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Every Snowflake a Unique Jewel

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METEOROLOGY

# Every Snowflake a Unique Jewel

**In Over Forty Years of Photographing "the Faery Daughters Of King Boreas", Wilson Bentley Never Found Two Alike**

**By FRANK THONE**

**U**P IN THE mountains of Vermont, where the winters are long and the snow falls frequently, there died a few weeks ago, a quiet, retiring man who was the world's foremost snow artist. His name was Wilson Bentley. He was not one of the numerous tribe of Michelangelos of melting marble, whose snow sculptures get into the newsreels and rotogravure sections. His was a far more difficult art, for it dealt with single flakes rather than great lumps of matted snow; yet though it dealt with single flakes it was a more permanent art than the efforts of these gravers of the earth's most impermanent plastic.

For Wilson Bentley made photographs of snowflakes: he was *Portraiteur* to Their Highnesses, the faery daughters of Old King Boreas. For more than forty years, he let the winds of the world bring beauty to his humble doorstep on a small farm near the village called Jericho; he captured it in its most fragile form and held it for a moment while the chilled kiss of the cloud-hidden sun has graven its lineaments in the invisible silver grains of photographic plates. For forty years he accumulated his portraits of princesses in frosty filigree, treasuring them as a less wise man might treasure the jewels they resemble or fine silver pieces whose smiths might learn lessons from their incredibly exquisite patterns. For at least a part of the forty years he had recognition from a few: scientists who would read the riddles of the weather, artists who love beauty and will follow her even to Jericho. But the world heeded him not, nor knew his work.

So far as that goes, even his friends of the outside world who sought him in his home in the hills, and once or twice coaxed him out for a few days of discomfort in the big cities—even his friends "from outside" knew very little about him. He was not a scientist in a great laboratory, for all his magic with the microscope and his cunning with the camera. Nobody knew what he did for a living. He said he was a poor man, and it is true he lived most unobtru-

sively and plainly, as it is still possible to do in a New England village community without losing caste. But so also have some of the world's richest lived: men like John Borroughs, and his own fellow New Englander, Thoreau, and the barefooted little man, centuries ago, whom his neighbors called "Il Poverello" when they came in admiring crowds to hear him talk.

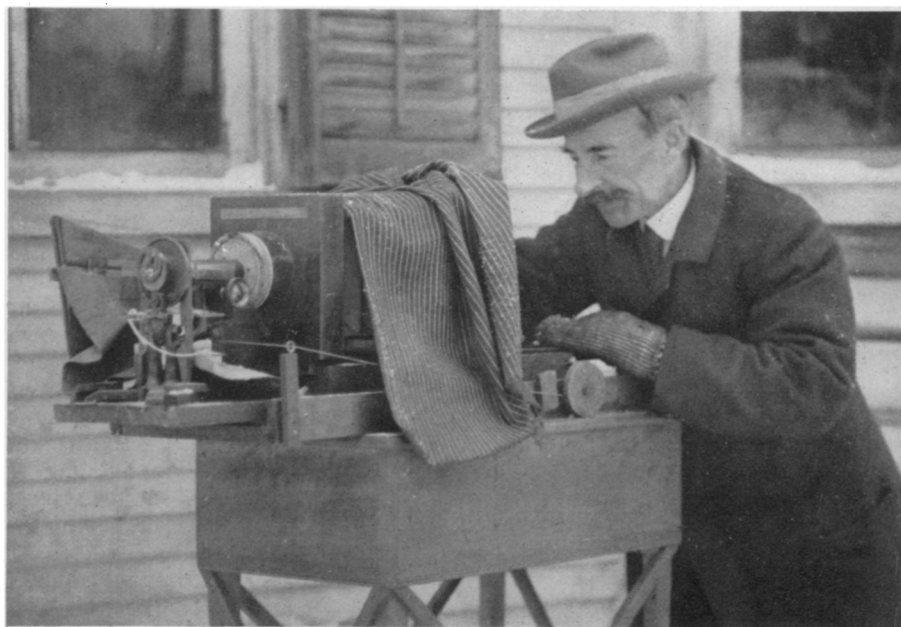
## A Hoard of Beauty

His friends of the outside world for years felt considerable concern over the fate of his great collection of plates and photographs. Hundreds upon hundreds they piled up in his little house, a hoard of beauty almost lost to the world. They felt like overprivileged guests, when they were allowed to see with only a few pairs of appreciative eyes what they knew thousands would be glad to behold. Some of them cast about in their minds for ways and means.

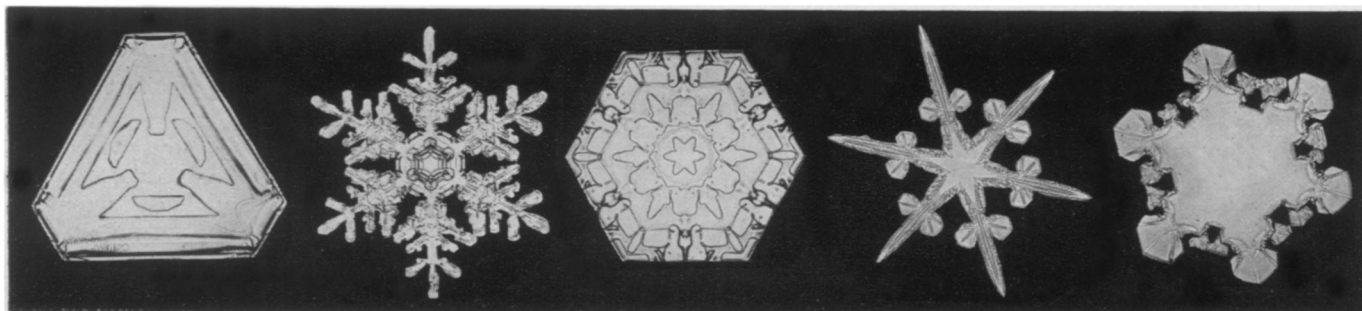
To Prof. W. J. Humphreys, physicist of the U. S. Weather Bureau, it seemed that the medium at once the happiest and most practicable would be a book, collecting all of these pictures into a

series of fine photographic plates. This would permit the world at large to see in its own houses the treasures that had hitherto been visible only at the cost of a pilgrimage to Jericho, and it would at the same time place this treasury of loveliness safely beyond the irreparable loss that a single fire or other disaster might have caused had it visited Mr. Bentley's home and destroyed his collection of plates and prints.

But such an undertaking would be expensive. There would be no profit in such a book, for it would have to sell at a rather high price to a comparatively limited number of people. A fund would have to be provided to defray a lot of preliminary expenses. A generous donor came forward with the fund, and the American Meteorological Society became its trustees, sponsoring the book. Hours and days of tedious labor would be required, to arrange the two-thousand-odd photographs in their most effective order and to write a few pages of carefully built explanatory text. Prof. Humphreys undertook this labor himself. A publisher would have to be found. The McGraw-Hill firm accepted the book gladly, though they knew they would be doing well to break even on it financially. The whole way was not easy, but such was the charm of Wilson Bentley's pictures that everybody who had anything to do with the task shoul-



**"... CAPTURING IMMORTAL BEAUTY OUT OF GRAY SKIES ..."**  
The late Wilson Bentley and his apparatus for photographing snowflakes.



dered his share willingly for the sake of the end they all sought.

Only Wilson Bentley himself hesitated, with characteristic self-effacement and equally characteristic New England caution.

"Surely nobody's going to want a great big book like the one you are talking about," he said to Prof. Humphreys. "Hadn't we better get out a little one first, and see how it'll go?"

But Prof. Humphreys had his way, and the book came out, and Wilson Bentley had the great satisfaction, in his last days, of seeing his work in permanent form. In it the eminent scientist, who was proud to have his name set down as co-author with that of plain, untitled Wilson A. Bentley, tells something of the technique used in capturing the breath-taking beauty that flocks through the many pages of pictures.

### Snow Surgeon

"Breath-taking" is the right phrase, too; for when you look at a snowflake through the microscope you must hold your breath. The warmth of the slightest puff from human lungs melts it at once; even the radiation from one's body will destroy it in a short time.

So the first requisite for a snowflake photographer must be a willingness and an ability to work in the cold. A picture of Wilson Bentley at his microscope-camera shows him in a thick overcoat and with his hands encased in substantial woollen mittens. How he was able, in this necessary armor against the cold, to perform swift and delicate manipulations that would put severely to task a neural or optical surgeon is one of the mysteries of his craft. Perhaps that is one of the things that come with practice—and Wilson Bentley had forty years and more of that.

The task of transferring the evanescent beauty of the snowflakes to the more permanent record of the photographic plate is well told by Prof. Humphreys himself:

"First you catch your snow crystal. This is conveniently done by holding a

smooth black board, a foot or so square, a moment or two, or as long as necessary, in the falling snow. The catch is then taken under shelter, to keep it from being blown off the board or otherwise disturbed, where the light is good and the temperature that of outdoors. After a hasty inspection with a suitable magnifying glass a promising crystal, if one is found, is transferred carefully and with most delicate touch to a suitable glass plate—a microscope slide—with a small wooden splint, and there pressed down flat or brought into other proper position and made slightly to adhere to the glass by the gentle stroke of a small wing feather. After this it should be more minutely examined with a microscope to determine whether or not it is worthy of photographic preservation. If it seems to be worthless there is nothing to do, of course, but start all over again. When, however, a photograph of a crystal is to be obtained it obviously is necessary to take it with a photomicrograph camera, that is, a microscope fitted with a camera bellows and plate holder where the eyepiece normally is placed, or farther removed. The camera is turned toward the sky (clouds actually) either directly or through a window; then, or previously if more convenient, the crystal, adhering to the glass slide, is properly centered in front of a low-power,  $\frac{1}{2}$  to 3-inch microscope objective, and the focusing so adjusted as to give a picture of the desired size. The plate holder is then put in position, lens covered, slide of plate holder drawn, lens uncovered for time of exposure, lens covered again, and slide put back."

It all sounds very simple. But just try and do it!

But the handling of the snowflakes themselves is only a part, though perhaps the most difficult part, of the task of snowflake photography. There is yet another delicate operation that must be performed before the image can be transformed from the developed plate to photographic paper.

As the original plates come out of the

dark-room, there is not much contrast between the picture of the flake and the background, for the exposure is necessarily made against a gray sky. To obtain this contrast, Mr. Bentley made a duplicate of each plate, and then carefully peeled all the background emulsion away with a very sharp knife, leaving only the clear glass around the image. Then when he made his print he got the image standing out in all its lacy delicacy against a dead-black background.

The hair-fine lines on a snowflake picture, that make it like a jewel, like a wrought silver brooch, like a pattern of lovely lace, are not really dark marks on its surface or in its substance. The whole of a snowflake is just a crystalline bit of ice, quite without color. But though a snowflake is one crystal, its unity is a manifold unity; it is a many-in-one. It is made up of united smaller crystals that have grown in harmony from a small original nucleus at the center. All of these smaller crystals let light straight through in certain directions, and turn it sharply aside in other directions. Where the light is turned away from our eyes it naturally seems to leave a dark line. Thus the markings on a snowflake.

### Fascinating and Baffling

It is fascinating—and baffling—to go through the collection of snowflake pictures, seeking duplicates. There are none. In his forty winters of snow study and photography, Wilson Bentley never saw two snow crystals exactly alike. Instead, he found the most bewildering variety.

While he was arranging the pictures, Prof. Humphreys was not always the scientist. Often he was the imaginative small boy, seeing birds and butterflies and flowers, and even milk-bottles and the heads of hippopotami. He points out some of them in the book, but wisely leaves most of these fascinating little voyages of discovery for the beholder to make for himself.

But even as the serious scientist, Prof.

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Humphreys has things to point out that are of interest to everybody. For instance, that the shape and substance of a snowflake is determined largely by the height of the cloud from which it falls. The higher the cloud, the colder and drier the air, the more slowly the crystal forms and the "plainer" its outline. The small, even-sided, little-branched flakes are the children of the dizzy heights where haloes circle round the moon. The feathery, lacy, starry flakes, with endless intricate branches, are formed in damper air at lower temperatures, and at less lofty altitudes. The intermediate forms come from moderate heights, medium temperatures, middle-of-the-way conditions all round.

### Older than Greeks

A perfect symmetry is rarely found in any snow crystal, even when its growth has not been violently disturbed. To the eye, most of Wilson Bentley's crystals appear flawlessly even in all proportions. But if one applies a rigorous measurement test one finds slight unevennesses. For instance, it is hard to find one pattern on which one can set down a pair of compasses and trace a circle that will just touch all six of its points, or on which one can lay down a ruler that will lie absolutely parallel with any of its sides.

For this hair's-breadth swerving from absolute mechanical accuracy, that satisfies the eye with symmetry and yet escapes a deadly sameness, the ancient Greek architects are much praised. But it appears that this idea in design is much older than the Greeks.

Science News Letter, February 6, 1932

## ENGINEERING

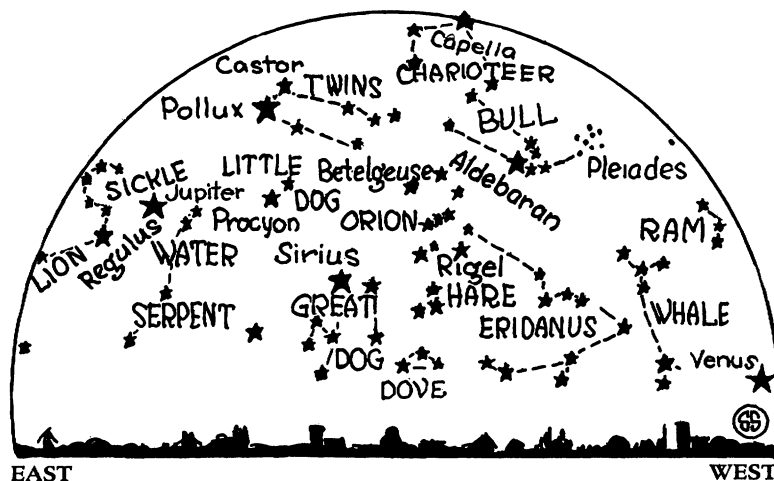
## Streamline Type Challenge To Automobile Makers

BECAUSE it conforms to natural laws, not subject to the ingenuity of man, the streamlined automobile with its engine in the rear, is challenging manufacturers of the world's 28,000,000 motor vehicles to adopt it as the design of smart appearance which will give maximum riding comfort and greatest economy at high speed. This opinion is presented in a report to the Society of Automotive Engineers by Sir Dennistoun Burney, noted car designer.

Pointing out that the streamlined car would reduce air resistance by half, as compared with present-day designs, Sir Dennistoun explained how the distribution of weight in an automobile and the location of its center of gravity are of prime importance to safety and comfort. In order to give maximum adhesion to the road when brakes are applied equal strain must be placed upon each of the four wheels, and this may be achieved, he said, only when the engine is situated at a point one-third of the length of the wheelbase in front of the rear axle.

At ordinary driving speeds, Sir Dennistoun stated, the unpleasantness of an uneven road is most keenly felt. By arranging the weights along the length of the car according to a formula based on physical laws, he continued, it is possible greatly to reduce the magnitude of impacts and shocks which must be taken up by the springs of the modern car.

Science News Letter, February 6, 1932



THE GREAT WARRIOR

This map of the southern skies during February should replace the one published last week on page 71 with the article "Reforming the Stars." In that map there was a duplication of the planet Jupiter and an incorrect showing of the planet Mars, the result of an art department mistake. Familiar Orion, most magnificent of the constellations, occupies the center of the southern stage.