of considerable importance. The wedges should press out the mouth of the clamp slightly, but more and more towards the back. Direct application of the loads proved quite unsuited, as zinc is highly influenced by the rapidity of the changes. Professor Martens, therefore, resorted to a testing-machine of his own design, three different modifications of which were employed. As indicators for these apparatus, a circular vessel filled with mercury was employed, from the side of which a vertical tube branched off. The cover of this vessel was formed by a strong central plate supporting a weight surrounded by a ring of german-silver. The strain imparted to the test-piece was partly taken up by the weight, the mercury column effecting the balance. This arrangement, which resembles others employed for similar purposes, did not answer; it was, moreover, not self-recording. The mercury-tube was therefore replaced by a horizontal cylinder with a piston-rod ended in another piston moving in a second cylinder with a slide-valve, which was actuated by an electric device comprising electro-magnets and relays. The common piston-rod carried a pointer recording on a paper drum. A third device, also electrical, but worked by gravity instead of water-pressure, was employed for the highest loads up to 50,000 kilograms. These three arrangements labored under the disadvantage that the cover of the mercury vessel retained an amount of mobility sufficient to affect the accuracy of exact measurements. Professor Martens hence returned to an often-employed arrangement, utilizing the elasticity of a spring of an elastic steel rod. The idea is, that the variations of the rod are marked directly (and without being magnified by multiplying levers or other devices whose accuracy Mr. Martens altogether questions) by means of a little conical diamond point on glass plates of the size for microscopic slides, fixed on a platform moved by means of a micrometer-screw and adjusting-spring, in a direction at right angles to that of the axis of the rod. Two of the resulting curves would occupy a space of not more than a square millimetre. The plates were examined and measured in a large Zeiss microscope provided with micrometers for both object and ocular glasses In this form, the recording device has been constructed by Mr. Boehme. It is, however, intended to leave the platform at rest, and to register the movements in the direction of both the abscissæ and the ordinate.

The chief objects of the tests were to ascertain the elasticities at ordinary temperatures and at 80°, 120°, 150°, 170°, and 200° C. (between 176° and 392° F.), and to ascertain the influences of different modes of rolling and of time-effects The latter are striking. One can hardly speak of the elasticity of rolled zinc, as even under very small strains the permanent expansion varies with each change of load. There was always a noticeable after-stretching. When cold, the breaking strength was 23 per cent larger, the breaking extension 22 per cent smaller, and the "fulness degree" (i.e., the ratio of the area comprised by the curve to the rectangle formed by the greatest extension multiplied by the greatest force) neither larger nor smaller, in a direction at right angles to the rolling, than in that of the rolling. The two samples supplied by other works showed, however, opposite characteristics, and one test-piece particularly deviated in a manner probably to be accounted for by some peculiar treatment during manufacture, the chemical composition seeming to afford no explanation. Rising temperatures modified the results. The breaking strength increased considerably in thinner sheets; that is, in such as have undergone greater and more continued pressure in the rolls. It rose from 11 kilograms per square millimetre for 6-millimetre plates, to 19 kilograms for plates .48 of a millimetre thick. The English equivalents of these values are 17.5 and 30 tons per square inch respectively for plates of .24 and .019 of an inch in thickness. The breaking extension decreases first, and increases rapidly afterwards. For the temperature tests, the pieces were heated in a linseed-oil bath. The results confirm the well-known and important fact, first established by Silvester and Hobson of Sheffield, that zinc should be worked, rolled, stamped, turned, etc., at 300° F., and that any higher temperature should carefully be avoided. On the whole, the tests demonstrate clearly that ordinarily tensile strength tests are not alone sufficient, and should be combined with folding and bending tests.

METEOROLOGICAL OBSERVATIONS ON PIKE'S PEAK.

SINCE the Boyden fund of the Harvard College Observatory was established for the purpose of obtaining astronomical observations at some station of great elevation above the level of the sea, an inquiry into the meteorological character of such stations seemed desirable before undertaking the proposed work. It was known that a long series of meteorological observations at the highest station ever permanently occupied for such a purpose had been made by the United States Signal Service on the summit of Pike's Peak, in Colorado. It was accordingly proposed to the chief signal officer of the United States Army, Gen. A. W. Greely, that these observations should be printed at the expense of the Boyden fund, in the "Annals of Harvard College Observatory;" and his courteous co-operation has enabled this plan to be carried out, as shown in Vol. XXII. of the "Annals" of the observatory, just published.

The summit of Pike's Peak, Colorado, is situated in latitude 38° 50′ north, longitude 105° 2′west, and has a height of 14,134 feet above sea-level, as determined by spirit-level from Colorado Springs. It is the highest meteorological station in the world; Leh, Ladakh, being 11,503 feet, and the Sonnblick, Austria, 10,154 feet. The station on the summit of Pike's Peak was established in October, 1873, and the first telegraphic report sent on Nov. 6 of that year. The telegraph line was frequently interrupted, and for long periods, until November, 1882, when it was virtually abandoned, owing to the great cost and the difficulty of its maintenance. Observations, however, were continued until September, 1888.

During the first few weeks the observations were more or less interrupted, and it has been deemed best to commence the publication from Jan. 1, 1874, at which date the station was in complete working order.

Pike's Peak rises very abruptly from the eastward, being about 8,000 feet above Colorado Springs, which is within ten miles or so from the summit. The open plain extending to the eastward affords unusual advantages for noting such cloud and storm phenomena as originate or move to the eastward of the mountain; and even the peaks to the westward are enough lower to permit observation of storm and cloud conditions below the level of the observer on Pike's Peak.

Perhaps the most notable fact resulting from a cursory examination of the meteorological elements is the remarkable resemblance between the recurring annual phases of atmospheric pressure and the temperature of the air. The curves of these elements not only are alike in having a single bend, but the maximum phase of both occurs in July, and the minimum in January. Not only are these elements coincident in their extreme phases, but the annual march is the same; so that the two curves are not only parallel, but almost coincident. When examined mathematically, it will be seen that not only are the plus and minus changes from month to month the same for both elements, but they bear a close, definite, and apparently dependent relation to each other, the mean monthly pressure rising or falling about .016 of an inch for each change of one degree Fahrenheit in the monthly mean temperature.

A similar relation between the mean monthly pressure and mean temperature obtains on the summit of Mount Washington, New Hampshire (elevation 6,279 feet above the level of the sea); but the barometer and temperature curves for the year at this last-named station are not as regular as on the summit of Pike's Peak. On Mount Washington, while the extremes of monthly mean temperature fall likewise in January and July, yet the maximum monthly pressure shows a tendency to prolong itself into August, and the minimum pressure to continue throughout January, February, and March. The relation on Mount Washington of monthly changes of pressure to like changes of mean temperature differs slightly from that of Pike's Peak, being about .012 of an inch rise or fall for each degree Fahrenheit.

The actual atmospheric pressure at Rocky Mountain stations above 4,000 feet elevation attains its minimum in January and its maximum in July or August; and the barometric phases are of the same sign, with reference to the annual mean, as the temperature phases at such stations. This phase of barometric pressure, which is the reverse of that in the parts of the United States of low elevation, results from the lower average temperature of the winter months contracting the great body of air, so that much of it is brought below the summit of the mountain, while in summer reverse conditions obtain.

The mean temperature of Pike's Peak is 19.3°, with a range in the annual mean temperature of 4°, dependent on the mean of 17.9° for 1880 and 21.9° for 1879. The highest temperature observed was 64°, July 19, 1879; and the lowest, — 39°, Dec. 21, 1887. As might be expected, the range at Mount Washington is considerably greater. The mean temperature at this latter station is 26.1°, with a range in the annual mean temperature of 4.5°, — from 23.5° for 1875, to 28° for 1878. On Mount Washington the highest temperature recorded was 74°, Aug. 9, 1872; and the lowest, — 50°, Jan. 22, 1885.

The daily range of temperature on the summit of Pike's Peak, as determined from ten years' observations with self-registering instruments, shows that the maximum range occurs in July and September (14.3° and 14.2° respectively), with the minimum of 11.6° in December. The greatest range likewise occurs at adjacent stations on lower level in the summer or early fall, as shown by ten years' record at Denver, Col., with the greatest ranges (27.9°) in September and (27.2°) in July; and at West Las Animas, Col., — record of five years, — (32.7°) in October. At Denver the minimum range occurs in February (23.5°), and at West Las Animas in May (29.5°).

It thus appears that the mean daily range on the summit of Pike's Peak is only about one-half of that which obtains on the low plateau country to the eastward. The mean daily range at Mount Washington differs materially from that of Pike's Peak, it having its maximum (18°) in January, whence it decreases quite regularly to July (10.6°), and then rises gradually to the winter maximum. The mean range — from ten years' observations — on Mount Washington is 13.8°, being only slightly less than that at Portland, Me. (15.4°), and at Burlington, Vt. (16.5°).

The precipitation of Pike's Peak exhibits peculiarities in its distribution throughout the year, the amount rising from a primary minimum in February to a secondary maximum in April. A very decided secondary minimum occurs in June, followed immediately in July by the primary maximum. The amount of precipitation in the summer (35 per cent) is substantially the same as that in the spring (33 per cent), the remainder being very equally distributed throughout the autumnal and winter months. The June minimum appears very remarkable, but its authenticity seems assured in view of the fact that at Colorado Springs, at the base of the mountain, and at Denver, nearly 80 miles to the northward, similar rainfall conditions obtain. At Denver the May rainfall is 18 per cent; the June rainfall, 9.5 per cent; July, 11; against 15, 12, and 24 per cent respectively at Colorado Springs, and 13, 6, and 15 per cent on Pike's Peak.

The mean wind-velocity throughout the year is graphically represented by a curve with one bend or inflection; the decrease in velocity being, as a rule, very gradual, from 26.6 miles in January, to 12.5 in July and 12.3 in August. The curve of the mean wind-velocity is substantially opposite in its phase to the curve of the mean temperature; that is to say, the highest mean monthly velocity occurs with the lowest mean monthly temperature, and the least mean velocity with the highest mean temperature. It is interesting to note that the same general rule holds true as bearing on the relations between the mean hourly temperature of the day and the mean wind-velocity. The average hourly velocity of the wind for the entire period decreases gradually from a mean of 23.2 miles per hour between 2, 3, and 4 A.M., to 17.5 miles between 11 A.M. and 12 noon. It is also noted that the minimum hourly wind-velocity for every month in the year occurs between 11 A.M. and 12 noon; but the distribution of the hours of maximum mean wind-velocity is somewhat irregular throughout the different months of the year, varying from between midnight and 1 A.M. to the hours of 4 and 5 A.M. Doubtless, were means of hourly temperatures available, it would appear that the highest temperature occurs quite regularly at noon, while the lowest temperature occurs more irregularly between midnight and sunrise. In July the maximum hourly velocity is 15.5 miles against a minimum of 9; but in January the range of the mean hourly velocities is very materially reduced, the range being from 28 from midnight to 1 A.M., to 25.4 from 11 A.M. to 12 noon.

Unfortunately, the direction of the wind was not automatically recorded, but the prevailing directions are obvious from the observations made thrice each day. It appears from these observations that 31 per cent of the wind comes from the south-west, 20 per cent from the west, 21 from the north-west, 10 from the north, 8 from the north-east, and 5 from the south; while 2 per cent pertains in each case to the east, south-east, and calms. The direction of the wind changes but slightly through the different months of the year; the records showing that the maximum per cent comes from the south-west from March to October inclusive, but during the winter months the direction changes slightly, and the winds from the west prevail from November to February inclusive, with the north-west winds and the south-west winds of slightly less frequency by 1 or 2 per cent.

On Mount Washington, however, from nine years' observations, 54 per cent of the wind comes from the north-west, 12 per cent from the west, and 8 per cent each from the south-west and north.

The observations for two years at Colorado Springs, at the base of the mountain, show, as might be expected, very different wind conditions. From the situation of this station, it might be inferred that the winds would blow from the north or north-west, or from the south and south-east, which is the case; the order of frequency being as follows: north, 27 per cent; south-east, 22 per cent; north-west, 15 per cent; south, 10 per cent. The influence of topographical features upon the wind is also clearly shown by the direction at Denver, where 28 per cent of the wind comes from the south, and 14 per cent from the north.

Severe and prolonged wind-storms are unusual on Pike's Peak, and the days are comparatively infrequent when the mean hourly velocity equals or exceeds fifty miles per hour. The most remarkable wind-storms were those of Sept. 28–29, 1878, when the mean velocity for twenty-four hours was 71 miles, and Dec. 25, 1883, when the mean velocity was 70 miles per hour. The highest extreme velocity recorded at Pike's Peak was comparatively low, being 112 miles, May 11, 1881.

Velocities exceeding these have been frequently noticed at exposed points on the Pacific and Atlantic coasts. Mount Washington not only has higher winds than the summit of Pike's Peak for short periods, but also for days or months. On Feb. 27, 1886, the mean hourly velocity on the summit of Mount Washington was 111 miles for the entire day, and in January, 1878, the extraordinary velocity of 186 miles per hour was recorded. The maximum monthly movement at Pike's Peak was 28,691, in January, 1887; at Mount Washington, 36,515 miles for January, 1885, a mean hourly velocity throughout the month of 49 miles, followed closely by a mean of 48 miles for February, 1883.

The mean annual cloudiness on Pike's Peak is 40 per cent, ranging from 33 per cent in November, to 74 per cent in July. The tendency is to an excess of cloudiness during the late spring and the late summer, with the least amounts from September to January inclusive. On Mount Washington the cloudiness is much greater, averaging 57 per cent for the year. The range at this latter station is also higher, varying from 52 per cent in September, to 61 per cent in March. The distribution throughout the year on Mount Washington appears to be accidental, with possibly a slight tendency to less cloudiness during the months of high temperature.

Pike's Peak is celebrated for its electrical storms. Many interesting details of these are given in the observer's journals. The storms only occur when the air is moist; the most favorable condition is during the time a light, soft snow is falling. When the hands are held up, sparks emanate from the tips of the fingers. At such times, with considerable wind, the anemometer-cups look like a circle of fire. Each flake of snow, as it alights on a mule's or burro's back, gives a spark like a firebug. The station was once struck by lightning. The electricity came down the anemometer-rod, following along the wire running to the battery. Every place the wire crossed a nail, the head of the nail was fused, and the wire melted at the same point.

In addition to the regular meteorological observations on the summit of Pike's Peak which appear in the "Annals," other special observations have been made.

HEALTH MATTERS.

Contagious Pneumonia.

DR. F. MOSLER, in a paper read before the Greifswald Medical Society, gives details of a series of cases of acute pneumonia in a family where there seemed every reason for believing that contagion was the cause of the spread of the disease. The patients, says the *Lancet* of Jan. 25, 1890, were all attacked during the last fortnight of January, 1889; the first to fall ill being the father, who died on Jan. 22, the fifth day of his illness. On this day his wife was attacked, and she too succumbed on the fifth day of the disease. While she was ill, her son, who constantly visited his parents during their illness, himself was attacked on the 26th. He was thirty years of age, strong and temperate, but succumbed on the twelfth day of the attack. Further, his sister, who had come from Arendsee, near Stralsund, to be with her sick parents, and who staid in their house from Jan. 22 to Jan. 26, was attacked at Arendsee on Jan. 29, and was admitted into the Greifswald Hospital. She alone recovered.

Dr. Mosler points out that the parents' house was dry, the two rooms they inhabited were well ventilated and clean, and that there had been no illnesses in the house within the past five years. He thinks the father must have acquired his pneumonia outside, and that the disease was communicated in turn to the members of his family by contagion through the sputa. In the case of the son, a *post-mortem* examination showed that the form of pneumonia was not the typical one: it was more lobular, was accompanied by a hemorrhagic pleurisy and by swelling of the spleen. Moreover, an examination by Professor Grawitz of some of the fluid withdrawn from the lung of the daughter during the height of the disease resulted in the discovery of bacilli resembling those of rabbit septicæmia, but neither the pneumono-bacillus of Friedländer nor the pneumono-coccus of Fränkel was found. In the case of the son, the blood from the heart yielded a similar micro-organism. Dr. Mosler thinks that such facts, as well as the peculiarities of the morbid anatomy of the latter case, suggest the occurrence of a special form of pulmonary inflammation, owning a cause different from that of the ordinary form. He sees in such cases a reason for believing that many varieties of poison may give rise to pneumonia. But the main lesson from the cases is that of contagiousness, and the need for the careful disposal and disinfection of the sputa, which he believes to have been the infective medium in these cases. He refers to recent contributions of Finkler and Cantani on infectivity of pneumonia, the latter recording some striking instances where the disease was more of the lobular than the lobar type.

MOUTH-BREATHING AND THE TEETH. — Dr. Scanes Spicer read a paper at the last meeting of the Odontological Society of London, upon "Nasal Obstruction and Mouth-Breathing as Factors in the Etiology of Disorders of the Teeth." In the course of his remarks, as we learn from the *Lancet* of Jan. 8, he said he had been struck with the frequency with which carious teeth were associated with obstruction of the pharynx and enlarged tonsils; so much so, that he had made it a routine practice to examine the teeth in all cases of nasal obstruction, and he believed that there existed a relation between them; and he further is of opinion that there is a generic relation between some cases of vaulted arch, narrow jaws, and irregular teeth, and nasal obstruction. Normally we should breathe through the nose, so as to warm and filter the air respired. All animals, savage races, and young infants do so; but a large number of adults of civilized nations breathe through the mouth, because they have some obstruction of the nasal passages, — erectile tumors, permanent catarrhal affections, polypi, post-nasal adenoid growths, etc. Mouth-breathing, he said, as a predisposing cause of caries of the teeth, came into action in various ways. The teeth were exposed to a current of air of a much lower temperature than that of the body, which would tend to cause inflammation of the periosteum and pulp of a tooth; the cold, dry air produced congestion of the mucous membrane, with a secretion of stringy acid mucus; and the rapid evaporation of water which takes place when the mouth is constantly open inspissated this mucus, which so formed a fertile soil for the development of micro-organisms. Again: when sleeping with the mouth open, the tongue falls back, and the parotid secretion finds its way directly through the pharynx instead of bathing and washing the teeth. With reference to the so-called V-shaped maxilla, Dr. Spicer thought that many cases might be traced to mouth-breathing, the muscles of the cheek pressing unduly upon the soft alveoli when the mouth is open.

SCRATCHING THE BACK FOR INTERMITTENT FEVER.—Dr. Alois Fénykövy communicates to a Vienna medical journal an account of some observations made on the treatment of intermittent fever by means of friction of the back along the spine. Many years ago, as stated in the *Lancet*, while at Nisch with his regiment, there occurred so many cases of intermittent fever that the stock of quinine was becoming exhausted, and, in order that the patients might not be entirely without some sort of treatment, it was ordered that they should be rubbed twice a day along the spine with simple ointment. The day after this order had been given it appeared that the usual attack had not come on. Accordingly since that time Dr. Fénykövy has very frequently employed this treatment, and usually with marked success. Indeed, he says that three-fourths of his cases have done very well without any quinine at all.

NOTES AND NEWS.

THE English Royal Meteorological Society have arranged to hold at 25 Great George Street, Westminster, on March 18 to 21 next, an exhibition of instruments and photographs illustrating the application of photography to meteorology.

— Herr Trautweiler thinks that a railway should go to the top of the Jungfrau, and in the *Schweizerische Bauzeitung* gives a brief account of his scheme. The railway would go from the valley below to the summit, and would be almost entirely under ground. There would be several intermediate stations, from which convenient, well-arranged tunnels would lead to points on the mountain whence the best views are to be had. If stormy weather came on, the passengers could withdraw into the shelter of those tunnels. The railway would be lighted by electricity.

— The Thomson-Houston Electric Company of Boston are building several large electric motors, or electric locomotives, for a street-railway company in that city. Each locomotive will be powerful enough to draw a train of cars.

— The Russian Government, it is stated, has announced its intention to begin operations soon on the great railway across Siberia. Work will begin at Vladivostok and at the present eastern terminus of the Russian railway system at the same time. The total length of the line is to be 4,375 miles.

— The Jull snow-excavator, illustrated and described in these columns some months ago, received several severe tests during the recent snow blockades on Western railroads. On Feb. 3 it opened up a blockade on a road between Pendleton, Ore., and