rise, with an ever increasing deflection in the cord and decreasing angle of flight, to a certain point of maximum altitude beyond which more line will sag to the earth. This is where the components of the weight and wind pressure due to the line, with maximum deflection, are in excess of $S_{\prime\prime}$ as given by equation (5).

Practical trial will determine the characteristics of a type in a short time, where mathematics would be unavailing. Many points treated here generally can be specifically determined by comparison only.

The kite which exposes the greatest area for a given weight of plane, ballast, and cord will have the most carrying capacity. The area of plane divided by the weight of plane will be some measure of the efficiency. But the form of plane and method of suspension are also of importance as influencing the angle of flight and steadiness.

In Eddy's design, a diamond-shaped kite of equal dimensions, the frame crossing at four-fifths the height of the upright, we have provision made, by convexing the frame and bagging the covering, for obtaining sufficient metacentric height without ballast in the form of tail or steadying fins.

The statics of kite are analogous to those of a ship. The vertical distance of the centers of pressure and weight might be called the metacentric height.

Eddy's kite, besides its motor efficiency, has other advantages. The form, triangular, with the base uppermost, gives small range to the center of pressure, therefore enabling an adjustment for raising conditions to hold well into high angles of flight. And the kite itself is a model of compactness, simplicity, strength, and low cost combined with the efficiency needed in high angle flying.

Multiplane kites, like the cellular Hargrave, are less efficient, because according to Mr. Langley's experiments, two superposed planes must be separated nearly their whole width in the direction of the wind motion to obtain the pressure due to their area, and the weight of the lateral partitions counts to disadvantage. Advantages for this special construction are claimed in the way of steadiness, which is probably due to the inertia of the columns of air flowing through the cells. This kite is not in stable equilibrium, as its natural center of gravity is above the centre of pressure of the lower planes which do most of the work.

The little Japanese bird kite will fly fairly well without ballast. The baggy form and flexibility of its wings carry the center of pressure above the center of gravity. But the angle of flight is low owing to the inefficiency of the surface. It is probable that this kite also realizes a steadying influence from the action of the currents of air, in the wing vents. All kites, especially the plane forms, are subject to considerable oscillation while in action, and in the aeroplane ship, where this vibration would be a factor, this idea of utilizing the inertia of air columns may be of advantage.

A kite may rise with the string fastened direct to the framework above the center of pressure, but the use of two or more conductors joining the frame with the line distributes the strains, insures steadiness, and gives self-adjustment in a degree. Call a point on the plane of the kite opposite to this connection, and in a line with the string, the center of suspension. The kite may rise, but if the center of suspension is too high, or if $S_{\prime\prime}\, d_{\prime} > w\, d$ at any angle of flight or ordinary position of plane, the kite will pull over, flounce, and fall. On the other hand, if the center of suspension be too low, or approach too near the center of pressure in any condition, the kite will rear or surge up and dive. These conditions may often be brought about by the wind itself. Air, because of its compressibility, is seldom a steady stream in motion, but consists of waves or impulses of varying velocity and direction, thereby producing glancing or darting in the kite.

In a well-designed kite there are rather wide limits for the position of the center of suspension within which a change only influences the angle of flight in a degree. That is, the kite with a given adjustment of connection, within these limits, will go safely and self-regulating through wide angles of inclination and flight. The length of the conductors or the distance of the point of suspension from the plane is also an important adjustment, since the amount of change in the position of the center of suspension subtended by a given change of angle of inclination is dependent on this length, and lack of adjustment in this particular will limit the angle of flight.

In general, the forces in action will vary with the square of the wind velocity, and the tension at the point of observation will decrease, for a given wind velocity and length of line, more or less closely with the cosine of the angle of flight. The bird, the prototype of the kite, presents many perfect analogies. In sailing flight the component $P_{\prime\prime}$ of the air pressure on its wings is balanced by the action of gravity, while $P_{\prime}$ represents the de-accelerating force on its mass, or the resistance to motion. The weight of the bird is comparable to the weight of the kite W, plus the vertical component of the line tension $S_{\prime\prime}$. And $S_{\prime}$ may be compared to the momentum, or, at times, the relative inertia of the bird. Again, the great disproportionate spread of wing to breadth in the best sailers is a natural proof of the law involved in the curves of Fig. 2.

HIGHS AND LOWS.

By N. R. Taylor, Observer, Weather Bureau (dated September 21, 1897).

Those who make a study of the weather maps issued by the United States Weather Bureau will doubtless read this article with at least passing interest. Although it is not an easy matter to write intelligently upon a scientific subject without scientific words creeping in, yet it is the intention to make this article plain without imperiling the subject, and to avoid all terms that would tend to confuse.

Besides the lines representing barometric pressure in inches and temperature in degrees, the maps contain the words "High" and "Low," every map showing at least one of each. These highs and lows are the most conspicuous features on the maps, and, it might be added, the least understood by the casual observer.

A whole chapter could be written upon the weather conditions represented by the lines, or curves, inclosing high and low areas, but this paper will suffice to give the reader a general idea of their importance in forecasting the weather.

As the words high and low imply, one is the opposite of the other, and they are used on the weather maps to designate the centers of those areas over which a relatively high or low reading of the barometer is observed. These areas of pressure are inclosed by isobaric lines, and include that part of the country over which the pressure is highest or lowest, as the case may be, when compared with other sections, and their centers are located where the greatest or least barometer reading has been observed. It will be seen that the words "High" and "Low" are comparative terms, hence when a high or low pressure is noted on the border of the territory covered by the weather maps, their areas are not sufficiently defined to admit of their centers being accurately located, in which case the highest or lowest pressure observed is quoted, and the isobars are then in the form of short curves.

The lines running through places of equal pressure, showing the different barometric heights, are aptly illustrated by the contour lines employed by civil engineers to mark the relative altitudes of various points.

A glance at a few characteristics of highs and lows and their effects upon the weather conditions will show their importance from the forecasters point of view.

A high, from the time it first appears, moves in a general easterly direction over well known tracks, with a velocity dependent upon the conditions surrounding it. Sometimes, however, its movement is so sluggish as to be hardly perceptible, and it hangs over a section of the country with a persistency that both surprises and confuses the forecaster. These cases are rare, and one noticing a high charted on this morning's weather map may look for it tomorrow at a point farther east, and so on, until it moves out of range of the Weather Bureau stations.

An area of high pressure when once formed can be counted upon to last for some time. This being so, and from the fact that air is continually flowing out from all sides as surface winds, it is evident that to maintain its characteristics air must be supplied from some source in proportion to that which flows out. Hence it would seem that in the higher strata of the atmosphere air must be moving inward and sinking downward, thus making it reasonable to believe that the pressure in the upper regions of the air is least above the spot where it is greatest on the earth's surface.

During the summer months areas of high pressure are characterized by dry weather; the days are warm, bright, and cloudless. The nights are cool, with clear and brilliant skies; and, as the dry air aids radiation from the earth's surface, the temperature quickly cools to the dew point, and heavy deposits of dew occur, and sometimes frost. Under these conditions the daily range of temperature is generally much greater than at other times.

Areas of high pressure during the winter months are more decided in their characteristics; they move with greater speed, and as the days are short and insolation weak, they are generally attended by low temperatures. Cold days and colder nights prevail.

The blizzards that sweep with icy breath over the west and northwest, the marrow-chilling northers of Texas, and all the cold waves are first located within areas of high pressure, and, as they advance with the frosty breath of colder climes, the forecaster notes their position and studies their progress.

As has been stated, the low is the opposite of the high, and it plays an equally important part in our weather changes. The air in the center of an area of low pressure being rarer, and consequently lighter than under ordinary conditions, tends to disturb the equilibrium of the surrounding air, causing it to expand and rush toward the low.

The term "cyclone" was originally applied to lows and storm areas for the reason that it was believed the wind blew around them in circles, but since the science of meteorology has advanced it has been demonstrated that the wind blows in toward the low's center in a spiral curve with a velocity dependent upon the gradient or steepness of the depression. As the center of an area of low pressure remains the lowest in spite of the fact that the surface winds are pouring in from every direction, the logical deduction is that the air must rise around the center and flow out from above, thus making an inward and upward whirl, or eddy, of the atmosphere. The eddy, however, is not stationary but is always moving, sometimes increasing in strength as it advances and again spreading out and becoming less intense.

The weather changes associated with a low are proofs of its being an eddy of ascending air from the fact that on its approach clouds are formed, the temperature rises, and often rain, accompanied by high winds, occurs. Then comes clearing weather, a sudden shift of wind, and a sharp rise of barometer, all showing that the storm has passed and that a high, with its quota of fair weather, will soon move in and assume control.

Like the restless billows of the ocean, the atmosphere is ever surging, and pursuant to the wise and economic laws of nature, compensates us with clear and sunny skies for the days that were dark and dreary.

NOTES BY THE EDITOR.

ORIGIN OF DESCENDING GUSTS OF WIND.

Mr. Charles A. Love, voluntary observer at Aurora, Ill., writing with reference to a storm at Laurelwood Park, 1 mile north of Batavia and 8 miles north of Aurora, suggests an experiment that might be carried out on a small scale in a laboratory, if any of the physicists who have the necessary conveniences at hand would kindly devote so much attention to meteorological problems. Mr. Love says:

> A visit to the place showed that a hard windstorm from the southwest had swept through the grove at Laurelwood Park in the afternoon of August 28, and that the damage had been confined for the most part to a limited portion of the natural grove of tall black oaks of about a quarter of a mile in extent each way. * * * The branches of the trees fell toward the northeast, and the roof of the dancing pavilion was pushed eastward. If the wind had been a lifting one it should have carried the roof clear of the floor, but it did not do so, and in this case as in others where hail falls, the wind appears to have been crushing instead of lifting. Reports from Kaneville, about 12 miles southwest from Laurelwood Park, report a wind, rain, and hailstorm at 5:25 p. m. from the southwest. First, there was a cold gust from the northwest, and then the wind veered to the southwest. Is it possible for a stratum of cold dry air to get in between an upper and lower rain cloud and freeze the rain from the upper cloud while falling through the cold dry stratum, if such a stratum be between 800 and 2,500 feet deep? I should like an opportunity to let water drops fall from some very high building and observe how great a falling distance and how low a temperature of the air is required to produce hail. The downward rush of cold air displacing the hot air at the surface of the ground appears to account for the peculiar crushing and pushing of the wind in the storm at Laurelwood.

Approximate calculations of the power of cold rain and hail to cool the air and cause it to descend are said to show that only gentle winds can be formed in this way. The Editor hopes that well-devised experiments may be instituted in order to test these calculations. The subject is too difficult and too important to meteorology to be settled by crude estimates.

THE POSTAL TELEGRAPH CLOCK AND WEATHER BULLETIN.

According to the Electrical Engineer of September 2, the Postal Telegraph Cable Company is in cooperation with the United States Time and Weather Service Company of New York, and is making rapid headway in the establishment throughout the city of tall handsome clocks which shall exhibit standard time, not only by the face of the clock but by the dropping of a time ball at noon, so that "Postal Time" is already becoming a standard well-known phrase. These clocks have been set up already in many western cities also, and will undoubtedly meet a popular want.

The clock is within a case about 18 feet high, which is surmounted by a short staff supporting a wind vane, and down which a gilded ball drops about 3 feet each day at noon. Over the clock dial is the name of the "Postal Company." Under the dials are large panels about 18 by 63 inches, which are filled up with local and special advertising. Beneath these are smaller panels which give each morning the latest Weather Bureau reports and forecasts two or three hours be-