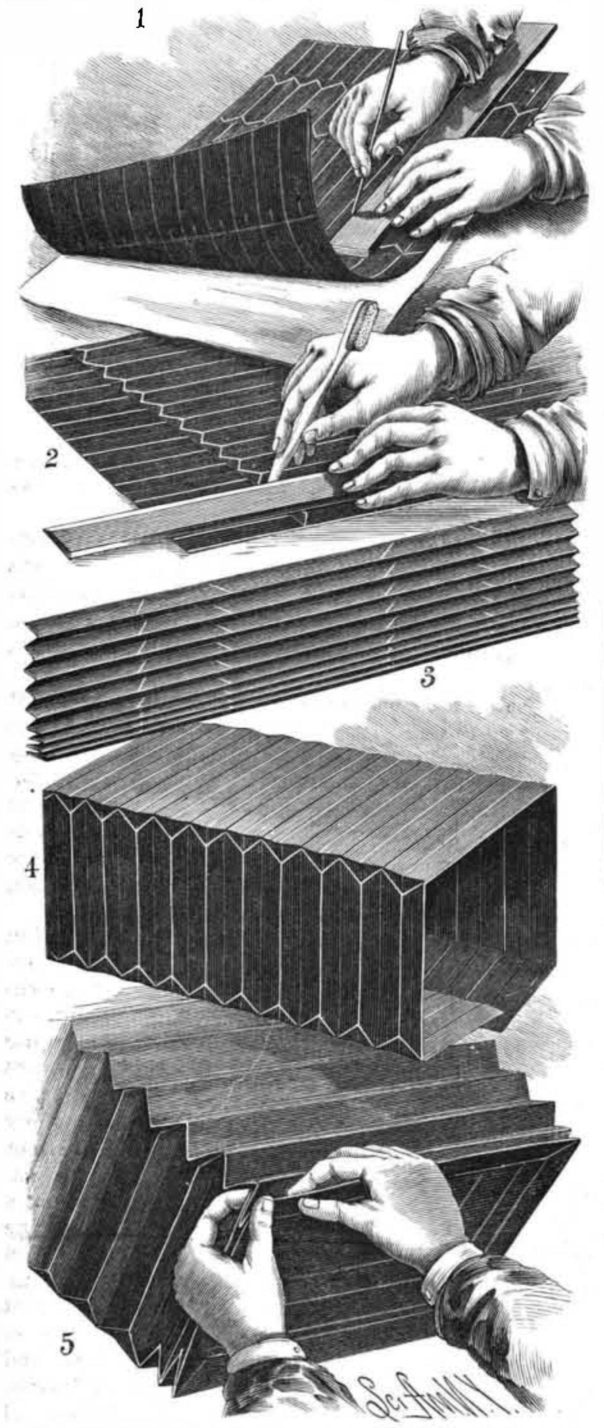
HOW TO MAKE A CAMERA BELLOWS.

In manufacturing photographic apparatus on a large scale, as is now necessary to meet the rapidly increasing demands of the amateur and professional photographer, very little care is taken by some manufacturers to critically test the light-tight qualities of each camera and bellows. Hence it happens that the purchaser sometimes finds, after careful trial, that he has obtained a faulty instrument, which, in these days of quick plates, is especially aggravating. A tight bellows is the most important feature about a modern camera, and it will be the purpose of this article to describe how one can be easily made. Leather, in some countries, is preferred to any other material, but the inferior qualities frequently used for the purpose are affected by moisture and become brittle, and will break at the corners in a short time. Rubber-coated cloth is largely used, on account of its imperviousness to moisture, but has the disadvantage of softening and sticking in a prolonged heat, particularly when the air is very humid, as it sometimes is in the United States, which results in the formation of minute interstices in the cloth support, through which the light



Figs. 1 to 5.—CREASING AND FOLDING THE BELLOWS.

will leak. Besides this, it is heavy and will break at the corners.

Mr. Edward Bierstadt, of this city, formerly an amateur photographer, noticing the several weak points in camera bellows, concluded to try paper as a substitute for the above named materials, which proved to be so satisfactory after ten years' use that he has now adopted it exclusively. For large sized bellows a heavy grade of the best calendered Manila paper is advised, since it is tough and pliable, but for small cameras a Japanese paper, commonly called "Japanese leatherette,' should be used, as it is remarkably tough, and is a perfect imitation of leather.

By using black paper the blackening of the inside of the bellows may be omitted.

Two forms of bellows, either straight or conical, as to their length, may be made, but that of the straight shape is the easiest to make, which we will first describe.

It is advisable that a model of the bellows be first planned out on a thin sheet of paper, then creased and folded, in order that one may become familiar with the peculiarities of the folds and the way of folding.

In calculating the size of the sheet required for a given length of bellows, allowance must be made for the extra length taken up by the folds. If a bellows is to be constructed for a camera adapted for 5 × 8 pictures, and it is desired that it have a stretch of fifteen inches, a sheet of paper 29 inches long by 15 inches wide should be selected. For this purpose we recommend a black leatherette paper, to be had from manufacturers of book binders' materials.

A yellow pencil should be used, so that its mark may be easily traced on the black paper, and a sheet of transfer paper, with one side rubbed over with chalk, as large as the bellows sheet, should also be provided.

The principal points to be observed in planning the bellows is to calculate where the outside and inside folds will come and what portions of such folds are to be creased from the inside and outside.

To ascertain these several positions on a flat piece of paper and properly locate them, so that the folds will all come together in unison when the bellows is formed, is the problem one has to first study.

Diagram A illustrates the method of outlining the sheet with measurements for a 5×8 bellows. The sheet, being bent around in the direction of its length to form the bellows, requires that the lines representing the four angles of the bellows be drawn at right angles to the line of the folds, or parallel with the shortest length of the sheet. Two parallel lines are first drawn, 8¼ inches apart, equally distant from the center of the sheet, at right angles to its longest length. Then 5½ inches equidistant on the outer side of these lines two other parallel lines.

These four lines represent the extreme four corners of the bellows, which, for convenience, we will call corner lines. They are creased from the inside. The bottom side of the bellows is divided, and an allowance is made for the lap. As the width of each side of a fold of the bellows is to be ¾ of an inch, we next proceed to draw parallel lines, ¾ of an inch apart, across the longest length of the sheet, as shown by the heavy lines in the diagram, commencing ¾ of an inch from the edge. These represent where each fold is to be made, which we will term fold lines.

To find where the corner folds are to come, we next draw four lines, parallel with the first four corner lines, two of which are ¾ of an inch distant from the outside of the two center corner lines, and the other two ¾ of of inch distant inside of the two outer corner lines. When so drawn, we have a series of ¾ inch squares made with respect to the corner lines and fold lines, the squares lying toward each other, on each side of the corner lines. Starting from the edge of the sheet, we now intersect each square with a diagonal line, carrying it outward from the two center corner lines and inward from the two outer corner lines. In the second square the reverse direction is taken. Thus we find the proper location of the corner folds by intersecting all the squares.

Having laid out the location of the folds, the next step is to ascertain which lines are to be creased from the outside and which from the inside of the bellows. Those to be creased from the inside are indicated by open or double lines in the diagram, while the heavy lines are to be creased from the outside.

Fig. 1 in the large engraving shows the manner of transferring the lines to be creased on the inside to the underside of the black sheet. The latter is laid upon a sheet of chalked paper, and with a rule and metal point the double lines drawn on the upper side of the sheet are run over. The pressure of the point is sufficient to leave a distinct white line on the under side of the sheet.

Fig. 2 illustrates the way the lines are creased, which may be done by drawing and pressing the point of a tooth brush handle or a carpenter's square lubricated with paraffine wax over the lines. First the side intended to form the outside of the bellows is creased, then the other side.

The sheet is folded up, after creasing, as shown in Fig. 3, and tightly compressed, which gives the folds a

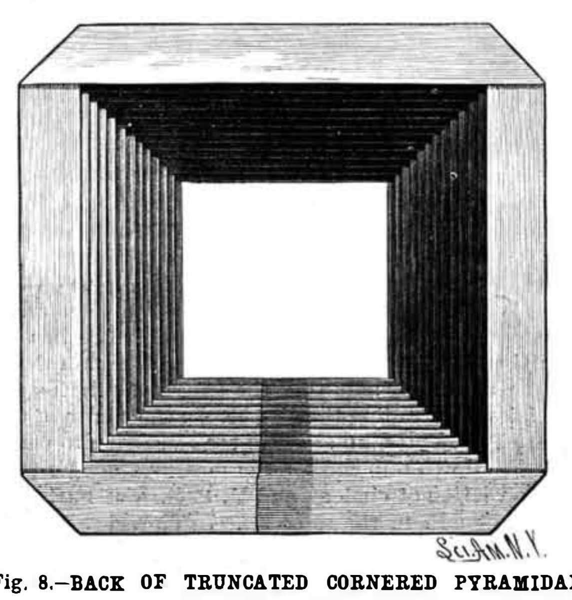


Fig. 8.—BACK OF TRUNCATED CORNERED PYRAMIDAL BELLOWS.

definite, fixed form. The sheet is next drawn out flat and folded transversely to its length at the four corner lines, as shown in Fig. 4, and the lap of a quarter of an inch at the bottom is cemented by glue or mucilage. A simple way to glue the joint is to first secure one

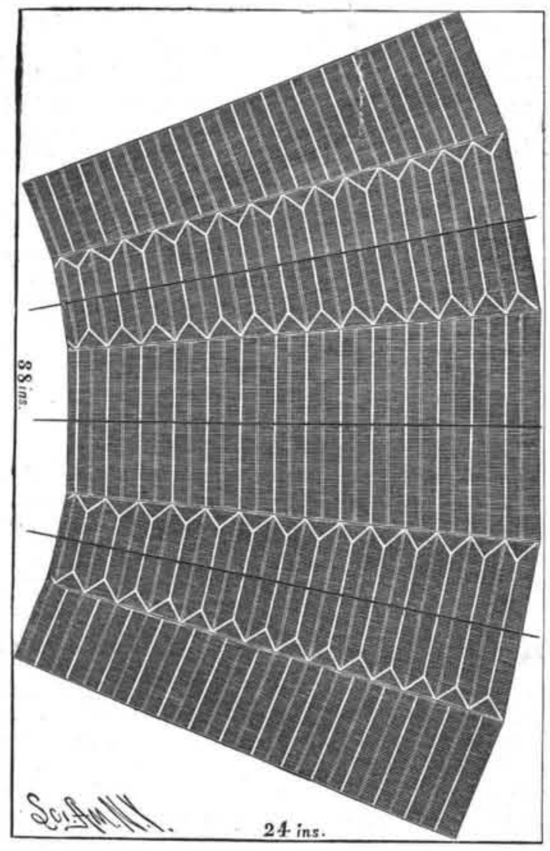


Fig. 6.—PLAN OF AN 8×10 TRUNCATED PYRAMIDAL BELLOWS.

end of a long, flat stick in a vise and then slide the bellows over it, allowing the lap to rest on the stick. A slight rubbing pressure on the paper will bring the previously glued surfaces into close contact and make a permanent light-tight joint. When the joint is perfectly dry, then the bellows is formed, as shown in Fig. 5, by commencing at the corners, and gradually crump-

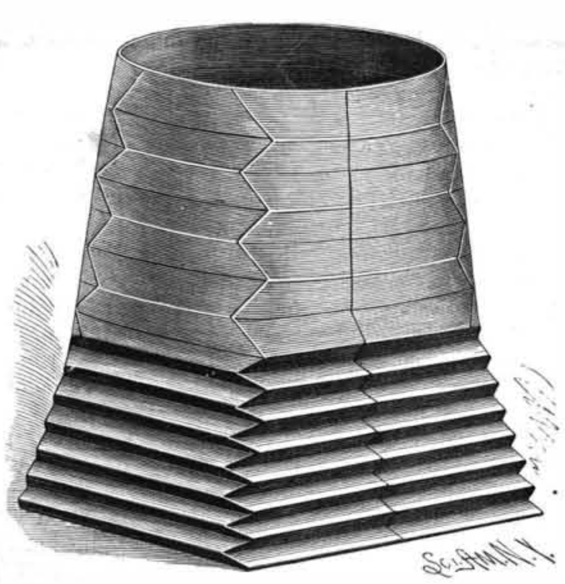


Fig. 7.—TRUNCATED CORNERED PYRAMIDAL BELLOWS.

ling and bending in the creased portions, continuing the manipulation on each corner of each separate fold one at a time. It is surprising to notice how readily the folds harmonize in with each other, provided the sheet has been carefully creased. To render the bellows waterproof, it is varnished on the outside with two coats of shellac varnish. When secured to the front and rear frames of a camera box, we have a waterproof non-crackable bellows which is absolutely light-tight, tough, and capable of being very compactly folded up. If light-colored paper is employed, the interior of the bellows should be blackened with a varnish composed of shellac and lamp black. If the shellac is dissolved in water, borax or ammonia must be added to make the shellac dissolve.

In making a truncated pyramidical shaped bellows, the plan of laying out the lines for creases and folds is quite similar to that previously described, with the exception that special compensation for the gradual tapering of the bellows has to be calculated for. The width of one-half of the folds is proportionately narrower than the other half.

In Fig. 6 is seen the plan of an 8×10 bellows, in which the solid white lines represent the crease lines for the sunken folds on the outside of the bellows, and the double lines the crease lines for the under or inside folds. The size of sheet required is 24×38 inches.

We first draw a center line in the direction of the length of the bellows, then, supposing the back of the bellows to measure 10½ inches, and the front end 6¾ inches in width, we lay off half of this measurement on each side of the center line and connect the ends of the two front and back cross lines. These oblique lines form the two upper radial corner lines of the bellows.

Supposing the sides to measure 8½ inches wide on the back and 4¼ inches on the front or small end, we divide the distance at each end and locate the side center lines (see Fig. 6). From these we determine the location, by measurement, of the two lower radial corner lines of the bellows. The bottom of the bellows is then divided, and one-half added to each side of the

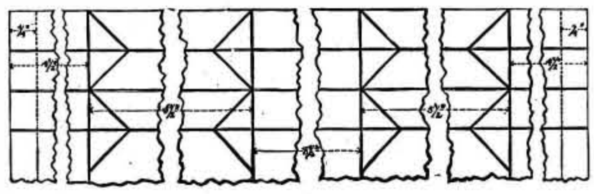


DIAGRAM A.—MEASUREMENTS FOR A 5×8 BELLOWS.

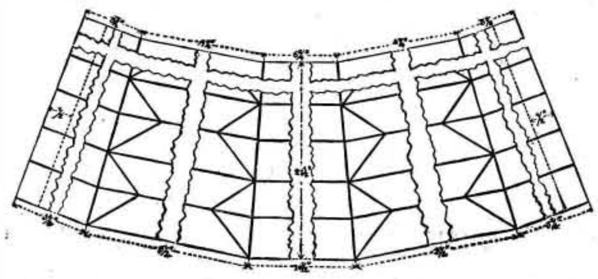


DIAGRAM B.—PLAN AND MEASUREMENTS FOR AN 8×10 BELLOWS.

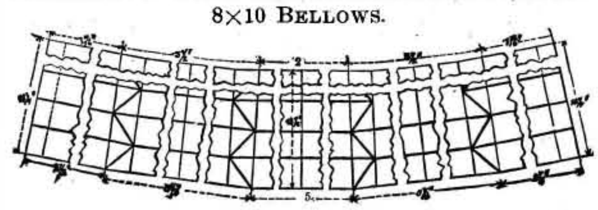


DIAGRAM C.—MEASUREMENTS FOR A 4×5 TRUNCATED CORNERED BELLOWS.

sides of the bellows, an extra length of ½ an inch being allowed for the lap or joint.

The crease lines for the cross folds are next determined, by first dividing off on the respective center lines in equal distances the width of a double fold, which may be about 1½ inches. The measurement should commence from the wide end and proceed toward the small end. Cross fold lines are then drawn between the four radial corner lines in each section, at right angles to their respective center lines, and will meet each other, producing a shape similar to a portion of an octagon. The next step is to locate the position of the intermediate fold. This is done by laying the base of a draughtsman triangle on the base line, or back of line, and drawing a line at 45 degrees inward from the intersection of the corner line with the back line, nearly across the fold, then by reversing the position of the triangle, so that its base is coincident with the next fold line, and drawing another diagonal line at 45 degrees inward from the intersection of the fold line with the radial corner line to where it will cross the other diagonal line. Where they meet will be the proper location of the intermediate fold line. This will be the same for all the intermediate folds. The points for these lines should then be located on the center line, and they should be drawn parallel with the other fold lines between the two center corner lines. Each side of the bellows is measured off in the same way. The corner folds are located precisely as in the case of the rectangular bellows, by drawing lines ¾ of an inch distant from the corner lines parallel with the latter, and crossing the squares so formed by diagonal lines, which represent the zigzag lines of the corner folds. Fig. 6 and Diagram B show positions of these lines. The double lines are to be creased from the inside.

One slight objection to this form of bellows is that it is liable to stick and not to freely expand. Hence Mr. Bierstadt has devised a simpler shape, in which the corners of the folds are truncated. This form is clearly shown in Figs. 7 and 8.

The bellows, by its peculiar construction, may be folded up more compact than any other, and at the same time is so elastic and springy that its folds do not in the least adhere or stick to each other. In Fig. 7 we see the conical shaped sheet after it is creased and cemented, in the process of being changed from the round to the square shape. After the flat sheet is creased, its ends are glued together, which forms a truncated cone. Then it is compressed at the creases into folds, as shown in Fig. 5.

Fig. 8 shows the peculiar corner fold of this bellows, the joint at the bottom, and its compact form when compressed.

Diagram C shows the plan and measurements of a bellows adapted for a 4 × 5 camera, as shown in Figs. 7 and 8.

The special difference in creasing from that shown in Fig. 6 and Diagram B is in the corner folds, which is explained more clearly by referring to Diagram D.

Supposing the inside measure at the back to be 5 in. and at the front 3 in., we locate a center line, C, and lay off the side corner line, D, as heretofore stated. We then divide the center line into inches, and draw lines parallel to A, extending them on each side as far as side line, D. We next determine the position of the intermediate line, I, by deducting from half the distance between E and A the amount of space between G and H, obtained by dropping a line from the intersection of fold line, E, with corner line, D, to the base line, A, the said line, E F, being parallel with the center line, C. Just here is an important difference. Instead of stopping the intermediate line, I, at the corner line, D, we extend it to point, J, or a distance beyond the perpendicular line, I F, equivalent to the space between I and F or between E and I. We then draw the line, J, parallel with corner line, D, and have a guide where to draw the zigzag line, since the intermediate lines like I extend to line, J, and the inner fold lines, like A and E, to line, D. By drawing a diagonal line from H to J across the square, K, and from J to E across the square, L, we have the proper location and angle for the corner crease lines. From the point H, we measure off half of the width of the inside of the intended side of the bellows. Draw a center line perpendicular to its base, and measure off on that the position of the fold lines as described for the top of the bellows. It will be seen that on the sides of the bellows the intermediate lines stop at line, J, while the other fold lines cross the line, J, and meet at E. By this method a curious skew shape of the cross lines, especially between lines, D and J, is observed, but is necessary in order that the folds may come out in unison.

A bellows constructed after the above plan presents a very neat and light appearance. It requires a little more paper, but is, by reason of its elastic qualities, almost self-acting. It should be remembered that the use of dividers must be avoided, since the slightest puncture in the paper will damage the bellows. Working plans of the different forms of bellows will shortly appear in the SCIENTIFIC AMERICAN SUPPLEMENT.

SARGENT'S PALM. (*Chamœphenix Sargentii.*)

For many years the royal palm held court as a small family of nobility on the southernmost extremity of southwestern Florida, at Cape Sable. These few examples were all that were known to belong to the United States, as a native growth. The small grove was a place of resort for lovers of the curious and interesting in nature, but the vandal hands of some of the too rapidly increasing bands of hunters and tramps long since carried off every vestige of the wood from these beautiful vegetable forms.

It was with great pleasure that we learned from Mr. Monroe, of Staten Island, that he had discovered several of the grand trees on a piece of timber which he had purchased near the Miami River. Mr. Monroe was an early purchaser in this region, and adds to his enterprise in planting the new lands near the Everglades considerable scientific and æsthetic skill. He

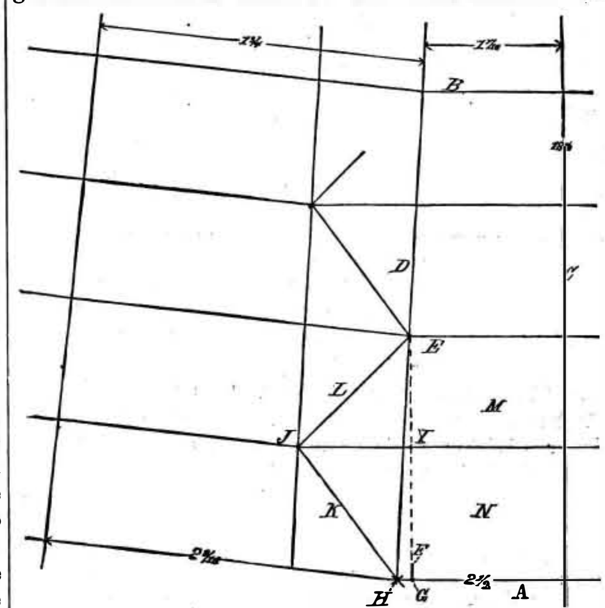


DIAGRAM D.—PLAN OF TRUNCATED CORNERS.

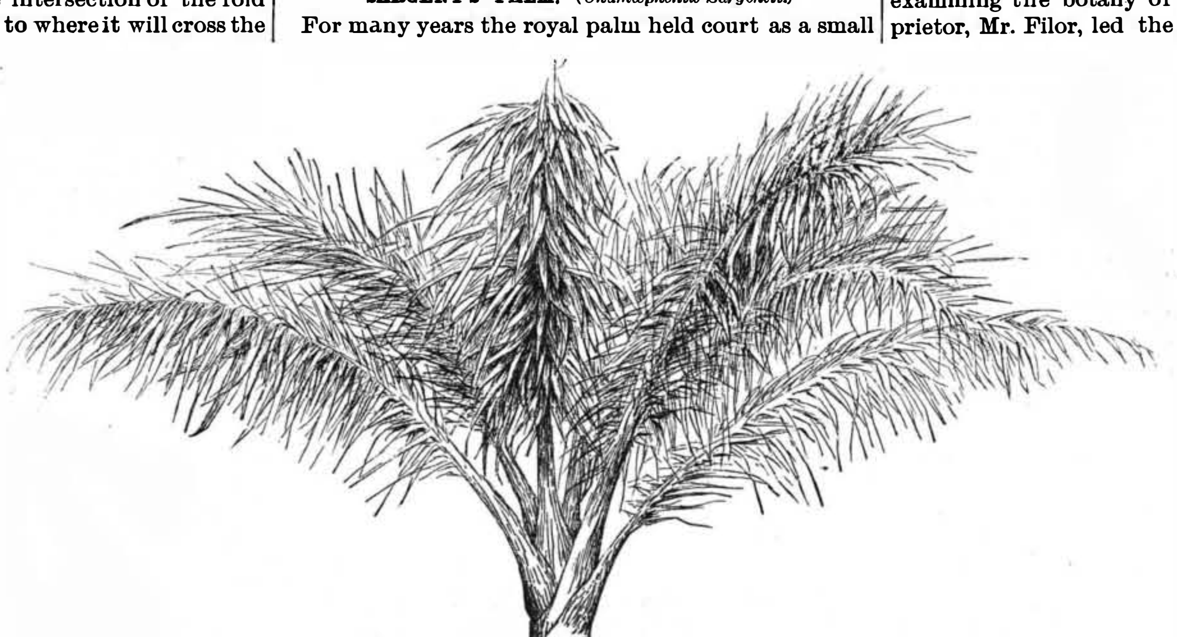
penetrated the thickets in all directions, and with photographic implements in hand he secured the pictures of all notable objects.

It was with surprise that he came upon several handsome palms, differing wholly from those which are familiar to the visitor there. He readily decided that they were royal palms, yet their low and outspreading foliage struck him as differing from those glorious trees.

The habitat of these palms is so difficult of access, it is scarcely strange that they have never before been seen. Elliot's Key is another and more recent locality of these palms, lying about eight miles off the southeastern coast of Florida, forming with Arsenicker Keys the southern boundary of Biscayne Bay. The island is about seven miles long and about a half mile wide. Here the very successful experiment of raising pineapples is being repeated with profit.

In 1886 Prof. Sargent, of Cambridge, was engaged in examining the botany of the region. Here the proprietor, Mr. Filor, led the party to what was considered a group of young royal palms. On observing the fruit, which was not fully matured at the time, it showed plainly that it was of a distinct species, and new to science. As there are about a thousand species of the palms, their identification is not always easily accomplished. Prof. Sargent sent a specimen of this tree, in the form of its fruit and some other essential parts, to Prof. Wendlandt, of Germany, who has great facilities for the study of such plants. It was found that the newly discovered tree was not only different in species, but in genus also. Hence the Professor has named it *Chamœphenix Sargentii.* The first or generic name denotes its resemblance to the date palm.

Prof. Sargent first visited these trees in April, when the fruit was not yet ripened. He thinks that the tree flowers in September, and that the fruit ripens in June—when it is about the size of children's marbles. The fruit is borne mostly in twos and threes, the thin, smooth pericarp incasing one, two, or three spherical nuts. The ber-



A NEW PALM—SARGENT'S PALM (CHAMŒPHENIX SARGENTII).