in the circumstance that it cannot be welded without great difficulty. With a higher per centage of carbon, it can only be welded under a coating of borax. With a per centage of 1.25, it can no longer be welded at all. Although, on the one hand, this behavior of the cast steel obtained in this way indicates its homogeneity, still it is a defect, one indeed which is likewise possessed by the English cast steel in a somewhat less degree.

12. The cast steel bears only low tempering heat, and acquires a very high degree of hardness, although at the cost of its tenacity. The proper mode of tempering it still remains to be ascertained.

13. The steel may be used for making the finest kinds of cutlery for files and chisels. For all purposes in which it is submitted to sudden and violent blows, it has proved destitute of the requisite tenacity. While very hard, it possesses considerable brittleness.

14. The last mentioned character of the steel affords ground for doubting its certainly apparent homogeneity, and this conjecture is confirmed by the fact, that its tenacity and capability of being welded are considerably increased by remelting. If, however, it should prove to be impossible to produce a good cast steel in one melting, the economical advantages of this process would probably be altogether lost.

The further prosecution of these experiments has unfortunately been interrupted by the long illness and death of Superintendent Stengel, who had for a number of years afforded me valuable aid in carrying out a variety of experiments, which appeared to me to be necessary for the purpose of throwing some further light upon the metallurgy of iron.—*Karsten and v. Dechen's Archiv*, vol. xxv, p. 218.

New Photographic Process. By JOHN STEWART.*

Your insertion of the annexed letter from my brother-in-law, Mr. John Stewart, of Pau, will much oblige me. The utility of this mode of reproduction seems indisputable. In reference to its concluding paragraph, I will only add, that the *publication* of concentrated microscopic editions of works of reference, maps, atlases, logarithmic tables, or the concentration for pocket use of private notes and MSS., &c., &c., and innumerable other similar applications, is brought within the reach of any one who possesses a small achromatic object glass of an inch or an inch and a half in diameter, and a brass tube, with slides before and behind the lens of a fitting diameter to receive the plate or plates to be operated upon, central or nearly central rays only being required. The details are too obvious to need mention.

I am, &c.,

J. F. W. HERSCHEL.

Hanley Street, July 6.

DEAR HERSCHEL:—I sent you some time ago, a few small sized studies of animals from the life, singly and in flocks, upon collodionized glass. The great rapidity of exposition required for such subjects, being but the fraction of a second, together with the very considerable depth and

* From the London Athenæum, July, 1853.

harmony obtained, gave me reason to hope that ere this I should have been able to produce microscopic pictures of animated objects. For the present, I have been interrupted. Meantime, one of my friends here, Mr. Heilman, following the same pursuit, has lighted on an ingenious method of taking from glass negatives positive impressions of different dimensions, and with all the delicate minuteness which the negative may possess. This discovery is likely, I think, to extend the resources and the application of photography, and with some modifications, which I will explain, to increase the power of reproduction to an almost unlimited amount. The plan is as follows: the negative to be reproduced is placed in a slider at one end (*a*) of a camera or other box, constructed to exclude the light throughout. The surface prepared for the reception of the positive, whether albumen, collodion, or paper, is placed in another slider, as usual, at the opposite extremity (*c*) of the box, and immediately between the two extremities (at *b*) is placed a lens. The negative at *a* is presented to the light of the sky, care being taken that no rays enter the box but those traversing the partly transparent negative. These rays are received and directed by the lens at *b* upon the sensitive surface at *c*, and the impression of the negative is there produced with a rapidity proportioned to the light admitted, and the sensibility of the surface presented. By varying the distances between *a* and *c*, and *c* and *b*, any dimension required may be given to the positive impression. Thus, from a medium sized negative, I have obtained negatives four times larger than the original, and other impressions reduced thirty times, capable of figuring on a watch glass, brooch, or ring.

Undoubtedly, one of the most interesting and important advantages gained by this simple arrangement is, the power of varying the dimensions of a picture or portrait. Collodion giving results of almost microscopic minuteness, such negatives bear enlarging considerably without any very perceptible deterioration in that respect. Indeed, as regards portraits, there is a gain instead of a loss; the power of obtaining good and pleasing likenesses appears to me decidedly increased, the facility of subsequent enlargement permitting them to be taken sufficiently small, at a sufficient distance (and therefore with greater rapidity and certainty) to avoid all the focal distortion so much complained of, while the due enlargement of a portrait taken on glass has the effect, moreover, of depriving it of that hardness of outline so objectionable in a collodion portrait, giving it more artistic effect, and this without quitting the perfect focal point as has been suggested.

But there are many other advantages obtained by this process. For copying by engraving, &c., the exact dimension required of any picture may at once be given to be copied from.

A very small photographic apparatus can thus be employed when a large one might be inconvenient or impracticable, the power of reproducing on a larger scale being always in reserve. Independent of this power of varying the size, positives so taken of the *same* dimension as the negative reproduce, as will be readily understood, much more completely the finer and more delicate details of the negatives than positives taken by any other process that I am acquainted with.

The negative also may be reversed in its position at *a* so as to produce

upon glass a positive to be seen either upon or under the glass. And while the rapidity and facility of printing are the same as in the case of positives taken on paper prepared with the iodide of silver, the negatives, those on glass particularly, being so easily injured, are much better preserved, all actual contact with the positive being avoided. For the same reason, by this process positive impressions can be obtained not only upon wet paper, &c., but also upon hard inflexible substances, such as porcelain, ivory, glass, &c., and upon this last, the positives being transparent are applicable to the stereoscope, magic lantern, &c.

By adopting the following arrangement, this process may be used largely to increase the power and speed of reproduction with little loss of effect. From a positive thus obtained, say on collodion, *several hundred* negatives may be produced either on paper or on albumenized glass. If on the latter, and the dimension of the original negative is preserved, the loss in minuteness of detail and harmony is almost imperceptible, and even when considerably enlarged, is so trifling as in the majority of cases to prove no objection in comparison with the advantage gained in size, while in not a few cases, as already stated, the picture actually gains by an augmentation of size. Thus, by the simultaneous action, if necessary, of some hundreds of negatives, many thousand impressions of the same picture may be produced in the course of a day.

I cannot but think, therefore, that this simple but ingenious discovery will prove a valuable addition to our stock of photographic manipulatory processes. It happily turns to account and utilizes one of the chief excellencies of collodion, that extreme minuteness of detail which from its excess becomes almost a defect at times, toning it down by increase of size till the harshness is much diminished, and landscapes, always more or less unpleasing on collodion from that cause, are rendered somewhat less dry and crude.

A very little practice will suffice to show the operator the quality of glass negatives, I mean as to vigor and development, best adapted for reproducing positives by this method. He will also find that a great power of correction is obtained, by which overdone parts in the negative can be reduced and others brought up. Indeed, in consequence of this and other advantages, I have little doubt that this process will be very generally adopted in portrait taking.

Should your old idea of preserving public records in a concentrated form on microscopic negatives ever be adopted, the immediate positive reproduction on an enlarged readable scale, without the possibility of injury to the plate, will be of service.

I am, &c.,

JOHN STEWART.

*Application of the Pendulum to the Determination of Velocities.**

The invaluable instrument which we call a pendulum has been applied to an infinity of objects, and always with characteristic advantages in point of precision or sensibility. It was only recently that by a new application of it, the most lofty in its object, and the most ingenious in its nature, it was made to render visible the rotation of the globe. Per-

* From the London Mechanic's Magazine, June, 1853.