especially if the writer can choose a background against which his body may be readily discerned. After a little practice one may "write" as rapidly as with a pen.

One advantage of this system of signalling is that the signals are identical to both reader and writer, from the fact that the writer stands with his back to the reader. The words are written by the writer, and as each word is written, he thereupon smartly faces about to the reader, who, if he has interpreted properly, returns a military salute ; (facing the reader, with arms hanging, is the equivalent of spaces between words) ; the writer then "about-faces" and proceeds with the next word.

If the reader has not read clearly, he stands facing the writer and signals "0" or "naught" twice, which suggests that the writer "repeat" the word.

At the end of a sentence the writer, facing the reader, stands at rest — "period" — with the hands on the hips and arms akimbo.

There should be no interval nor movement between letters ; the writer as he exhibits each letter will stand posed until his mind is clear as to the next letter, into which position he will then directly transpose his arms ; this holds the attention of the reader ; at the word's end the writer drops his arms by his side and turns to face the reader.

The usefulness of this signal-phabet will be obvious for railway trainmen, surveyors, yachtsmen, and fire-department employes in action, when the noise frequently renders trumpet-orders inaudible ; in fact there are few out-door sports, professions, or employments in which it might not at times be useful.

For opening communication it is well for the would-be writer to swing his hat or hand once to the reader, who if ready will respond by either the swinging twice of the hat or hand, or perhaps a

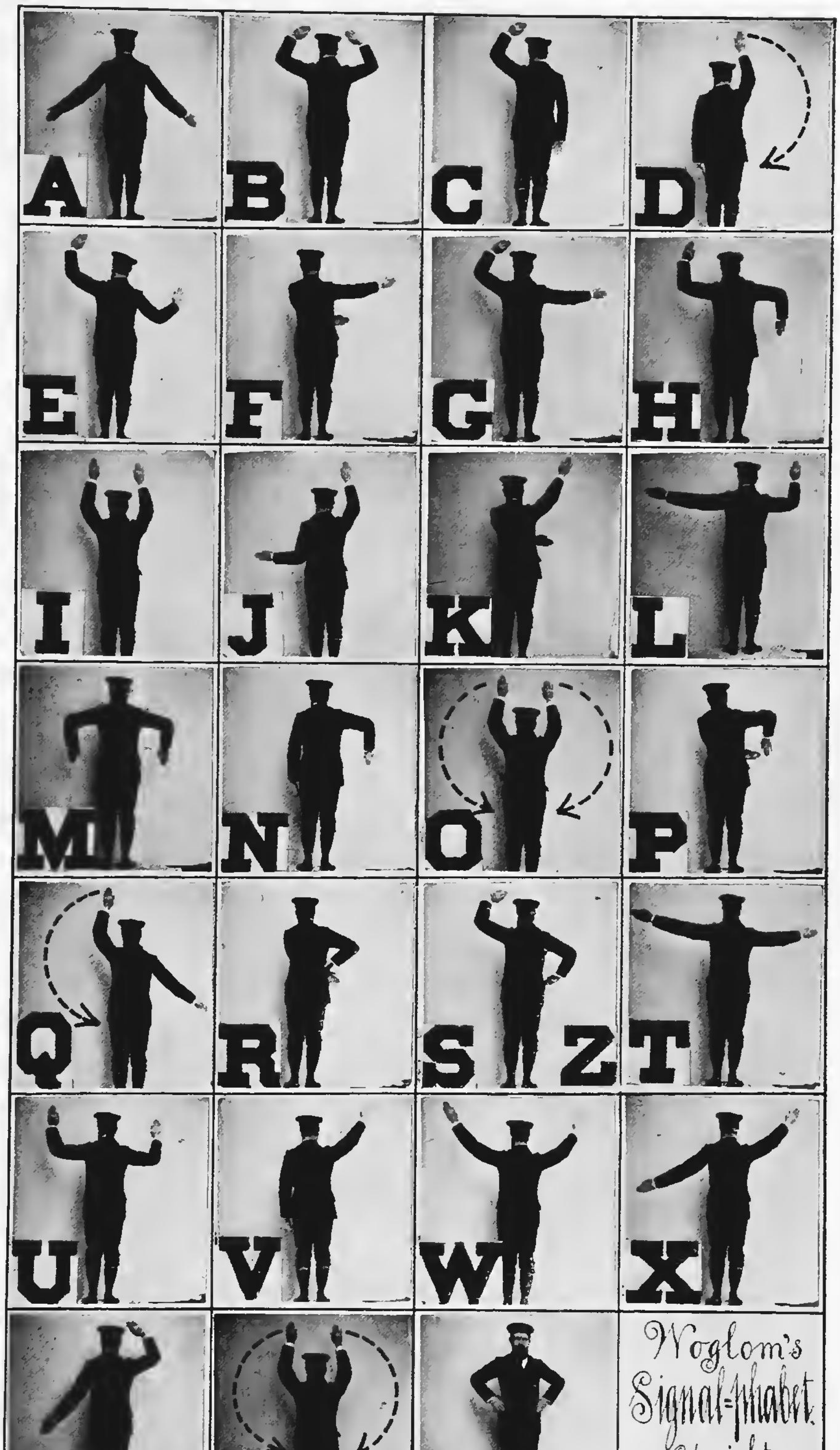


FIGURE 26.

military salute to indicate that he is at "attention."

The communication will be ended by both when each shall have signalled the fact by standing with one arm extended vertically.

SECTION 73. *Impracticably rigid frames.* — Rigidity of frames, of which mention has been frequently made in this manual, should be understood as a comparative term contradistinguishing them from such frames as would be distorted by high winds.

In the course of experiments, frames have been used which were trussed and braced into — as nearly as possible — absolute inflexibility. Though some satisfaction was found in an ability to produce such rigid constructions, it was found that they did not fulfil the requirements for successful flights. Though built and covered with the utmost care, when in the wind, with everything in complete order for meeting any possible wind pressure, these parakites' behavior told as plainly as could voicelessly be told that they were not adapted to their work ; their impatient, even angry, flitting and tugging, wordlessly told that they were actually fighting the wind instead of utilizing it — that with everything ataunto, it was a drawn battle, and that nothing was to be learned from such antagonisms.

In one such contest, *i. e*., while studying whether stiffly pliant or whether inflexible frames were the most efficacious, a frame-work which was the production of many hours of labor by Captain Isaac Cole, was blown and broken into fragments (*i. e*. the frame, not Captain Cole), of the fragments of which frame only about ten per centum returned into the hands, of the experimenter. The remainder were whirled merrily away in the embrace of their whilom windy antagonist.

Many and many evening-hours' work and expensive materials have thus been sacrificed on the writer's altar of determination to "find out." Such losses might have been spared had he sooner apprehended the truth that if in brisk and high winds rigid frames were the best, God would in that manner have fashioned the birds' wings, which are such wondrous models of lightness and elastic firmness ; the birds' wings adapt themselves to their pure environments, instead of contending against them. When we attempt to improve upon the models presented to us by the Supreme Being, we undertake the impossible. The sooner this is impressed upon the minds of the aerodronomists, the sooner will they arrive at a solution of Daëdalus's problem by studying at the feet of such an humble member of God's creation as the bird.

The genius is yet to present himself to the world, who will attempt to *improve* the flight of a bird by training it to work with its feet a treadle which will, with multiple speed, revolve an aërial propeller under its tail feathers, without giving a thought to whether its Creator had not already considered and discarded such an appliance in the application of his own laws to *all* creation inclusive.

Yes, the writer is an "aviarist."

SECTION 74. *A conclusion.* — If men absorbed in business affairs would devote some of their leisure to parakite-flying, they would become fascinated by it ; they would give to their tired brains a change of occupation, which is rest.

When engaged in the management of a train of parakites afloat in the air, one gives no thought to stocks, finance, the store, his profession or his quest for the elusive dollar. Were more men thus engaged in restful work we would hear less of paresis, heart-failure, and Bright's disease in these days of over-active business men. You ask why Bright's disease ? Well, the writer has been much impressed by the statement once made to him by a boyhood friend, now a scientist and prominent specialist in the city of New York, that brightisis, in his estimation, was an indication by and in the kidneys of an overtaxed and consequently debilitated brain. Admit it to be true, recall the lives of those we have known to have died of Bright's disease, and see if they do not fit the case. Oh no ! They have no time for rest or recreation ! But the time will come, before it 's their time for it, when they will get all the rest they need — in the grave.

As *Jack Bunsby* says — "The wisdom of my remarks is in their application."

Kite work, and the fresh air in which they must be flown, will maintain the equilibrium between the mental and the physical — the "sana mens in sano corpore."

SECTION 75. *The genesis of storms.* — When contemplating rotatory or whirl-winds of considerable extent (cyclones) the general conception is that they move or are moved in a horizontal plane. We learn from observations at different points on land or sea that in certain latitudes they are usually revolved in one direction. So much reliance is placed upon this theory that mariners are advised of means by which when caught in a vortex they may direct their courses toward the less violently moving periphery and emerge from the circle of its movement into milder or less violent winds.

The cyclone is generated ; it must have its genesis ; its genesis, though it be apparently an aerial paradox, must accord with some law or laws of aero-dynamics.

Let us look away from the cyclone, and in another direction than it, for the cause of its being.

Speaking from the latitude of New York City, we find that most of our N.E. storms — *i. e.*, northeast when they reach a certain locality — "come up the coast," as is the popular form of expression. Our coast-line trends from the S.W. to the N.E. It is plain that as to these particular cyclones, their own wind (from the N.E.) first is felt S.W. of us ; the effect of the cyclone is experienced progressively as it comes "up the coast" in a direction opposite to the direction of the wind of the storm itself ; this seems a paradox. Although the wind we experience is from the N.E., the storm itself, of which the said N.E. wind is the evidence, is moved in a direction opposite to that of the wind.

But a N.E. wind does not bear and bring this N.E. wind-storm toward us ; if it did, the storm, as well as the wind thereof, would come from the N.E. No ! on the contrary the storm brings with it this N.E. wind, for until the arrival of the storm or its harbinger, we do not experience it on the earth's surface. It was not projected towards us from the S.E. — it is not a southeaster — nor was it driven from the N.W. — it is not a nor' wester ; it could not come through the crust of the earth, and Holy Writ clearly implies that there are no cooling winds to be expected from the regions below ; neither are there, outside of legislative halls, any wind factories or wind generators on the surface of the earth — as the surface is ordinarily understood — which drive their wind-products backward.

Concurrence with the laws of God and his nature does not cause retrogression, but rather progression. Not even so fickle a commodity as the wind would travel backward.

Now, to summarize, this N.E. wind does not come from the N.E., for in advance of the storm the wind is usually from any other direction ; it does not come from the S.E. nor from the N.W., nor from the nadir — or elsewhere in that direction ; yet this is a N.E. wind, which we phrase as coming to us from the S.W. The heavens must be the source of this N.E. wind. There is no other source but the heavens to which to ascribe it. Let us reason together. My mercantile reader will want to suggest that there are enough in number, of other merchants in this country, continually raising the wind, etc., to which another reader will retort that such wind is only intended to convey in the direction of the wind-raiser's bank, etc. ; so let that pass, and recur to the latter part of Section 9, where we find concurrent, authentic evidence of the existence of upward wind-currents and downward wind-currents. Thus the ideal is realized, in that the sailor's expression "Paddy's hurricane" — wind up-and-down the mast — is not an impossibility.

Each of us who occasionally looks heavenward has discerned the evidence of wind currents, substantially horizontal, moving in a certain direction at a certain height above the earth's surface, and in a diametrically opposite direction at a greater height.

Heat expands air ; compression of air produces heat.

Cold densifies air ; expansion of air produces cold.

The air which has become an upper stratum, by its release from the gravity pressure of former superimposed air strata, becomes colder as a result of its thus-permitted expansion and rarefaction.

A rarefied, cold upper atmosphere and a compressed, denser, warmer lower atmosphere, are in an equilibrium which maintains them when undisturbed in their relative superincumbent strata. Were it not so, the (cooler) dense air would persistently descend by its own pressure weight, and the (warmer) rarefied air would as consistently ascend.

The air of the tropics, rarefied by heat, must rise in vast volume, and thereupon spread, mushroom-like, its cap pushed forward in the line of the least resistance — the direction of the north pole — by the upward and rear pressure of the continuously rising warmed air. To fill the place of the risen air, the indraft from the northern hemisphere southward to the north tropic, is an air-flow at the surface in a direction the opposite of the upper, northward air-flow toward the pole.

Thus we have : 1. A surface wind-flow toward the tropic ;
2. A vertical rise from the tropic ;
3. An upper-air flow therefrom toward the pole.

Any considerable down-flow of air (wind) from the upper atmosphere of the temperate zone towards the surface, now completes tentatively a rectangular circulation by providing the fourth essential (complemental to the three above recited) of a continuous circulation of "atmosphere in motion," which is wind.

In the four-sided plane figure thus indicated, viz.:

1. — The horizontal, extending from the temperate zone to the tropic;
2. — The perpendicular, extending from the tropic to the upper atmosphere ;
3. — The horizontal, extended in the upper atmosphere, from its conjunction with the up-moving tropical current to the junction-point with the down-flowing current to the temperate zone ; and
4. — The perpendicular, the said down-flowing current to the temperate zone —

in this figure we have a rectangle the plane of which is vertical. Here is a circulation in all but being circular.

As much as "Nature abhors a vacuum," so much does she abhor a right-line or a right-angle. The flow of wind (from the horizontal into the vertical, and again from the vertical into the horizontal at these junction-points) becoming continuous, though here outlined as rectangular for the purpose of demonstration, will be transformed into a rotatory circulation as surely as are the dust-laden winds into dust eddies at the street and house corners ; the concatenation of these four wind currents to produce such sequences has no periodicity ; however rare or frequent, it is just the chain of fortuitous conditions to effect a vertical, rotatory wind — a cyclone.

It is noticeable that our spring and summer cyclones have their birth in the southwesterly states, and that their speed is usually reported by telegraph as increasing hourly in both rate of progress of the storm to the northward and eastward, and in the accompanying wind-velocity. These conditions accord with the theory here advanced that such cyclones roll forward as a gigantic wheel having a tread many miles ' wide ; the circulation once initiated, would be protracted and energized by the upper air current driving towards the north, great volumes of which are, by frictional contact with the upper periphery of the north-moving wheel, carried forward and downward and beneath it to the surface of the earth. The downward draft from the colder upper strata develops and fosters the vertically downward and rotary motion. The cyclone wheel in its vertical, vertiginous plane, passes over the country with the cumulative speed of perfected circulation. The under periphery next the earth is our N. E. wind which is being rotated towards the S. W., and in a direction the reverse of the north-eastward rush of both the axial center and the upper periphery of our wind-wheel.

This rolling over, and down, and under, of the wind brings the now N. E. wind in contact frictionally with the earth's surface — i. e. the lower arc of this disk or wheel impinges the earth ; the said impinging and friction protracts the progress of our wind-wheel in its movement from the S. W. to the N. E.

The cyclone accumulates momentum while travelling its course. If it were a horizontal wind — moving as a great mass in a path identical with its direction — its headway would be impeded by the cushion of quiescent air accumulated by and before its forward thrust.

The vertical-plane cyclone theory is plausible as an explanation of the increasing energy of the cyclone ; its primitive velocity is increased coordinately with .its perfected circulation.

In contact with the roadway, the surface of a wagon tire at rest is static. The wheel revolves because friction of its tire on the road resists the energy applied at the hub ; the initial application of energy by a locomotive engine to a heavy train to be moved, causes the driving-wheel to slip on the rail before it takes complete frictional hold thereon ; this simile better describes the action of the vertical cyclone which, revolving itself at a greater speed than a normal frictional velocity, the lower-peripheral wind is driven backward with greater differential velocity.

Thus, though our storm is coming up from the southwest, the wind thereof, which we feel, is from the northeast. Let us not be startled from our conviction by an assumption that the wind, moving according to our perception in substantially a horizontal direction, cannot therefore be the convex arc of the circle simulated by our wind-wheel. In this gigantic disk-movement of the wind, what we experience of it is so diminutive an arc of so immense a circle that to us pygmies it appears as a right-line. In support of the claim that the cyclone wind — in this attempted solution of its vagaries — does move in an arc convex to the observer, is the frequent fact that objects large and small, fixed and unfixed, instead of being blown prone, are lifted and carried upward and onward to great distances ; this could be effected only by winds with upward inclinations.

If the cyclonic wind moved in a plane substantially parallel with the earth's surface, it is fair to presume that upright fixed objects on its surface would simply be prostrated. It is difficult to realize that such objects could be both *lifted* and *transported* any considerable distance in the direction of and by such wind ; but it is in evidence, during and in the wake of every forceful cyclone, that objects have been not only carried but lifted to considerable heights relative to their normal places and positions, and have been found miles away. Such transportation could be effected only by an upwardly inclined energy — such an one as would be the upward and rearward curve of the wind after it had impinged the earth's surface at the lower periphery of this wheel of wind, the objects picked up by and immersed in the said upward- and rearward-moving wind being carried thereby until thrown out and down by both centrifugal and gravity forces.

This theorem proven, the writer has the temerity and the humor to claim, cannot be as a whole successfully controverted or disproven, even by an affidavit.

We shall leave it to some other theorist to suggest the furthering of our simile of the wheel, by making the simile that of a vertical friction-wheel in contact, by its lateral faces, with and between the peripheries or treads of two horizontal friction-wheels, the latter two of which will simulate the horizontally swirling cyclone, and the anti-cyclone, in the conventionally opposite directions as to their outer or farther peripheries.

On September 10, 1896, an as-it-were American cyclone, which was a novelty to the Parisians, struck Paris ; during an interview immediately thereafter with M. Joubert, Director of the Observatory on the Tour de Saint Jacques, and in response to the query by a correspondent of the Paris Bureau of the *New York Herald*, "Where did the cyclone begin ? " he said :

" We do not know. All we can say at the present time is that it seemed to commence at the Place Saint Sulpice, and finished at the Hospital St. Louis. . . .

" Accustomed to cyclones ! " said M. Joubert. " I. should think not. This is the first one on record in Paris, and it will cause no end of study to define and explain this subject. Certainly we have had storms of great severity in Paris, but cyclones — we thought they were peculiar to America. A curious thing about this cyclone is that here, in our little park surrounding the tower, while trees gave way to the giant forces of the wind, those meteorological instruments, delicate to a degree and sensitive to the slightest change of the atmosphere, were left absolutely intact and unharmed. . . .

" This movement of the atmosphere brings up the question of whether or not in these extraordinary atmospheric changes currents move upward or downward. All we know is that all the objects in the way of this current on Thursday were dispersed by the wind. . . .

"M. Angot was absent from the Bureau Central, but one of his assistants told me that he (M. Angot) had seen the cyclone and had been in the midst of it. This was fortunate, because observations made at the time by a professional scientist could not fail to be interesting.

" M. Angot was standing on the Pont Royal at the time the cyclone broke over Paris, when suddenly he saw an immense wind current mounting spiral shaped to a considerable height in the air. Of course, when I say saw the wind, I mean the dust and objects propelled by the wind in a spiral column ; but, mark you, the column was ascending, not descending, for you know there are a great many scientists who contend that cyclones come down in a spiral column and do not ascend. The fact, therefore, of M. Angot's having seen the ascending spiral is of considerable value in connection with meteorological studies, but I must not trespass upon M. Angot's communication to the Acaddmie des Sciences, which will be made to that learned body in due course."

M. Joubert probably witnessed the effect of a Mediterranean or Atlantic mistral (Sec. 9, page 13) becoming merged with some tropic horizontal and upward wind currents, getting itself into the vertical plane wheel form, cavorting across the national domain, and then, as its lower periphery swept down to the surface, it scooped ("dispersed," he says) and carried away objects from that portion of the city which he has indicated as the course and width of tread of this rotatory storm wheel. Where observed, its trend was towards the northeast.

An important omission in this doubtless hastily imparted account is that of the direction of the wind — whether it was coincident with, or contrary to, the movement of the storm ; if the latter, it was possibly an American-export Gulf or Texas cyclone ; if the former, we may assume it to have been a comparatively feeble European-continental production.

We may learn in the course of study that cyclonic wind storms confine themselves to neither horizontal nor vertical planes, but that at their own sweet wills they assume such dihedral angles with the earth's surface as may best accomplish the purposes for which they have been generated.

Extracts from an address by Prof. Willis L. Moore, chief of the Weather Bureau at Washington, delivered at Springfield, Mass., Aug. 30th, 1895, before the American Association for the Advancement of Science — subject : "Relations of the Weather Bureau to the Science and Industry of the Country."

" The goal to be striven for is the improvement of weather forecasts, and surely one of the prerequisites to determine coming events is a thorough knowledge of existing conditions. To those who have read every important treatise on Meteorology, and who have studied every text-book on the subject, it is painfully patent how extremely ignorant we are of the mechanism of storms ; of the operations of those vast and subtle forces in free air which give inception to the storm, and which supply the energy necessary to accelerate cyclonic action as formed, or to disperse the same when once freely in operation."

"... We have been for years taking our measurements at the bottom of this great ocean of air, while the forces which cause the formation of storms, and which influence their intensity and direction of motion, operate at great elevations or are extraneous to our earth. It therefore seems imperative that systematic explorations should be made of the upper air."

" Upper air explorations may be accomplished by a train of kites, carrying automatic instruments, by captive kite-balloons which may be forced nearer and nearer the zenith with increasing wind velocity, or by the ascension of trained observers, in free balloons. We must strive for the perfection of appliances and instruments which will, at no distant day, enable us to present to the forecaster the charted synchronous meteorological conditions prevailing at high levels and covering a great area. Mr. McAdie, at Washington, has secured some good records with kites at 1,000 to 2,000 feet elevation. Systematic explorations of the upper air with a continuation of the studies begun by Prof. Biglow of terrestrial magnetic forces as induced by the solar magnetic field, will be the line of investigation prosecuted during the next two years, and from which it is hoped that results satisfactory to the practical as well as the theoretical man may be obtained."

" Harmonious co-operation between the practical worker and the scientific investigator is essential to success." *

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* Whilst this book is in press the following excerpt appears in the New York Herald of Sept. 17, 1896. The inferences which this author has drawn from his observation of the upper air are not inharmonious with the remarks by this prominent scientific investigator ; they are reproduced here as according with the author's tentatively expressed Genesis of Storms :

" [Remarks on the great Paris storm of September 10, 1896, by Frank Waldo, Ph.D.. Member of the Austrian and German Meteorological Societies. Author of Modern Meteorology, Elementary Meteorology, &c.J

" The violent storm which occurred in Paris a few minutes before three o'clock on the afternoon of September 10 was evidently a specimen of the Northern European representative of the American tornado ; which is not, however, a true tornado, but is similar to the straight blows or derechos to which Hinrichs called the attention of Americans some ten or a dozen years ago. In order to make clear any explanation of this class of storms, it is necessary to examine the causes which give rise to them.

" It is a characteristic of air motion that the masses of air move in whirls. No matter if the wind appears to have a perfectly straight course, it will, if followed out far enough, be found to belong to or bear some close connection with some system of whirling air motion. When this whirling motion takes place around some centre in the direction opposite to that of the hands of a watch, then the motion is said to be cyclonal ; if the spiral motion is with the hands of a watch (face up), then the motion is said to be anti-cyclonal. It is from these terms that we get the corresponding substantive terms cyclone and anti-cyclone. These directions of whirl apply to the hemisphere north of the equator, and in the southern hemisphere the cyclones and anti-cyclones have opposite directions of whirling motion to those just mentioned.

SECTION 76. *Operators should keep records.* — As a suggestion to be adopted or otherwise by those who would intelligently enjoy the pastime of parakite-flying, the author mentions the fact of having kept detailed records of all flights ; they include the date, time of beginning and ending the flight, the direction and velocity of the wind, with variations if any during the time of flight, the names of parakites used, recording them numerically as dismissed into the air, the rating of each, the cordage used for each, describing it by its breaking strain, the pull of the pilot-parakite first dismissed, and successively the pull with each parakite added to the train and dismissed to the intended position in the air, and approximately the length of cordage served out to each parakite. [10]

Memoranda of the behavior of each flier in the current wind are useful to fix upon the rating of fliers best adapted to different wind-velocities. A record also of the operating crew, and witnesses, if

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" Thus in each hemisphere there is a huge cyclone, having the poles as a centre, and this cyclone extends down toward the equator to about latitude 30 degrees, and from there to the equator the direction of motion is anti-cyclonal (considering still the poles as centres of rotation).

" Within these huge whirls there arise smaller whirls, which have the cyclonal direction of rotation, and which in our latitudes may be even a thousand miles in diameter. Such whirls are the so-called cyclonic areas, lows, or barometric depressions, of our daily weather maps. In these the barometric pressure decreases from the outer circumference toward the centre. Such cyclones, but of much greater intensity and of less lateral extent, are the hurricanes of the southeastern coast of the United States and the typhoons of the Chinese and Japanese coasts. These hurricanes and typhoons frequently come up into our latitudes, where they lose much of their intensity and assume a milder and more diffuse form, similar to that of our ordinary extended cyclones.

" These weather map cyclones may be termed parasites of the huge hemispherical cyclones, and in turn have their smaller parasitical atmospheric disturbances, which are the sudden and more or less violent local storms, such as the one which has recently spread devastation in Paris, and another of which a short time ago caused the St. Louis horror.

"SAME GENERAL CHARACTERISTICS.

" The weather map cyclonic areas, or extended cyclones, have the same general characteristics in the United States and Europe, and in fact the same cyclone not infrequently forms in America, crosses the Atlantic Ocean, and entering Europe, disappears somewhere on the European Continent. One of these atmospheric whirls began as a typhoon near Manila, and was traced as a cyclonic area across the Pacific Ocean, North America, the Atlantic Ocean, and over part of Europe, a distance of 14,000 miles, which it traversed in thirty-five days. The meteorological investigations undertaken by the Herald have been of great service in tracing the progress of these areas from America to Europe.

" Some meteorologists prefer to call all sudden storms of this class "squalls," and they distinguish between the straight blow, such as occurs in our thunder squalls, and the rotary squall or tornado.

" We know that when air is compressed it becomes warmer, and when it is expanded it becomes cooler, even though no heat is added to or subtracted from the air mass. And this change, called adiabatic change, proceeds according to a regular law. The air pressure, and, consequently, the air density, decreases with the increase of altitude above the earth's surface, and so when air moves upward it expands and becomes cooler, and at the rate of about I degree Fahrenheit for each 183 feet of ascent; and likewise it becomes warmer i degree for each 183 feet of descent in cases where it moves downward.

" So then, if the temperature of a mass of air decreases 1 degree Fahrenheit for each 183 feet of increase in altitude, then the air is said to be in indifferent equilibrium, and any air carried upward or downward in it will remain in its new position, because its adiabatic change of temperature has been just such as to allow the air so moved to accommodate itself to the temperature of the surrounding air in its new position.

" If a mass of air decreases at a rate of less than 1 degree Fahrenheit for each 183 feet increase in altitude, then the air is in stable equilibrium, and if any air is forced upward in it, it would gradually become denser than the air at its level and would sink back again to its starting place after the force which caused it to move upward had ceased to act.

" If the mass of air decreases in temperature at a rate greater than 1degree Fahrenheit for each 183 feet of increase in altitude, then it is in unstable equilibrium, and if any of the air is started upward or downward it will continue so to move, as it will become lighter than the surrounding air with the upward and heavier with the downward motion.

" It is on this condition of unstable equilibrium that most squalls depend for their origin and in great part for their maintenance.

"NOT NEAR THE EQUATOR.

" Now, curiously enough, these rotary squalls (tornadoes) do not seem to occur very close to the equator, nor in high latitudes, but they do occur in middle latitudes. Thus it happens that the circumstances and conditions which in latitudes thirty to forty degrees produce tornadoes, in higher latitudes — say, from fifty to sixty degrees — produce straight blow squalls. And it was undoubtedly one of these which played such havoc in Paris. The same conditions in the Eastern United States would probably have produced a genuine tornado. Had a true tornado struck the city of Paris there would have been a repetition of the St. Louis disaster. I do not mean to say that a Parisian tornado would be an impossibility, for this phenomenon undoubtedly has occurred in France ; but only very rarely. It is, however, very improbable that Paris will ever have to view the scene of desolation which is produced by a genuine American tornado.

" Such storms as the recent Paris squall are quite common in Middle and Western Europe, and one of very great intensity, which occurred in Holstein, on August 9, 1881, was studied in every detail by my friend Professor Dr. W. Koppen, of the Deutsche Seewarte, at Hamburg. Professor Koppen has taken that opportunity to give to meteorologists a model investigation of such a storm, and it has proven very useful as a pattern for subsequent studies.

any, during each flight is useful for future reference.

SECTION 77. *Table of ratings for various wind-velocities.*— The author's experiences with parakites of various ratings (Sec. 68, page 37), and their adaptation to varying wind-velocities, have been collated into the following approximate table after industriously traversing a multitude of flight records, during which more than one hundred and fifty parakites were used and their fitness noted :

Ratings.					Wind Velocity.
0035	to	.0045	adapted	to	5 to 15 miles.
0045	"	.0060	"	"	15 " 25
0060	"	.0070	"	"	25 " 35
0070	"	.0080	"	"	35 " 40
0080	"	.0090	"	"	40 " 50
0090	"	.0095	"	"	50 " 55

An attentive parakite-flier will be surprised at his own ability to determine the wind velocity after a few trial estimates have been compared with the actual records of a neighboring United States Weather Observer (if he is so fortunate as to have one within consulting distance).

It will be found that winter winds of certain velocities have greater lifting energy than the same wind-velocities in summer. This is doubtless due to the greater power of the colder and therefore denser atmosphere when in motion.

" The place and time of the origination of such storms cannot be successfully predicted until further studies have been made of the upper atmospheric conditions. But when such a storm has once developed its northeasterly movement can be counted on, and places lying in its probable path can be forewarned by telephone or telegraph perhaps several hours before its arrival. It may be added that, in the early lists of tornadoes published by the United States Signal Service, the straight blow squalls of great intensity were counted in with the true tornadoes. And so the average numbers of tornadoes, tabulated previously to about 1884 or 1885, cannot be used as applying to tornadoes alone, but rather to severe local storms. Dr. Hinrichs pointed out this confusion of storm classes in the records for Iowa, and the same undoubtedly existed for other States.

" According to the reports in the Sunday Herald, it seems that the Paris storm was really an incipient tornado, which, as I have said, was possible, but not probable, in Northern France. Its main characteristics must, however, have been those of a straight blow."

10 Local Forecast Official Elias B. Dunn, of the New York City Weather Bureau Observatory, has been so uniformly courteous in responding to the writer's frequent demands upon his time for weather data, that it is becoming that an expression of appreciation and thanks be here proffered to him.

APPENDIX.

Extracts from the New York City and other newspapers anent the "Flag in the air," at the Dedication of the Washington Arch in New York City, on May 4, 1895.

New York Morning Advertiser, May 3, 1895.

"A Flag to Fly from Kites.

"One feature of the dedication ceremonies of the Washington Memorial Arch to-morrow which is not down on the programme will be the display of a ten-foot American flag 1000 feet above the arch, if the wind is favorable. The flag will be supported by six large kites which will be sent up from a neighboring building. The flag will fly from a wire strung between the kites."

New York Herald, of May 4, 1895.

"A Novel Flag Exhibition.

"An unusual feature of the dedication ceremonies which should attract some attention, although it is not down on the programme, will be contributed by Mr. Gilbert T. Woglom, who resides in the Judson Memorial Tower, on the south side of Washington Park. Mr. Woglom will display a beautiful American flag, if the wind is from the south, at an altitude of 2000 feet above the arch."

"The flag will be flown from an upright staff, supported by about ten aeroplanes, or tailless kites, in the manufacture of which Mr. Woglom has acquired deserved distinction. Mr. Woglom does not claim any of the honors of this display, but characterizes it as the tribute of the Judson Memorial Tower to the Washington Memorial Arch."

"HOW IT will be done.

"The aeroplanes are made of silk and are of various sizes, some of them being 65 inches in height. They possess the power of rising to lofty altitudes. Mr. Woglom gains his great altitudes by stringing the kites tandem fashion, so to speak, so that the strain upon the uppermost kite is relieved by those lower down. He says that he is thus enabled to guarantee an immense carrying power"

The above two notices anticipated, and the remainder followed, the tribute to the dedicatory ceremonies of the Washington Arch.

The New York Press, May 5, 1895.

"Gilbert T. Woglom, the well-known experimenter with aeroplanes, a strictly tailless kite, sent up six gaudily colored flyers from the Judson Memorial Tower, south of the arch. When they were so high that they were almost invisible a large American flag was attached to the kite line and sailed far into the air, until it was over a thousand feet above the earth. There it fluttered, grandly outlined sharply against the Venetian sky that glorified the city's holiday, until the celebration was ended."

The New York Times, May 5, 1895.

"Stars and Stripes High in the Air.

"Next after the arrival of Gen. Miles those who had seats heard loud shouts from those on the ground. A beautiful American flag was seen high up in the sky. The perfect clearness of the day brought out every star and every stripe with striking distinctness. The sudden appearance of the emblem was acknowledged by a general uncovering of heads and a spontaneous outburst of prolonged cheers. The core of patriotic feeling was deeply touched, and the lofty flag became one of the most conspicuous omens of the day.

"The flag in the heavens was the conception of Gilbert T. Woglom, who carried his idea into execution with his aeroplanes of silk which jointly held the flag upright. They were flown like ordinary kites so as to give the flag an altitude of 2000 feet above the surface of the earth."

The New York Tribune, May 5, 1895.

"Marching regiments and blaring bands, ringing speeches and cheering crowds, high officials and glittering escorts, the silent majesty of the superb structure in whose honor all these things were, and high above all the stars and stripes, hanging in mid-air looking as if blazoned on the sky — that is the story of the dedication of the Washington Arch yesterday.
. . . The Arch Committee, decorated with their blue and gold badges, went down to meet the Governor and escort him to his seat on the rostrum built out from the centre of the western stand. Here he was welcomed by Henry G. Marquand, chairman of the committee, by Mayor Strong and by General Miles, who had come over from Governor's Island with a dozen members of his staff to witness the review. The Governor's staff strung out along the front of the stand. An orderly followed with the flag of the State of New York and took his position on the right of the Governor while an attendant from the Mayor's office stood to his left, behind His Honor, holding the white flag of the municipality aloft. High in the air, hanging by an invisible support from a line of six great kites, coupled in tandem, was a large American flag flattened out in the strong south wind and bathed in the glory of the May sunshine."

The New York Sun, May 5, 1895.

"The Washington Arch was dedicated yesterday in the presence of a great crowd of people in Washington Square and in lower Fifth Avenue and with the co-operation of thousands more who crowded Fifth Avenue up as far as seventy-second street. During the exercises a large American flag floated over the square suspended hundreds of feet in the air, from three tailless kites in tandem, the uppermost of which was almost lost to sight. The air was clear, and as the flag unfurled itself curling gracefully in the varying air currents, it could have been seen from the Hudson Highlands or from far down the bay, and told the dwellers on the hilltops and those by the waterside of what New York was doing in memory of the man who gave the emblem meaning. . . .

"Some one discovered numerous kites of various colors high over the heads of the crowd, and as the word passed around there was a craning of necks and straining of eyes to look against the sunlight at them. They were the heralds of the tandem string that later carried up the emblem of the United States, and when the flag went up the multitude cheered. The unique display was the work of Gilbert T. Woglom, an enthusiast in aerostatics."

The New York News, May 5, 1895.

"American Flag in Mid-air.

"A beautiful effect was produced by the elevation from the tower of the Judson Memorial Church of a very large American flag, which hung suspended from several tailless kites. The kites were so high in the air that the cords supporting the flag were invisible. It hung 1 500 feet in the air immediately above the centre of the square, and was admired and marveled at by everyone. The conception and carrying'out of the idea are due to the clever brain of Mr. Gilbert T. Woglom, who lives in the Judson Tower."

The New York Recorder, May 5, 1895.

"The fine old residences about Washington Square were a mass of gorgeous and patriotic decorations, those of Gen. Sickles and William Rhinelander Stewart being notable. A unique decoration that was watched by many eyes was a large American flag that seemed to float in mid-air high over the crowded square. Four kites were flying like aerial anchors in four quarters of the heavens. It was evident that they were holding the flag aloft and were all connected by cords."

The New York World; May 5, 1895.

"Washington Arch.

The noble Monument Dedicated with Oratory and Military Show.

Crowds like at the Centennial.

Gov. Morton's staff, with Col. J. J. Astor on the saddle, a gorgeous success.

But Woglom's Kites Surpassed it.

WOGLOM'S GREAT FLAG TRICK.

"But after all Woglom was the man who carried off the real spectacular honors of the day.

"Imagine a great American flag, many feet in length and breadth, standing out stiff as a board in the strong southeast breeze and projected against the very portals of the sky fully 2000 feet in the air, and as far as the human eye could discern, with absolutely no visible means of support.

"That is what Woglom did. Gilbert T. Woglom is his name, and he said in advance that he would do it.

"HARNESSED TO BIG KITES.

"It was by kites. Woglom harnessed his flag to a team of seven or eight large kites driven tandem, one kite flying the other, and all of them dragging upward, slowly and steadily, the flag which at last hung like a dazzling meteor against the Western sky.

"As the sun sank lower and the West turned to the molten gold which goes so often with the close of an early summer day, the spectacle of the great streaming banner hung like a scroll against the fervid yellow light became startling. Away up and still up like a great flight of steps, one above the other, hung the red and white and blue kites, connected with invisible cords, and all as motionless with the strain of hauling the flag aloft as though they were fast secured and bolted against the deep blue sky.

"Up in the tall campanile of the Judson Memorial Church, on the south side of the park, was Woglom and the other end of the cable.

"WONDER AT THE SIGHT.

"For a considerable time the great crowd did not notice the flag as it slowly climbed skyward, but at last when it was seen and one pointed it out to another, until all faces were turned heavenward, there was a low rumbling murmur of astonishment, which grew louder and louder, until it finally burst into a long, deep-throated cheer.

"During all the speech-making and other exercises, during the parade and reviewing of the troops, and while the crowd was breaking apart, nearly six o'clock in the afternoon, and streaming out through the many streets that lead from Washington Park, Woglom's Old Glory remained there, bright and radiant. It was a great day for G. Washington, it was likewise a great day for G. Woglom.

". . . As Mayor Strong advanced to reply, the crowd in the street below broke out into a cheer of a depth and volume and continuity equalled only by that with which they had greeted the sight of the American flag floating in the sky."

The New York Herald, May 5, 1895.

"A feature of the celebration which attracted widespread attention and no little wondering comment was the display of an American flag about one thousand feet in the air above the arch and seemingly unconnected with the earth.

"This interesting achievement, which was referred to in yesterday's Herald, was the tribute of Mr. Gilbert T. Woglom of the Judson Memorial Tower, to the Washington Arch. The flag was lifted into its lofty place, where it was visible for miles around, through the agency of a series of kites or aeroplanes, flown one after the other. The flag was strung up last of all, and floated to the breeze as though supported by some magic power. The effect was beautiful and appropriate, and was universally commended by all who witnessed it."

Newark Daily Advertiser, May 6, 1895.

"The man who hit upon the happy idea of floating the Stars and Stripes in mid-air high above the throng that was gathered about the Washington Arch in New York on Saturday afternoon was a genius. By a clever arrangement of a series of kites the flag was suspended in the air, floating superbly over the crowd, in its way more conspicuous even than the Arch itself."

The Statesman, Yonkers, May 6, 1895.

"WASHINGTON ARCH DEDICATION.

"The dedication of the Washington Memorial Arch in New York City was successfully accomplished on Saturday. The magnificent spring weather brought the spectators out in limitless multitude, who filled Fifth Avenue and Washington Square, and the thoroughfares leading to it. There were marching regiments and blaring bands, ringing speeches and cheering crowds, high officials and glittering escorts. Governor Morton and his staff were among the guests.

"Henry G. Marquand, Chairman of the Arch Committee, presided. Bishop Potter offered prayer, the Lord's Prayer was recited, and General Horace Porter delivered the oration. Chairman Marquand then spoke, and at the close he delivered the key of the Arch to Treasurer William R. Stewart, who in turn formally transferred the Arch to Mayor Strong, on behalf of the city. The Mayor's reply of acceptance was received with enthusiasm. The Governor reviewed the parade at 5 o'clock.

"Gilbert T. Woglom, who for many years was a resident of Yonkers, carried off some of the honors of the day by raising a large American flag 2000 feet in the air by means of seven or eight big kites. He held the cord, up in the tall tower of the Judson Memorial Church."

Argosy, June, 1895.

"SCIENTIFIC KITE-FLYING.

"During the dedication exercises of the Washington Memorial Arch in New York on the 4th of May, an American flag fluttered in the air 650 feet above the assembled spectators. It was not ' flying wild ' either, but was a contribution to the festivities by Gilbert T. Woglom, a jeweler whose hobby is kites. He flies them from the Judson Memorial Tower on Washington Square, and to a certain reporter he made the following statement :

" 'I have forty kites in all, and it would not be so very difficult for me to send them all up and suspend a man below them almost as high as that kite was.'

"All the kites are tailless. They are made of stout sticks, crossed, each of the same length, their point of crossing depending upon fixed laws that the experimenter has evolved from experience. They are covered with the lightest of silk, one covered with gauzy white Japanese napkins sewed together, weighing only a few ounces.

"The kites are all named, just as one would name a boat, and Mr. Woglom says that the experiments he is making are simply for his own amusement ; but he admits that the eyes of many great men of science are following him closely, and that many of his experiments are in the line of those in which Professor Eddy, in Bergen Point, New Jersey, is so deeply interested. Six kites were sent up, but two were so far out of the vision of the wondering spectators below that only four were noted. The flag, although it looked as much as half a mile above the top of the arch, was lower than any of the kites."

The Evening World, May 6, 1895.

"The flag was of bunting, ten feet long, and with its staff weighed i| pounds. The top of the staff was securely fastened directly to the main kite-line, the bottom of the staff swung loose save that a stout twine long enough to keep the staff at a constant perpendicular, and was extended between it and the main line. Up went the flag, unfurled itself, and stood out stiff as a board — radiant and beautiful, sun-kissed, glorious."

The New York Jewelers Weekly, May 8, 1895.

"Gilbert T. Woglom, 38 John Street, who is a student of aerodynamics, last Saturday, during the exercises incident to the dedication of the Washington Arch, floated the national flag 2500 feet above Washington Square by means of a gang of kites."

Further details incidental to the raising of the "Banner in the sky" have been published in the following journals to which my attention has been called by friendly readers thereof :

The Morning New York World, May 6, 1895.
The New York Recorder, May 6, 1895.
The New York Morning Journal, May 10, 1895.
The Illinois Record May 11, 1895.
The Chicago Inter-Ocean, May 12, 1895.
The New York World, May 26, 1895.
Popular Science News, June, 1895.
Scientific American, June 1, 1895.
The New York Sun, June 16, 1895.
The Argosy, July, 1895.
The Outlook, July 13, 1895.
The New York Herald, Sept. 3, 1895.
The Philadelphia Ledger, Sept. 4, 1895.
The Rochester Union Advertiser , Sept. 5, 1895.
The Christian Advocate, Sept. 5, 1895.
The Portland, Me., Advertiser, Sept. 7, 1895.
The New York Commercial Advertiser, Sept. 7, 1895.
The New York Mercury, Sept. 8, 1895.
The New York Sun, Sept. 8, 1895.
The Oil City Derrick, Sept. 10, 1895.
The Rochester Advertiser, Sept. 11, 1895.

N. Y. Herald, Jan. 1, 1896.

"OBSERVATIONS TWO MILES HIGH.

"To the Editor of the Herald :— ,

In answer to your question, I have to say that the invention needed most in meteorological science for the purpose of perfecting weather forecasts is an appliance which will carry meteorological self-recording instruments quickly to an altitude of not less than two miles, and enable them to be drawn downward, and the meteorological conditions of the upper air, as shown by the in.strument readings, incorporated into the telegraphic reports of the Weather Bureau. This will enable a synoptic chart of the upper strata to be studied by the forecaster at the same time that the surface conditions are considered. A simple balloon will not accomplish the purpose.

WILLIS L. MOORE,
Chief of the Weather Bureau."

Washington, D. C, Dec. 31, 1895.

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