

## LETTERS TO THE EDITOR.

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**The Modern Range-finder.**

PROF BOYS, in his review of Prof. Cheshire's pamphlet on "The Modern Range-finder" in NATURE of September 6, has raised certain questions which may be amplified with advantage.

The application of stereoscopic principles to range-finding is due to Hector Alexander de Groussilliers, who communicated his invention to Messrs. Carl Zeiss, by whom it was elaborated and constructed. As in principle the stereoscopic range-finder is so simple and beautiful it is desirable that the name of the true inventor should be remembered.

Prof. Boys is scarcely correct in stating that the stereoscopic range-finder was proposed by a workman in the Zeiss works. De Groussilliers was a chemist and an engineer in the Continental sense, who lived at Charlottenburg. His British patent, No. 17048, was applied for on September 11, 1893. It is interesting to note that the corresponding German patent, identical in substance, and applied for on January 3, 1893, is issued in the name of Messrs. Carl Zeiss.

As Prof. Boys says, it is fascinating to sweep the scale past more or less distant buildings and see the divisions of the distance scale pass behind or in front of the different objects; but when the observations are made upon objects of known ranges and the results are analysed, the fascination is generally tempered by disappointment.

It has been said with considerable truth that a coincidence observation is a fact, whereas a stereoscopic one is an impression; the former is based upon a self-contained micrometer measurement effected by one eye, while the latter is the result of balancing the effects produced in two separate eyes.

Prof. Boys suggests that for anti-aircraft work the stereoscopic range-finder may be of advantage, owing to its speed of operation, on the assumption, presumably, that an object in any part of the field can be compared with the fixed scale and that accurate direction of the instrument upon the target within the limits of the field is therefore not required. In practice this is not the case. If any reasonable accuracy is to be obtained, the object must be brought close to the appropriate mark or on to the imaginary "plastik" line between two marks; that is to say, the instrument must be both trained and elevated with considerable accuracy. In a coincidence range-finder the image must be brought to the separating line, but it may occupy any position along the length of the line.

In a stereoscopic instrument it is necessary to compare the image with one mark, then with the neighbouring one, and, finally, to locate its position between them. Compared with coincidence, the stereoscopic observation is not more speedy, and therefore not more suitable, for anti-aircraft or similar services, where speed of operation is essential. It involves as careful direction and the accuracy attained is much inferior. Great claims as regards accuracy have been made for stereoscopic range-finders, but these have not been substantiated in practice.

With regard to the question of accuracy, the resolving power of the objective is not one of the limiting factors in the case of coincidence observations. Suppose, for example, that the image is a point circle; then the coincidence operation consists in making the

separating line cut the circle approximately diametrically, and in bringing the edges of the upper semicircle into alignment with those of the lower. If now the resolving power of the objective is diminished by decreasing its diameter, the point image will be of larger diameter, but the coincidence operation will not be more difficult than before. Indeed, if the objective diameter is so small that the image is surrounded by distinct diffraction circles, the operation will be facilitated, as such lines constitute ideal coincidence objects. The accuracy depends upon the character of the edges as regards sharpness, and not upon the size of the image of the ideal point.

The coincidence observation figures quoted by Prof. Cheshire are quite ordinary. So far as the unaided eye is concerned, the only limit to resolving power that the writer is aware of is the quality of the definition of the edges of the image at the retina. On natural objects the unaided eye can resolve less than four seconds, and under good conditions of definition an accuracy of two seconds has been obtained with considerable consistency in coincidence observations, but *plus* or *minus* three to four seconds is the more usual practice.

JAMES WEIR FRENCH.

Anniesland, Glasgow, September 27.

I AM obliged to Mr. French for correcting me in the matter of the origin of the stereoscopic range-finder. My statement that the idea originated with one of Zeiss's workmen was made on the basis only of my recollection of conversation with Dr. Czapski at the Paris Exhibition in 1900, and it may well be that my recollection is at fault, or possibly that I misunderstood what I was told.

When suggesting that this type of range-finder might have some advantage for anti-aircraft work, the observation I had in mind was sweeping the scale of distance slowly across the object and noticing which division came within and which beyond, and then not more than a rude guess at the proportion between. Such a process I considered would give a very quick but less accurate range than that given by a coincidence instrument, but nevertheless a very useful range in view of the rapid and erratic change of distance. The most aggravating property of the stereoscopic instrument is the transparency that it imposes, even upon buildings, for the more distant scale divisions remain in view as they pass behind them.

C. V. BOYS.

**A Plea for the Fuller Utilisation of Coal.**

THE important letter from Major Martin (NATURE, August 16) on the above subject involves many considerations, and I would suggest that the following points merit attention:—

(1) It seems probable that after the war there will be a demand for greater home comfort among the poorer paid classes of the community. The supply of very cheap gas for heating and cooking should improve matters greatly.

The cost would be further reduced if arrangements could be made to fit houses with surface-combustion heaters, cookers, and the like (*cf.* Prof. Bone's experiments).

At present it appears to pay many gas companies to supply ordinary gas stoves on specially favourable terms to consumers, so that there seems no reason why surface-combustors should not be supplied from various depôts in different districts. If the gas were distributed at a high pressure, it should be possible to devise some injector arrangement which would obviate the necessity for the use of compressed air, a