THE HOMESTEAD DIFFICULTIES.

The Carnegie Steel Works, at Homestead, Pa., several views of which are given on our first page, are among the largest of the kind in the world. Their output of steel recently has even been compared to that of the famous Krupp establishment at Essen. The immense plant, in its machinery and buildings, is all of the most modern type, embracing the most recent improvements, Superintendent Potter testifying before the Congressional Investigating Committee that, by reason of the improved machinery, "the output was 50 per cent greater than that of any other mill in the world!" This seems to be a truly enormous gain, but the improvements which have been but recently made in the machinery and methods in the manufacture of steel in large quantities are hardly appreciated by those not directly engaged in the business. The new beam mill, completed within the past two months, cost nearly a million dollars, and the entire establishment has been absolutely created within the past ten years, for it was only half a score of years ago that Homestead had less than a thousand inhabitants. Then it was an unimportant and unknown suburb of Pittsburg, while now it has over 12,000 inhabitants, substantially all of whom have obtained their livelihood and made for themselves comfortable homes by the building up of the great steel works at that point.

But at this thriving and prosperous industrial center there has been a "labor difficulty" which has attracted the attention of the whole country for the past six weeks, and, on July 6, the matter was the occasion of a bloody engagement, as of between opposing forces engaged in actual war, in which some twenty men were killed and a far larger number injured.

On July 1 the 3,800 workmen employed at the mills were paid off in full, and work was "shut down," the company having declined to sign an agreement to pay a scale of wages for the future which had been demanded for the men by the Amalgamated Association of Iron and Steel Workers, a labor organization to which all the men belonged. The men and the company had got along under a similar agreement for the three preceding years, although there had all the time been a good deal of friction, from the fact that the company found it difficult to deal with its men individually as to many details of the work, and on this account, after a failure to come to an agreement as to a future scale of wages, the company decided to no longer recognize or deal with the association as a body, but to hire all the help needed without regard to any labor organization. It may be briefly stated that the company had asked: First, a reduction in the minimum of the wage scale from $25 to $23 for 4×4 Bessemer billets; second, a change in the date of the expiration of the scale from June 30 to December 31; and third, a reduction in tonnage rates at those furnaces and mills where important improvements have been made, and new machinery has been added that has greatly increased their output, and consequently the earnings of the workmen. Where no such improvements or additions have been made, no reduction in tonnage rates was asked. It has been conceded by the men that the proposed reduction of wages would affect only 325 men out of the total number of employes.

From the date of the stopping of work at the steel works the plant of the company was placed practically in a state of siege by the former workmen. On the 5th of July, a sheriff's posse, in response to the Carnegie Company's demand for protection, attempted to take nominal possession and post guards at the works; but they were captured by the men and sent out of town. The company had, however, in anticipation of trouble with their workmen, been making preparation to meet it for some time previous. They had erected a high fence around their grounds, with a barbed wire strung along its top, through which an electric current might be sent; placed a great search light in commanding position, put up a big instantaneous camera at an advantageous point, and in various other ways were preparing to protect their property. As a part of this system of defense, a force of Pinkerton detectives had been engaged as watchmen, and they were to have been installed at the works in the early morning of July 6. Some 300 of the men, hired for this purpose, were, therefore, taken on two barges, in tow of tug boats, from Pittsburg to the works, which are on the south side of the Monongahela River, about eight miles southeast of its junction with the Allegheny. The fact that the company was thus moving to place Pinkerton men in its works at Homestead created the greatest excitement in the latter place.

The news was telegraphed ahead and, on the arrival of the barges, just before sunrise, the river banks at Homestead were crowded with angry and threatening workmen. It had been intended to land the men from the barges near the pump house, fully a mile within the boundary line of the premises of the company, but the crowd speedily broke down the fence and poured over the company's grounds along the steep embankment skirting the river, reaching the landing place ahead of the boats.

Then succeeded an engagement which lasted nearly all day. It has been disputed from which side the first shot was fired, but the firing quickly became general on both sides, and was kept up with occasional intermissions until three o'clock in the afternoon. The strikers secured a small brass ten-pounder cannon and kept up a fire from it on the barges from within a steel billet embrasure on the grounds, while another cannon opened fire also from the opposite side of the river. The barges were of strong build, having been made for shipping iron, and as an extra precaution they had been lined with heavy steel plates. Little impression was therefore made upon the barges by the fire of the men on the banks, and then it was sought to fire the boats, as shown in one of our views, which is reproduced from a photograph. Oil was spouted on the decks and sides of the boats by means of hose and a small fire engine of the company, but the oil was a lubricating mixture and did not burn well, and the failure of this attempt was followed by an effort to burn the boats with the flame from a natural gas pipe. The tug boats had cast loose and left the barges early in the day, and at 5 o'clock the men on the barges, seeing that there was no hope of escape, surrendered to the mob. Before surrendering they were promised protection, but on the way from the boats to the Opera House, where they were finally lodged as prisoners for the night, they were most brutally assaulted and maltreated by the mob which lined the streets of Homestead.

Within a week after this bloody exhibition of organized mob violence Homestead was taken possession of by the State militia of Pennsylvania, and a force of five or six thousand soldiers was encamped in the town and upon the hills around, their tents upon the hillsides being visible in one of the views, and from this date, under military protection, the company has been gradually filling its workshops with non-union workmen. Another view shows the headquarters of the Amalgamated Association at Homestead, where the men have been accustomed to assemble to mature their plans, and from which the leaders directed their campaign against the Carnegie Company. The office of the latter company in Pittsburg, shown in one of the views, has a peculiar interest, from the fact that here was shot, a few days later, Mr. H. C. Frick, the managing head of all the different Carnegie establishments. A New York anarchist, a Polish Jew named Berkman, went to Pittsburg for the special purpose of killing Mr. Frick, and succeeded so far as to shoot him twice in the neck and inflict several stabs in his back. The wounds did not prove fatal, however, and Mr. Frick has since sufficiently recovered to again assume full charge of his vast business interests. It is not claimed that the would-be murderer had any direct connection with the strikers' organization, but there is only a question of degree of crime between the mob which invaded the grounds of the Carnegie Company, and for hours took part in the bloody work there on July 6, and the dastardly miscreant who, on July 23, sought to aid in carrying out the work of the rioters by killing Mr. Frick.

For the photographs from which some of our views are made we are indebted to Mr. B. L. H. Dabbs, of Pittsburg.

Artificial Precious Stones.

What promises to be a most important discovery has been made by one of our Glasgow scientists. Although imitation gems are obtainable in any required quantity, the production of crystals having the hardness, durability, and other qualities, both physical and chemical, of natural stones has been one of the unsolved problems of applied chemistry. The most advanced efforts up till now have been made in Paris, and the French specialists have at least proved the possibility of producing sapphires, rubies, and other stones by artificial means, their products being real gems, and not glasses. It is doubtful, however, if the originators of the French methods themselves claim that theirs are the methods of nature, and it is reasonable to suppose that the most natural method will be the most practically successful one. Although no geologist or chemist can declare the new process to be the process of nature, yet many analogies point that way.

Experimenters in this field may have been partly discouraged by the thought that the gems of nature were produced under conditions of enormous pressure, to which might have been added very high temperatures, and that they were in some cases the products of long periods of time. It is possible, however, that too much weight has been given to this point. In the process now under notice no such discouraging conditions are present, and the method is wonderfully simple. Even working on the laboratory scale, using small vessels, stones have been obtained over one-sixteenth of an inch in diameter, and very large numbers have been formed approaching that size. There is no reason to doubt that working on a larger scale will yield stones of any size likely to be required. The noble nature of the products is beyond doubt, as they are very hard, infusible at all ordinarily attainable temperatures, and insoluble in any acid. The bulk of the gems are white or rather colorless sapphires. They are compact and transparent crystals, and many specimens have a splendid luster. By subsequent treatment some of them have taken on the sapphire blue.

Some of the specimens seem to contain a small amount of carbon. This element is sometimes present in small quantity in natural emeralds, a fact not generally stated in books on the subject. In a few specimens the proportion of carbon seems to be considerable, and there are present individual crystals having physical properties more nearly allied to the diamond than to the sapphire. In nature diamonds are often found associated with other gems. In any case the products contain little or no silica, this compound being the characteristic ingredient in all kinds of glass. Apart from the possibilities of the process in the direction of producing the diamond, the chief point already established is that of having found an easy method of crystallizing alumina. The Oriental ruby, Oriental amethyst, and other gems coming under the heading "Oriental," are all of them only variously colored sapphires, and alumina forms the chief constituent of the series.

There is little doubt that the process will yield the ruby and other varieties. Apart from ornamentation, their hardness will fit them for mechanical purposes, and their cutting power is remarkable, perhaps due to the small amount of carbon already spoken of. The author of the process has sought the opinion of several of the foremost men of science, and their general verdict has been very favorable. The discovery may prove to be one of the most important yet made in mineralogical chemistry, and the future developments both commercially and scientifically difficult to estimate. The originator of the process is Mr. James Morris.—*Glasgow Herald.*

THE MOON AND MARS.

A most interesting spectacle in the southern sky, in connection with the recent near approach of the planet Mars, was presented on the evening of August 7, when the planet was for some hours apparently very near the full moon, as shown in the accompanying view. When one remembers that the planet was some 35,000,000 miles away from us, while the moon's distance is only about 240,000 miles, that the diameter of the planet is just about twice that of the moon, and that the planet itself has two small moons coursing around it at a rapid rate, it was not necessary to call up the further comparisons, almost everywhere entertained, as to the probability of life on Mars and the absence of life on the moon, to render the sight one well worthy of attracting and holding the attention, aside from its beauty as a mere spectacle.

THE LOOPED PATH OF MARS.

My father, Professor Richard A. Proctor, was very much interested during his lifetime in the study of the miniature earth, Mars; and about which now the scientific world is especially interested. In his magazine *Knowledge* for March 31, 1882, vol. 1, he makes reference to a map, published in an earlier number (March 24), of the looped path of Mars, designed by himself. With regard to it, he wrote as follows: "There are some 600 positions of the planet (all separately laid down before the path was carried through them), and the constructions for these involved many hours of labor." The following is the illustration of the looped path, with the accompanying descriptive text, as written by my father:

"Many even of those who have read the usual descriptions of planetary motions, in our text books of astronomy, are perplexed by the way in which the planets pursue

> Their wandering course, now high, now low, then hid,
> Progressive, retrograde, and standing still.

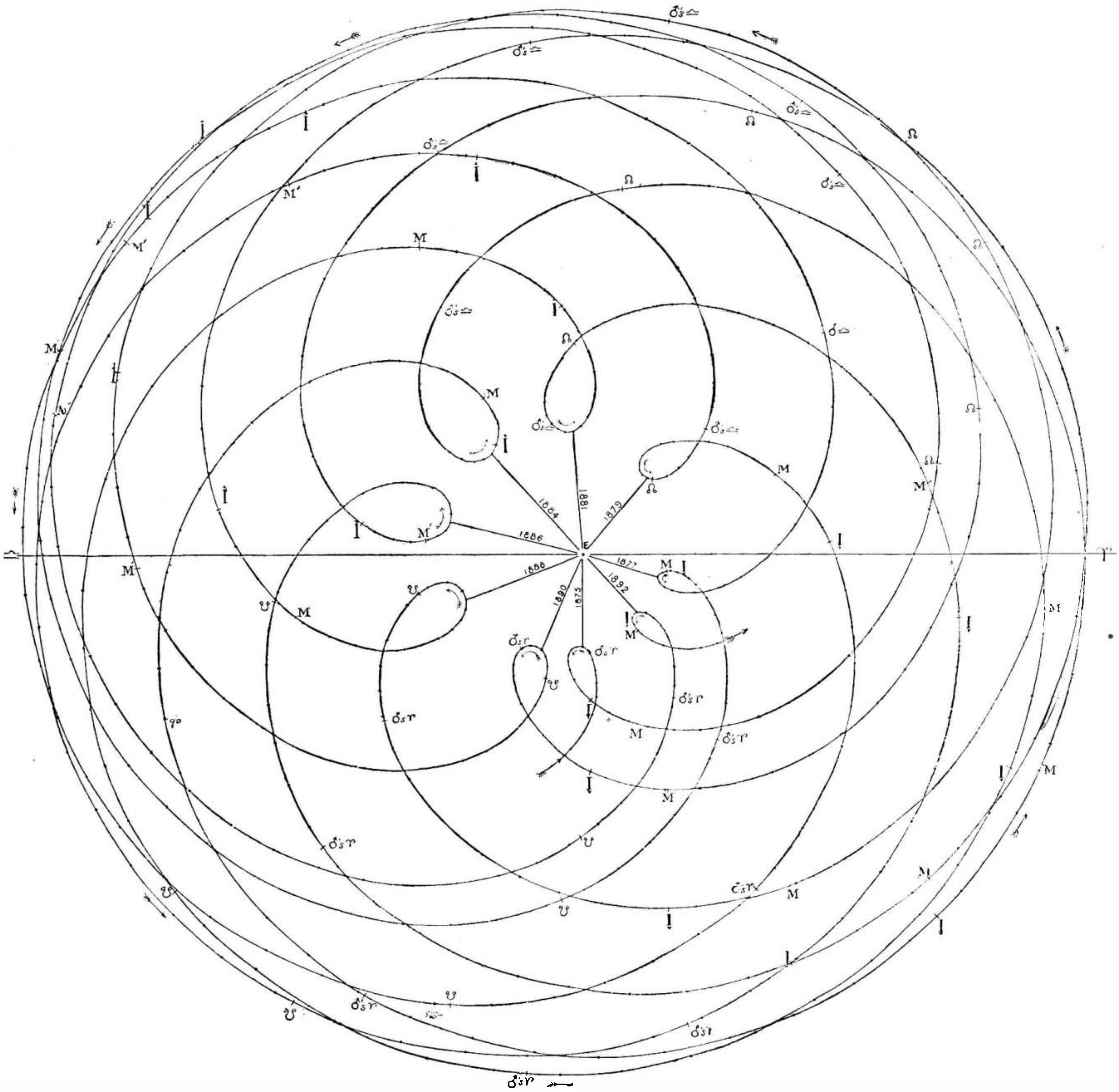
"Mars, Jupiter, and Saturn during the last few months have given striking illustrations in the skies (as indicated in our maps) of their strange and at first view fantastic and irregular motions. Mars, in particular, traverses a singularly devious course upon the background of the starlit heavens. It has seemed to me that it would be interesting to exhibit the real course of this planet, the one of all the sun's family whose path, with reference to the earth, has the most complicated form. Of course, in reality this planet travels around the sun in an ellipse which is almost circular in form, though considerably eccentric in position. The earth also pursues an elliptic path, smaller in size, still more nearly circular in form, and much less eccentric. But viewed from the earth, the planet Mars, in consequence of the combination of these two circling (but not strictly circular) motions,

travels on such a looped path as is shown in the accompanying map. Here the planet's position, as viewed from the earth (his geocentric position, as it is called), at the successive oppositions (or times of nearest approach to the earth), is shown by the small dot at the end of the dated radial line. Then, at successive intervals of ten days, measured forward and backward from the time of opposition, Mars has the positions indicated by the successive dots. Of course, there is a place in the outermost part of each whorl where these ten-day dots meet without an exact ten-day interval; this, however, is unimportant, as in these parts of his geocentric path Mars is invisible. At the proper places along the planet's looped geocentric path are shown the places where Mars is in perihelion (M), aphelion, M', at a rising node (or crossing the plane of the earth's orbit from north to south), (☊) at a descending node (or crossing the plane of the earth's path from south to north), (☋) the place where he attains his greatest distance north ($\hat{I}$) and south ($\underset{v}{I}$) of the plane of his orbit; the place where Mars is at the point of his orbit corresponding to the vernal equinox (beginning of spring) of his northern hemisphere, marked ♂'s ♈, and the corresponding point for the autumn of Mars, marked ♂'s ♎.

"The scale of the drawing is the same as that of my picture of the orbits of the terrestial family of planets (Mars, Earth, Venus, and Mercury) in the 'Encyclopædia Britannica,' viz., fifty million miles to the inch, and on this scale the lines I, I, etc., indicate the greatest distance attained by Mars north and south of the plane of the ecliptic. The northerly displacement, it will be seen, is the greater.

"The path of Mars must be regarded as passing above the plane of the paper, at a point marked ☊, gradually attaining its greatest height (indicated by the length of the "I") above that plane at the point marked $\hat{I}$; gradually returning toward the plane of the paper, which it crosses again at a point marked ☋; then attaining its greatest distance below the plane of the paper at the next point marked $\underset{v}{I}$; whence it returns gradually to the plane of the paper at a point marked ☊; and so on continually." MARY PROCTOR.

616 North Sixth Street, St. Joseph, Mo.
August 7, 1892.



THE GEOCENTRIC PATH OF MARS—BY THE LATE R. A. PROCTOR.

Prof. Pickering's Observations of Mars.

In December, 1890, the Astronomical Observatory of Harvard College sent out an expedition to Peru in prosecution of its self-assumed task of making a complete map of the heavens. In order to do this it had been found necessary to establish branch observatories in various parts of the United States and other countries, so that the entire sky might be mapped out. A preliminary station had been established at Chosica, Peru, in May, 1889, but it was found necessary to remove the observatory to a point where the cloudy season was at a minimum. Messrs. S. I. Bailey and M. H. Bailey, two of Professor Pickering's assistants, were in charge at the Chosica observatory. Mr. M. H. Bailey superintended the removal and made a temporary erection in the desert of Atacama, one of the driest spots on the earth and nearer the coast than Chosica. It was subsequently determined to establish a permanent observatory at a point near the city of Arequipa, where a position was secured at an altitude of about 8,000 feet.

To this point Professor W. H. Pickering, accompanied by his family, started. The party does not expect to return to North America for four or five years. By the end of that time Professor Pickering hoped to have mapped out the entire southern half of the heavens, which, as is well known, is far richer in bright stars, clusters and nebulæ than the northern half, with which we are familiar. Professor Pickering also expected to be able to secure photographs of the moon which will be superior to any yet made. For instance, he hoped to be able to produce in that clear atmosphere a photograph six feet in diameter of the lunar surface.

Another of the special objects of the expedition was to observe the planet Mars during its present opposition. The chief difficulty with observing Mars in this country and Europe at the present time is that the planet is now in almost the lowest portion of the ecliptic, near to the horizon, and consequently the telescopic view is affected by all sorts of atmospheric disturbances.

In Peru, however, the planet will be almost directly overhead, and the observatory being situated at a high altitude, the difficulties of view occasioned by dense atmosphere will be avoided. With his superior instruments Professor Pickering will, no doubt, be able to make remarkable discoveries. The access to the observatory is very easy, as a line of railway leads directly from the coast to this point, and delicate and heavy instruments may be transported with ease and safety.

Among the instruments which were taken to Peru were the Harvard Observatory eight-inch photographic doublet, a five-inch visual telescope and an instrument for measuring the brightness of stars. Professor Pickering took with him his own effective astronomical "battery," consisting of a thirteen-inch photographic telescope with an eight-inch finder, a twenty-

inch reflector, made for the purpose of finding faint nebulæ, and an instrument with which he discovered the great spiral nebula in Orion, also a portable transit instrument for determining time and a seismometer for observing earthquakes.

Last year a visual twelve-inch telescope was added to the equipment, so that there can be no failure of the expedition on the ground of lack of instruments. Owing to the lack of building materials in the country where the observatory is erected, the university was obliged to send with the astronomical outfit wood and iron for constructing the buildings and domes and iron piers for the telescopes.

The New York *Herald*, to which we are indebted for the foregoing particulars, has received a special telegram from Prof. Pickering, dated at Arequipa, August 9, in which the professor says:

In my observation of Mars I have seen two large areas near the equator which are permanently blue. Near the edges they appear light blue. The light is slightly polarized.

The total size of the area is about 500,000 square miles, one-half the size of the Mediterranean Sea.

On June 23 a small dark spot appeared in the southern snow cap. Later this spot lengthened rapidly, and early in July it was a thousand miles long, dividing the snow in half.

Sixteen hundred thousand square miles of snow have melted within the last thirty days. The melted snow has apparently been transferred to the seas, across land.

Small, dark areas, surrounded by snow, appeared on July 10, and two days later I first saw a dark line in the fork of a Y shaped mark in the direction of the seas. The line became more conspicuous on July 14, and on the 16th a dark area about the size of Lake Erie appeared on the northern side of the stem of the Y, which was connected with the northern sea. The next day there appeared a large dark gray area near the northern sea.

This had grown much fainter by July 23, and a new area appeared to the south of the northern sea, concealing its outline. The line in the fork of the Y had disappeared, but the area of the Y had extended. On July 24 a large dark area, apparently either a lake or a sea, appeared near the melting snow, and on July 25 the southern branch of the Y became very narrow. The outlines of the northern sea were seen again, a narrow white line stretching north from the snow.

Many other changes were noted. Rapidly changing, faint whitish areas were seen. Green areas near the poles have not been seen for many weeks, but traces were recently suspected, and a bright green area was distinctly seen near the north pole last night.

Magnetic Photography.

Prof. E. J. Houston describes his new mode of photographing the magnetic groupings of iron filings as follows: I place a dry sensitized photographic plate over the magnet whose field I desire to fix, and after the characteristic groupings of filings have been obtained, I expose such plate while over the magnet to the light of a gas flame for a few seconds.

This operation is necessarily performed in the dark photographic room. After exposure the light is turned out and only the non-actinic red or yellow light left.

The filings are allowed to fall off the surface of the dry plate, and the finer particles that still adhere to it are brushed off by a feather or dry camel's hair brush. The plate is then developed and fixed in the usual manner.

This process of obtaining records of magnetic fields produces true negatives, which, when employed for printing by blue print, silver print, platinotype, or similar process, produce excellent positives.

As the negatives so obtained are more permanent than the positives obtained by the use of the filings themselves, they permit the taking of an indefinite number of photographic prints.

A DEEP BASEMENT.

To make a basement on Broadway, New York City, as deep as the one shown in our illustration, is a work involving some interesting, though by no means novel, engineering features. To accommodate the great rope traction wheels which are to be used in the cable railway service of the Broadway railroad, it was necessary that this basement, in which the plant is to be located, should be nearly 40 feet deep, and this is the depth at which, on the corner of Houston Street and Broadway, a permanent water-holding stratum is reached. It was especially desirable to have the plant all placed beneath the street level, so that the space above might be profitably utilized for stores and other purposes, Broadway property at this point being very valuable.

In order to have the room in this basement as clear as possible from obstructions, and of the whole size of the building, 200 by 225 feet, the method has been followed of sinking in the water-holding stratum separate foundations for the numerous pillars which are required to support the interior of the superstructure. A great room is thus provided, in which there will be no interior walls, in which will be placed the four engines, of 1,000 horse power each, for driving the cables. The engines are to be arranged in pairs, each pair operating a shaft on which is a rope traction wheel, from which the power is transmitted, through other traction wheels, to the large wheels on the shafts carrying the cable drums. There will be four of these large traction wheels on cable drum shafts, the wheels being each 32 feet in diameter and 8 feet 4 inches wide over the face, weighing over 100 tons each.

DEEP BASEMENT OF THE BROADWAY R.R. POWER HOUSE, CORNER OF HOUSTON STREET.

The Rights of Labor and the Laws of the Land.

The laws of this country are the fairest, the most reasonable and the most just laws that history records. The principles which they embody are those which have been recognized as fair and just by all civilized nations in all ages, by the best and ablest men in those nations, and also by the great religious leaders and organizations of the world. The liberty of the individual and the welfare of the state are the two chief interests of all just laws and all good government. These two interests are cared for in this country more carefully and intelligently than they have been or are in any other. This is proved by the fact that to get an anarchist we have to import him ready made. The sunshine of our laws and customs is too genial for their breeding here. It is also proved by the fact that hundreds of thousands, yes, millions of men, since we became a nation, have under our laws developed their lives from a low beginning in ignorance, poverty and obscurity into intelligence, usefulness and prosperity. It is not under bad laws that such things can be done.

It is only reasonable, therefore, that labor organizations should be urged not only to obey the laws of the land, but to teach their adherents that to obey these laws is their first and most important duty. The weakness of these organizations has been, and is to-day, that they claim—not in words, perhaps, but in acts—that the organization of wage workers into unions gives them certain "rights" not before possessed. The leaders of labor unions can engage in no better work than to teach their followers that whatever claim of "rights" cannot be enforced under the law is not right, and must be abandoned. If this had been done by labor union leaders, the twelve men who were recently shot to death at Homestead would be alive to-day, and the red smear of murder would not appear on so many pages of the history of labor unions.

One of the facts which organized labor would do well to understand is that under the laws of this country a man may work for whom he pleases and for any price that may be agreed on between him and his employer, and that the employer may at any time cease to employ him and hire some one else in his place. Employes and employers have precisely equal rights in these matters. Another fact equally important is that the law will punish the man who, by physical force, prevents another from working. To do so is a lawless act, and that it is done by or for the benefit of organized labor makes no difference. The law does not take cognizance of organized labor any more than it does of red-haired or temperance, or Catholic or Protestant labor. And not only the law of the land, but also the sentiment of right-thinking people everywhere makes it an evil and an inexcusable act to prevent the man who needs work and wants to work from doing so. How much sympathy for labor is there in the sentiment which beats a man black and blue when he applies for the work the wages of which his hungry family needs—because he does not belong to a union? What sort of charity would that be which would refuse help to a starving child unless it was enrolled in some Sunday school mission class?

Still another point to be learned by combinations of labor is that they cannot claim from the law the same recognition which it gives to employers until they become equally responsible before the law. As it is now the employer can be compelled to make good any violations of contract with his employes. But if his employes, acting through a labor union, sign a contract to-day and break it, greatly to his pecuniary injury, to-morrow, he has no redress. This has recently happened at Pittsburg, where several hundred employes, after signing an agreement to work, broke their agreement without any lawful reason, leaving the works idle. In such a case the employer has no remedy. The labor union insists on being "recognized," and uses all lawful and even many unlawful means to secure recognition, and yet has nothing of that responsibility before the law upon which, only, can one business concern recognize another. When the law compels labor unions to become pecuniarily responsible for their actions, some phases of the labor question will be settled. Employers will prefer to deal with a responsible organization rather than with individuals.—*Railway Master Mechanic.*

THE following directions for joining band saws are given by the Defiance Machine Works: Bevel each end of the saw the length of two teeth. Make a good joint. Fasten the saw in brazing clamps with the back against the shoulder, and wet the joints with solder water, or with a creamy mixture made by rubbing a lump of borax in a teaspoonful of water on a slate. Put in the joint a piece of silver solder the full size thereof, and clamp with tongs heated to a light red (not white) heat. As soon as the solder fuses, blacken the tongs with water, and take them off. Remove the saw, hammer it if necessary, file down to an even thickness, finishing by draw-filing lengthwise.