

through the strange maze of cliffs which I had seen from my col and the Cima di Ball. But the view from the valley I have described was certainly not promising. The highest block of the Palle seemed to be cut off by trenches too deep and too vertical to offer much hope to an assailant.

I am half inclined, therefore, to fancy, and have no scruple in ardently hoping, that the Primiero Peaks may remain inaccessible. I, for one, have no hope of climbing them, and I cannot say that I wish that glory to fall to anyone else. At no distant period Primiero will be invaded by the mob of tourists. The select few are already beginning to admire its singular beauties. It will be an additional claim to our admiration if, in this last fastness, the spirit of the mountains should make a final and successful stand, and keep at bay those daring adventurers whose success elsewhere has only been too complete. No one is a more loyal member of the Alpine Club than myself, if I may venture the boast. No one wishes more sincerely that it may flourish and spread, and that it may discover new fields of enterprise, and call forth fresh energy in the most perfectly delightful and innocent of all known amusements. But even my good wishes have their limit; I don't wish the Club to be universally irresistible; and I shall rejoice if at some not very distant day, when I hobble on aged legs (if my legs live to be aged) about the scenes of former exploits,—delightful at the time, and, if possible, still more delightful in the memory—I may still look up at one cluster of magnificent summits, and say proudly, I have been to the foot of those peaks, and nobody has been much farther.

NOTES ON PHOTOGRAPHY IN THE HIGH ALPS. A Paper read before the Alpine Club on Dec. 15, 1869. By the Rev. H. B. GEORGE, M.A., F.R.G.S.

IT is only within the last two or three years that it has become possible to do what I hope to persuade many members of the Alpine Club to do—take photographs anywhere and everywhere that the climber chooses to go. When I went round the Oberland on a photographing tour with Mr. Edwards, in the summer of 1865, his apparatus was deemed, by those competent to judge, a marvel of portability and neat adaptation. I forget its exact weight, but I remember that it was a heavy load for the stoutest of Oberland porters. The whole apparatus I carried during my tour of 1869 weighed rather less than four pounds, exclusive of the stand, which was

fitted to the handle of my axe. I suppose that I may assume in the present audience a knowledge of the mere outline of the photographic process—that a glass plate is covered with a chemical preparation sensitive to light, is exposed so many minutes or seconds in front of the picture which is to be taken, and is subsequently developed, that is to say, subjected to other chemical operations which serve to fix the picture on the plate, after which impressions are taken from it by a process analogous to printing. Further knowledge than this is not requisite even for taking photographs with the apparatus I use; it is only necessary to learn, in addition, some practical rules as to the length of time for which a plate requires to be exposed under varying circumstances. But even this small amount of theory is sufficient to make clear the importance of the first step on the royal road to photography—the introduction of satisfactory dry plates—that is to say, the discovery of a mode of preparing plates under which they should not need to be used within a few minutes, but might be used after any interval of time, provided they had been kept carefully from the light in the meanwhile. It then became possible to dispense with all the paraphernalia of dark tent and ill-smelling chemicals; for the plate can equally well be kept after the picture is taken, provided always that no daylight gets to it, until it is convenient to perform the after processes. Some of my most successful pictures of this year were taken on plates a year old, and were developed nearly two months after the picture was taken. The importance of dry plates consists, however, not merely in the saving of a great deal of apparatus, for, after all, one can have things carried almost anywhere, if one does not mind paying for it. For instance, Mr. Edwards' kit was carried over the Lauteraarjoch in 1865, under glacier conditions of very special difficulty. A still greater gain is being able to dispense with water, which is required in great abundance for the ordinary, or wet, process. On an open glacier one can usually obtain plenty of water; but, as we all know by thirsty experience, there is seldom any to be found above the snow-line, nowhere certainly in sufficient quantities. Thus dry plates alone render photography in the High Alps practicable. The second step, which opens photography to everyone who is willing to take a small amount of trouble, was the perfecting of a method of enlarging pictures taken on very small plates. It is not my business to explain the nature of the process by which this is done; I adhere to the principle of requiring no detailed knowledge of the photographic art. But it may be worth while to say that there

are two possible methods, each of which has its advantages:—(1) the original may be photographically copied on a new plate of the required size, after which prints are taken in the ordinary way from the new negative; or (2) the enlarged print may be taken directly from the small original. The latter method gives the most perfect results, but it requires sunshine to work it—an article not too abundant in our climate; and therefore long delay may occur before one can get the enlargements done. The former method is the more expeditious, and for a number of copies the cheaper; but the results are not as good, and inasmuch as there is an extra stage to be gone through, there is an additional chance of imperfection. It has, however, the advantage of improving pictures that have been under-exposed, which the method of direct solar enlargement cannot accomplish. It is needless to say that these magnified copies cannot be expected to be all as good as pictures taken on large plates, with a larger lens. Every little defect, the trifling unsteadiness caused by a gust of wind at the wrong moment, the blurring of outline occasionally produced by the sun on a snow sky-line, the motion of a cloud or a branch while the picture is being taken, will of necessity be exaggerated in the enlarged picture, and become blemishes, though they would hardly be discoverable in the original. But, after all, this process is capable of producing some very satisfactory results. At the worst, these pictures are better than nothing; and they can be obtained wherever a tripod can be made to stand, at any place a mountaineer can reach, for a very slight expenditure of time and trouble.

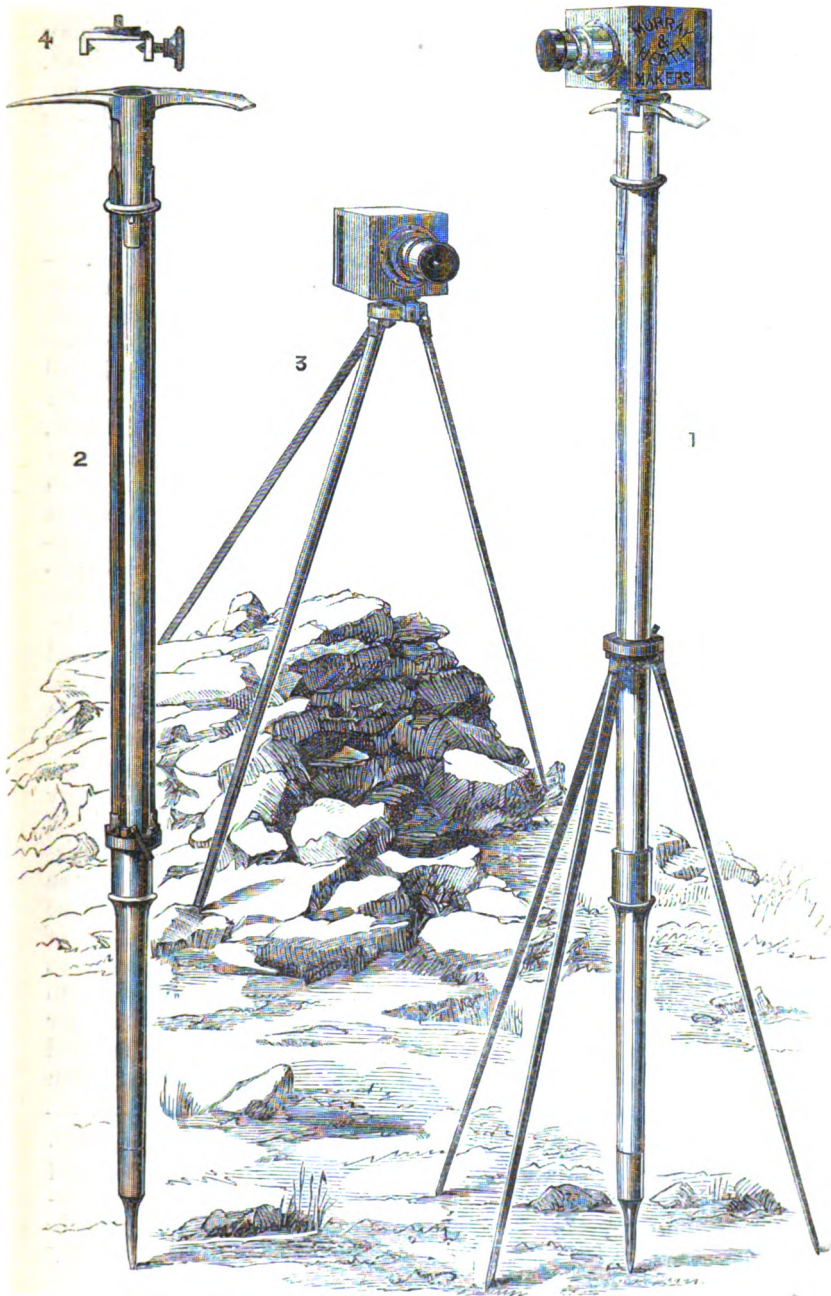
The camera is a cube of about $3\frac{1}{2}$ inches, and the ordinary landscape lens fits inside it when the apparatus is packed up. The dark slide in which the plates are carried contains two plates back to back, on each of which two pictures can be taken. My own experience is, that two such slides, or eight pictures, are amply sufficient for a day's work; but on this point everyone must judge for himself. A bit of black velvet to cover the camera while a picture is being taken is the only other thing necessary to be carried during the day; for the store-box of plates, out of which the slides are filled at night, and into which they are returned after use, will of course remain in the traveller's portmanteau. Mountaineers, however, who are apt to part with their portmanteau for several days at a time, will find it convenient to have a small store-box, to hold about a dozen plates, which they can carry with them. I had one made of zinc, as lighter and more compact than a wooden box, in spite of remonstrances from the manu-

facturer, who thought that metallic dust would be scraped off in putting the plates in and out, and would injure the pictures; and certainly I found nothing of the kind happen. Such a box, when full, weighs some 18 ounces, and furnishes, with the two dark slides, an ample provision of plates for several days; it cannot be exhausted under four days, and will on the average suffice for a week. The camera, slides, and zinc box I carried in a square leather case (measuring $7\frac{1}{2}$ in. by 4 in. by $7\frac{1}{2}$ in.) without quite filling it; in fact, there is room in the case for the extra luxuries which I have yet to describe. The first of these is a second lens, with which pictures can be taken instantaneously if necessary. The ordinary lens is certainly better for landscape purposes, but is useless for portraits, and not perfectly adapted for buildings. Moreover one often sees cloud effects, for instance, which it is hopeless to attempt to record on a plate that requires four minutes of exposure, but which might well be pictured if a few seconds would suffice. When on the summit of the Gross Venediger, I found myself in sunshine surrounded by a ring of the most wonderful cloud-masses, whose beauty, to my mind, compensated for their concealing the vast panorama. Pictures of them would have been absolutely unique, worth any trouble that might be needed for obtaining them; but I had no second lens with me, and I vowed then and there that I would never again go mountaineering without one. The second additional luxury is an invention of my own, suggested by the desire I felt at several points of view to obtain something like a panorama, more, at any rate, than could be included in one picture. To do so, I had to shift my camera-stand, and it is manifestly impossible, especially on a rocky mountain top, to get exactly the same level again. Accordingly, I invented a little device, to be inserted between the stand and the camera—a cone turning in a socket, which can be fixed in any position by means of a set screw, and, when the screw is loosened, can be turned quite smoothly. The edge of the socket is graduated, so that it is unnecessary to displace the dark slide in order to look at the second picture through the camera: one can always ensure the second view fitting on to the first. This contrivance has the further merit of enabling one to set up one's camera without troubling about the direction in which the view is going to be taken, since the camera can be readily pointed afterwards—no insignificant advantage on a pile of loose rocks at the top of a mountain, where it is hard to get one's tripod to stand at all. The third extra is a little plate with a groove along it, by which, if desired, a pair of stereo-

scopic pictures may be taken, by placing the camera first at one end of the groove and then at the other. It is for each traveller to judge for himself whether he cares to have all or any of these appendages to the camera; no one need be deterred by the weight, for the case containing all that I have described—camera, two slides full, zinc box full, extra lens, and the other fittings—weighs but $5\frac{1}{2}$ pounds.

It remains to describe the stand with which this miniature camera is used; and this is the point at once of most importance to the mountaineer, and on which I can, from my own experience, speak most decidedly. In 1868 I used, with a camera of slightly different and, I think, inferior make, an ordinary wooden tripod, the legs being so shaped as to form segments of a solid pole, and being held together with a brass ring. Such a composite pole may, to a certain extent, take the place of an ordinary alpenstock, but is not the sort of instrument one would like to carry for a serious mountain expedition. Moreover, most climbers like an axe, and it becomes a real encumbrance to drag about a second pole of any sort; the practical result to me in 1868 was that I several times left my camera behind when going up a mountain. Accordingly, I set about devising something more portable, and, after one or two not altogether successful attempts, hit on the plan of making my axe itself the stand.* A saddle-shaped clamp screws into the bottom of the camera, and is placed across the head of the axe, being fixed there with a set screw. The axe stands upright, and is steadied by a small brass tripod, the top of which, instead of being a solid plate, is a ring fitting loosely round the handle of the axe, and capable of being firmly clasped round it by means of a screw. I consider it an absolute *sine quâ non* that the tripod shall not be in any way attached to the axe, so that when desirable either may be used separately. When the axe has to be turned to its special work of step-cutting, the tripod will necessarily be an encumbrance; but it is better carried loose than in its place on the axe, spoiling its balance, and getting its own screws bent and broken. And the tripod is very convenient without the axe, the clamp being placed across the ring which forms its head. There are many places, especially on rocks, where it would be difficult to set up an upright

* The cuts on the opposite page show the tripod in its various positions. Fig. 1. The axe serving as camera-stand, with the tripod steadying it. Fig. 2. The tripod shut up and in its place for carrying. Fig. 3. The tripod apart from the axe. The little clamp into which the camera screws is also drawn, separate, at the top of Fig. 2.



pole, surrounded by the tripod, but where the three legs may always be made to stand firm. It is obvious that this tripod, weighing as it does two pounds or more, is a serious addition to the weight of an axe. All I maintain is, that it being necessary to have a camera-stand, this is the easiest mode of carrying it. Put on the right way, however, which is that shown in the drawing, it is less cumbrous than it looks. But the best evidence in its favour is from practice. I carried my axe, with the tripod on it, throughout every mountain excursion I made in 1869, and I fully intend doing so on every future expedition. For the photographic success of this stand I need only say that not one of my pictures was injured by any want of steadiness, and this although they were taken in all sorts of places, often much exposed to wind. It is hardly necessary to add, that it will suit an alpenstock equally well, provided it has a flat knob at the top over which the clamp may be fixed. Lest I should seem to be claiming the merit, such as it is, of this device entirely to myself, I ought to state that when I first went to Messrs. Murray & Heath's, the instrument-makers, to see about having a stand made according to my own ideas, Mr. Murray showed me the model of a similar contrivance which he was making from the instructions of Mr. Marshall Hall. In this, however, the axe-handle was a good deal cut and grooved, thus not fulfilling my primary principle of not interfering in any way with the axe; and I believe that Mr. Marshall Hall has since fully recognised the superior convenience of having the axe and tripod completely separable.

The one matter on which knowledge is essential before any traveller can take photographs successfully by this, or, indeed, by any process, is the time during which, under different circumstances, the plate* is to be exposed. Inasmuch as the traveller who brings his plates home for development can have no idea whether he has succeeded or not, it is manifestly of great importance that he should obtain as much information as possible before starting on a tour, unless he is prepared to have all his labour wasted. The apparatus required for developing is not bulky, and the process is both easily learned and requires less practice and skill in manipulation than

* The plates I have used have been those of the Liverpool Dry Plate Company, with which I have every reason to be satisfied, as I have scarcely had one faulty plate. Those of other makers perhaps require greater or less time, so that the little I can say on the subject must be taken with some grains of allowance, as tested only with these particular plates.

preparing a plate by the ordinary wet process: anyone willing to develop his own plates in the evenings would find the materials no encumbrance worth considering. But most men would prefer having it done for them, and nothing will dispense with the necessity of understanding the right time for exposure. The rules are tolerably simple in outline, though it is as impossible to reduce them to a formula as to give precise instructions by which to make a picture artistically excellent. The operator must determine the exact time required for each separate picture by his own instinct, just as he determines exactly what shall be included in it. The general principle is, that the greater the amount of light received on the lens, the more rapidly will the picture be printed. That is to say—

(1) A distant view requires less time than a near object.

(2) An object light in itself, or brilliantly illuminated by the sun, requires less time than a dark object.

(3) The amount of light varies considerably with the time of day, and the amount of cloud in the sky.

The first rule is but a particular case of the second, as students of Ruskin are well aware. I need only refer to the paragraphs in his volume on *Mountain Beauty*,* in which he demonstrates the extraordinary lightness of very distant objects, such as mountains a few miles off; but the whole chapter is worth attention for the purpose of judging of the exposure required for a photograph. I have also found that as a matter of fact, as one goes higher, the time necessary for a picture tends to diminish. To take extreme cases from my own experience, a view from the top of a pass 10,400 ft. high, of a mountain a mile or so distant, taken at 9 A.M. in bright sunlight with a snow foreground, was a trifle over-exposed in two minutes; and a plate exposed on the summit of the Antelao at noon on a cloudless day was burnt up altogether in $2\frac{1}{2}$ minutes. On the other hand, for a picture taken in the gorge of Sottoguda at 9 on a dull morning, $4\frac{1}{2}$ minutes proved barely sufficient, and the same exposure at 5.30 on a dull evening in the Ampezzo valley failed to produce any picture at all, though the view was a very distant one. There is no avoiding the ever-present difficulty that near and far objects, foreground and background, require for perfection different exposures. All we can do is to assimilate them as nearly as possible. If there is a great distance to be taken, choose a brightly illuminated foreground; on a mountain-top, for instance, prefer snow to rocks. Disturb the snow a little if possible, to break its uniform sur-

* 'Modern Painters,' vol. iv. p. 39, &c.

face; but rocks will not print themselves distinctly till the distance is burned. Similarly, it is impossible to obtain a satisfactory photograph of what is to the eye most attractive, a mountain view framed in the branches of some closely overhanging tree; one must be sacrificed to the other. The scale ranges from a minute and a half, on snow, under a bright sun, for a very distant view—such for instance as one from the summit of Mont Blanc—to five minutes, or occasionally even more, for a deep ravine on a dull day, or a dark object very near at hand. In an open valley, with no very extreme distance, for instance in the valley of Grindelwald, the limits would be $3\frac{1}{2}$ minutes, if clear and near midday, to $4\frac{1}{2}$ minutes, if either early or late. With regard to the time of day, it may be stated generally, that morning is better than afternoon; the best hours are from 9 to 2; but with longer exposure one may get pictures at hours considerably before and after these. I got a very fair picture at 7 A.M. on August 14, and several at 4.30 or 5 P.M. But all rules resolve themselves into one: judge for yourself how much light there is on the lens, and expose a proportionate time, between the sort of limits that have been indicated. The only supplementary advice I can give is, when you are in doubt expose a little more. For if a plate is under-exposed, the picture is not there, and cannot be got at; if it is over-exposed, the picture is there, though more or less discoloured and burnt, and a little management in developing will correct much of this.

The mountaineer who intends to make a miniature camera his companion in a future tour, will doubtless prefer to try his 'prentice hand at home before going to the Alps, and will seek more detailed instruction on any points which do not seem clear. On these any photographer will be able to advise him; the best thing he can do will probably be to apply to Mr. Murray, of 69, Jermyn Street, the agent for the apparatus I have been describing, who knows every detail of my Alpine experience, besides understanding photography fully. My purpose is merely to call attention to the facility with which any traveller can enrich himself with memorials of a tour, and evidently add much to the general store of topographical knowledge; and, if possible, to save others from having to blunder to their experience through a variety of failures.