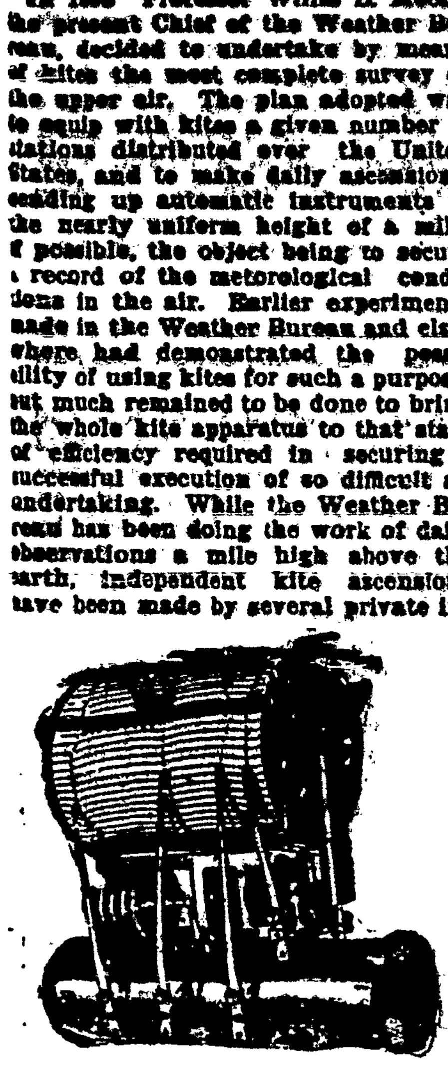
SURVEY OF THE AIR.

THE U. S. WEATHER BUREAU'S WORK OF DAILY OBSERVATIONS.

Kites That Are Used to Survey the Upper Air—How They Are Controlled at an Elevation of 7,000 Feet—The Wonderful Meteorograph.

In 1895 Professor Willis L. Moore, the present Chief of the Weather Bureau, decided to undertake by means of kites the most complete survey of the upper air. The plan adopted was to equip with kites a given number of stations distributed over the United States, and to make daily ascensions, sending up automatic instruments to the nearly uniform height of a mile, if possible, the object being to secure a record of the meteorological conditions in the air. Earlier experiments made in the Weather Bureau and elsewhere had demonstrated the possibility of using kites for such a purpose, but much remained to be done to bring the whole kite apparatus to that state of efficiency required in securing a successful execution of so difficult an undertaking. While the Weather Bureau has been doing the work of daily observations a mile high above the earth, independent kite ascensions have been made by several private in-



The Meteorograph.

dividuals, the most important of which in the United States are the ascensions made at the Blue Hill Observatory, near Boston, under the direction of A. L. Rotch. The results from a single station of this sort serve to show only the change in atmospheric conditions as the kites pass up or down through successive strata; or, if the kites are kept continuously at a fixed elevation, the observations show the change in conditions from hour to hour.

In Europe small balloons, equipped with automatic instruments, have been cast free from time to time, and have ascended to great heights before losing their buoyancy, when, slowly falling to the ground, they have thus brought back records of the conditions at extreme heights in the atmosphere which never were reached before. Lately European meterologists have employed both kites and balloons for atmospheric explorations, so that we may fairly say that now kites no longer are toys only, but are highly valuable pieces of scientific apparatus, the use of which no doubt will be extended greatly soon.

The modern scientific kite is a far more efficient structure than any of the well-known toys, but its construction is correspondingly complicated, and, in most cases, somewhat more than the average mechanical skill and facilities are required to build one. The illustration of the kite printed herewith is taken from a photograph of one of those used by the Weather Bureau in its aerial work. The oval object seen suspended between the cells is the automatic instrument which produces the desired record. This kite contains nearly seventy square feet of supporting surface, and in a strong wind will exert a pull amounting to from sixty to one hundred pounds and over. Of course, such a kite cannot be flown and managed directly from the hand. The line is carried upon substantial reeling apparatus, which, in turn, is anchored securely to the ground.

One of the hand reels employed at kite stations has a large drum, containing between two and three miles of fine steel piano wire, joined in one length. The greater part of this often is carried out by the kite in making a high ascension. This wire is the lightest, and, relatively, the finest and strongest material known for the purpose. The size used is about the thickness of an ordinary pin, and yet it has a tensile strength of 200 pounds. The box containing the reel revolves upon the table beneath, thus permitting the wire to lead off to the kite in whatever direction it may take.

The unwinding of the wire under the pull of the kite is controlled perfectly and easily by a brake. A spring attached to one of the crank handles enables the pull of the kite, in pounds, to be determined. Certain dials arranged on the axle of the drum give the amount of wire out to the kite, and, finally, the inclination of the wire is shown by means of a graduated arc and radius rod over the drum.

A matter of great importance in the construction of a kite reel is to secure sufficient strength in the rim to withstand the enormous cumulative pressure exerted by a large amount of wire wound in under great tension. A single turn of wire around the drum under a uniform strain of fifty pounds, for example, tends to produce a compressive stress of fifty pounds at every point around the rim. The next turn, at the same tension, adds fifty pounds to the preceding stress and so on. Two thousand turns at his rate, therefore, will produce a pressure of 100,000 pounds, or 500 tons. The heavy rim of the cast iron drum is calculated to resist a crushing pressure of 1,000 tons.

In actual practice the crushing pressure is not so great as that calculated by the process, because the material of the reel yields a little as the pressure increases, and this lessens the tension on the turns of wire already wound on the drum. The side flanges of the drum must also be strong, as the wire crowds sidewise against these with great force. It is best on this account not to wind the wire on in smooth and even layers, but rather to crisscross the turns of wire slightly, but in a regular manner. Wound in this way, the wire tends to support itself, even without side flanges; at any rate, the lateral pressure is greatly reduced, and, moreover, the outside turns of wire are not able to squeeze down through what is already wound on the reel, as they tend to do when the wire is wound in an even manner like thread on a spool.

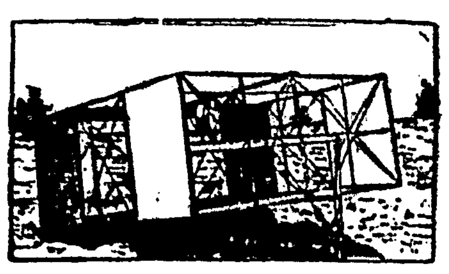
When flying at an elevation of from 5,000 to 7,000 feet one of the Weather Bureau kites, supporting its instrument, will pull from sixty to eighty pounds, if not more, and from 8,000 to 10,000 feet of wire will be out. To wind all this wire in under such conditions is laborious, and usually requires two men at hard work for from a half to three-quarters of an hour.

In a favorable wind the tension on the line is more than sufficient to unwind the wire, and the ascension of the kites is controlled by the lever projecting upward at an angle in the rear of the drum. This operates the strap-iron brake fitted around the flange of the drum, and a gentle pressure regulates the speed of the drum or to stop it completely even when the wire is under the greatest tension.

The Meteorograph.

The instrument sent up with the kite to secure the automatic record of the conditions of the air is called a meteorograph. It is a complicated and remarkable affair, and, withal, light, weighing only about 2.1 pounds. The instrument is shown in the cut of the kite, inclosed in its light aluminum case. The larger illustration shows the mechanism inside the case. The sheet on which the record is produced is wound around the cylinder seen at the bottom of the figure. A clockwork inside the cylinder causes it to revolve at a slow and uniform rate of one revolution in twelve hours. Four different meteorological conditions are recorded by the four pens of this instrument. The pen on the right traces a line on the paper which shows the humidity of the air, the pen being actuated by a strand of human hairs stretched inside the long tube seen at the top of the figure. These hairs lengthen when subjected to moist air and shorten in dry air. The next pen toward the left traces a line upon the record sheet which shows the pressure of the air, the pen being actuated by the gang of five round, thin objects seen between the pressure and humidity pens in the figure. The next pen traces a line showing the temperature of the air, which acts upon a special form of thermometer contained within the long tube at the top. When the instrument is attached to the kite the wind blows directly through this tube, thereby acting strongly upon both the thermometer and the hair hygrometer inside.

The pen at the extreme left is designed to record, electrically, the velocity of the wind. For this purpose a small anemometer, not shown in any of the illustrations, is fixed to the kite and connected to the instrument by wires. The pen makes little marks on the record sheet corresponding to every two miles of wind movement.



The Kite.

The great importance in meteorological studies and weather forecasting of such observations as can be obtained by means of kites is apparent. These give the conditions prevailing in the free atmosphere, often in and above the clouds themselves, at points far removed from the disturbing effects of great cities, forests, the earth's surface, etc. In fact, observations thus obtained are characteristic conditions of great masses of the atmosphere, and when determined regularly and completely they afford far more exact and probably earlier indications of important forthcoming atmospheric changes than the most elaborate observations taken at the surface. The tops of our highest buildings, after all, are only an insignificant distance up in the free air, and all surface conditions always are modified as a result of the actual contact of the air with the earth and the immediate effect of the latter upon adjacent portions of the air.

Dead Letters of the Law.

The ordinance requiring lamps on all vehicles after dark is dead and alive in New York.

The law against stuffing apartment-house mail-boxes with advertising circulars is wholly a dead letter.

The ordinance forbidding the obstruction of fire-escapes is dead most of the time, and the lives of people pay the penalty.

How much easier it is to pass new laws than to keep up the vitality of old ones.

Launching a Japanese Ship.

The Japanese apply one of their many pretty ways to the launching of ships. They use no wine, but hang over the ship's prow a large pasteboard cage full of birds. The moment the ship is afloat a man pulls a string, when the cage opens, and the birds fly away, making the air alive with music and the whirr of wings. The idea is that the birds thus welcome the ship as she begins her career as a thing of life.

Increase in Post Offices.

There were 903 post offices in 1800; to-day we have 75,000—that is, in America alone. It took a letter sixteen days to go from Philadelphia to Lexington, Kentucky; twenty-two days to Nashville, Tennessee. The cheapest letter postage was eight cents, and to send a letter more than a hundred miles cost a shilling. Three million letters and papers were then sent in a year; at the present time the post office handles about 30,000,000 pieces of mail in a single day.—Ladies' Home Journal.

From one end of Japan to the other a child is treated as a sacred thing, be it one's own or a stranger's. Each one carries its name and address on a ticket round its neck; but should it indeed stray from home, food and shelter and kindness would meet it anywhere.

ANCIENT COPYBOOK.

Made of Papyrus and Used by Egyptian Schoolboy Long Ago.

Every boy and girl who thinks that arithmetic is a recent invention devised to punish children in this day are mistaken. Arithmetic is an old study. The Philadelphia Record tells about a remarkable discovery in Egypt.

Probably the oldest copybook for home lessons in arithmetic was recently unearthed in Egypt. The papyrus, which was found in excellent condition dates from the period about 1700 B. C. —that is, about 100 years before the time of Moses, or almost 3,600 years ago. It proves that the Egyptians had a thorough knowledge of elementary mathematics almost to the extent of our own. The papyrus has a long heading: "Directions how to attain the knowledge of all dark things," etc. Numerous examples show that their principal operations with entire units and fractions were made by means of addition and multiplication. Subtractions and divisions were not known in their present forms, but correct results were obtained nevertheless.

Equations are also found in the papyrus. Among the examples given is this one: Ten measures of barley are to be divided among ten persons in such a manner that each subsequent person receives one-eight of a measure less than the one before him. Another example given is: There are seven men, each one has seven cats, each cat has eaten seven mice, each mouse has eaten seven grains of barley. Each grain of barley would, if cultivated, have yielded seven measures of barley. How much barley has been lost in that way?

The papyrus also contains calculations of area, the calculation of the area of a circle, and its transformation into a square, and finally calculations of the cubic measurements of pyramids.

THE BAD BOY.

His hair is red and tangled, and he has
a turned up nose;
His voice is loud and strident, and it
never gets repose;
His face is full of freckles, and his ears
are shaped like fins,
And a large front tooth is missing, as
you'll notice when he grins.
He is like a comic picture, from his
toes up to his head—
But his mother calls him "Darling"
when she tucks him into bed.

It is he who marks the carpet with
the prints of muddy boots,
And rejoices in a doorbell that is
pulled out by the roots,
Who whistles on his fingers till he almost splits your ear,
And shocks the various callers with
the slang he chanced to hear,
He fills the house with tumult and the
neighborhood with dread—
But his mother calls him "Darling"
when she tucks him into bed.

—Washington Star.

What a Boy Can Do.

Here are some of the things a boy can do:

He can whistle so loud the air turns
blue,
Make all the sounds of beast and of
bird,
And a thousand noises no one ever
heard;
He can crow and cackle, and also
cluck,
Just like a rooster, a hen or a duck;
He can bark like a dog, low like a
cow,
And a cat itself can't beat his
"me-ow."
He can roar and puff like a railway
train,
Whistle down brakes—then be off
again;
And with the vocal powers at his
command
He can make of himself a full brass
band,
And with all the instruments ever
played,
He is the whole show and a street
parade.
It's a pretty sure sign that a boy is
ill
If he's wide awake and is perfectly
still.
But earth would be minus half of its
joys
And a dreary old place were there
no boys.

A Bit of Natural History.

How many of our young readers know that a sponge is an animal and that the soft, squeezable straw colored mass that we call the sponge is nothing but the skeleton? In its natural state as it grows in the water the many holes of the skeleton sponge are filled with a jelly-like substance, which is the flesh of the animal. The smaller pores of the sponge are the openings by which the living sponge draws in water, and countless streams are continually flowing through every part of it, bringing in little particles of food and all the necessary air for breathing purposes.

It is very curious the way these sponges eat. When a bit of food comes in contact with any part of its body the jellylike substance sinks in, forming a little hollow, into which the food drops, and then the jelly completely covers it over and absorbes it.

All the best sponges come from the Mediterranean and Red Seas. Divers are sent down in search of them, and they are carefully cut with a knife from their resting place. The Turks, who have control of most of the trade, have something like five thousand men employed at this work, and the value of the product amounts to about $100,000 a year.

There has been some fear that the demand would outgrow the supply, and experiments are being made to artificially force the sponge growths.

The Duchess of Northumberland possesses the most remarkable shawl in the world. It is made entirely from the fur of Persian cats, taken from the skins of thousands of pussies. The shawl is eight yards square and is so fine and soft that it can be compressed into the space of an ordinary coffee cup. It was formerly the property of Charles X of France and it is said that the weaving of it took several years.

"WEEDS"

Bad Habits May Be Considered as Troublesome Sorts.

My dear Nephews and Nieces.—

You will probably think "weeds" a rather commonplace and uninteresting subject, yet it is about them that I wish to chat with you to-day. But what is a weed? A definition I once heard was, "A weed is a flower growing out of its sphere," and I thought it very appropriate. When we find some plants of clover in our flower beds we call them, in common with other undesirable plants, "weeds," yet in another case we would not dream of bestowing on them such an appellation. Again, the same title would be unhesitatingly bestowed upon some of our garden favorites if found by the careful farmer growing among his grain. Then, many plants that have become so troublesome in this country are in other places carefully cultivated as valuable additions to floriculture. The common mullein that infests our pastures and highways is quite an aristocrat in England, where it rejoices in the name of American Velvet Plant. On the other hand, the beautiful flowering cacti that adorn our windows and greenhouses grow wild in many parts of the States, where they attain an enormous size, and with their dreadful thorns prove very troublesome. In the Scandinavian Peninsula our much-loved pansies revel in freedom o'er hill and dale, and are not highly valued, while we have to work a little to procure them. Thus we see the truth of the definition above quoted. There are, unfortunately, more weeds in the world than those that take root in the earth—weeds of an infinitely more dangerous character—human weeds, creatures whose low sense of honor and lack of moral principles do not mean to deal, although, to carry the plant simile further, might not even these be improved if given such care and cultivation as a skillful florist bestows upon his seedlings? Perhaps, too, we designate as "weeds" many who deserve a better name, the fault being in our failure to appreciate their worth.

Bad habits may be considered as troublesome sorts of weeds, very difficult to exterminate. Once I was given a young plant, supposed to bear beautiful flowers. I tended it carefully, it flourished abnormally, and in course of time buds appeared. How I watched for the first flower! Imagine my disappointment at finding it not merely insignificant, but very like a bad weed often seen growing by the roadside. I dug it up immediately, but the roots seemed to have penetrated everywhere, and it was only after considerable work that I felt satisfied that I had got rid of it. After some time fresh shoots appeared that required similar treatment, but by untiring vigilance I succeeded in eradicating them.

If when we find some unlovely habit growing upon us we took just such vigorous steps to root it out, we should certainly overcome it. True, the roots may be far-reaching and possessed of almost unlimited vitality, but persistent effort will conquer these difficulties; and some wise person has said if we free ourselves from one fault every year we shall in time become perfect. All seasons are suitable for weeding of this kind, so let us examine our mental gardens, find the most troublesome plant therein, and forthwith exterminate it. Not only this must we do, but if we would not be classed with the "weeds," we must also confine ourselves to the sphere to which we belong.

Your loving Uncle Tom.

Nursery Rhymes.

A silly little fish
Once made a foolish wish:
That he might dress like little girls
and boys;
And then his wish came true—
He got a hat bran new—
And a little dress filled his heart
with joys.

Not having any legs
He used his fins for pegs,
Which made him move so slowly,
you may guess,
That when he heard a shout:
"Here's a fish that walks about!"
It scared him so he tore his fine
new dress.

Good Housewives See That:

The dish towels and glass linen are scalded each day and thoroughly washed and ironed each week and dried in the open air.

Cupboards and store rooms are overhauled at least once a month.

Every penny spent be accounted for in a book kept for that purpose.

All dusters are hemmed and regularly washed.

The draughts are checked in the kitchen range as soon as the meals are prepared, to reduce the coal bill.

The beds are stripped and aired daily, and the clothes placed where the fresh air can reach them.

A regular routine of daily work be planned and carried out.

The servants' room be kept as neat and clean as any room in the house.

Old rags are not used in the housework, but suitable cloths provided.

Watering House Plants.

The best and most satisfactory method of watering ferns and plants is to put the pots in a pail of water not quite cold from the tap, but just lukewarm; do not remove them from the pail until they have ceased bubbling. The leaves should be washed once a week with a sponge and tepid water. It is a good plan to wash the leaves of palms with milk-warm water in which a very little soft soap has been dissolved; they should be washed on both sides, then wipped over with a sponge dipped in clear water.

THE TRAVELS OF COLUMBUS.

In the winter of 1491, as the army is about to depart upon its final campaign, Columbus demands an immediate decision.

FIND MESSENGER WHO BEARS COLUMBUS' DEMANDS.

THE TRAVELS OF COLUMBUS.

De Talavera again calls the conference together by royal command, but reports to their majesties that this second conference rejects the schemes of Columbus as wild and impossible.

FIND TWO HIDDEN OPPONENTS OF THE [illegible]

THE TRAVELS OF COLUMBUS.

Their majesties refuse to consider the verdict of the second conference as final, and decide that at the conclusion of the wars they will confer again with Columbus as to his project.

FIND TWO HIDDEN ROYAL ADVISERS.

THE TRAVELS OF COLUMBUS.

Columbus in anger [illegible] feeling that after [illegible] waiting he has been [illegible]

FIND TWO STRANGERS [illegible]