EFFECT OF EXTERNAL MAGNETIC DISTURBANCES
ON WESTON INSTRUMENTS.

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The Weston instruments are slight modifications of the well-known D'Arsonval galvanometer. In the voltmeter we have a pivoted fine wire coil turning between two poles of a permanent magnet, the restoring force being a pair of watch springs.

The action is as follows: When the terminals of the coil are connected to the points whose potential difference we wish to measure, a current flows through the coil proportional to this P.D. This current sets up lines of force and these acting upon the lines due to the permanent magnet cause a force which deflects the needle. It is evident that anything which permanently or temporarily changes the number of lines of force passing through the coil due to the permanent magnet will make the reading different from what it should be for a given P.D. at the terminals of the coil.

Owing to the difficulty of maintaining constant the strength of a powerful magnet, Mr. Weston employs a comparatively weak one, and hence we should naturally expect that comparatively small magnetic disturbances would affect the instrument.

In fact, the earth field exerts an appreciable influence and this fact is taken account of in the calibration of the instruments, although for commercial work the effect is too small to be of any account.

The effects to which I desire to call attention are those of the commercial or workshop order.

In many tests such as determination of the characteristic curve of a machine, the resistance of armature or fields, coefficient of magnetic leakage, etc., two instruments are employed and the question comes up, how far apart must we put the two instruments so as not to affect each other appreciably.

One of my students, Mr. J. A. Stewart, has made at my suggestion some quite extended experiments upon this point and finds that :

(1) A Weston instrument placed close to another may change its reading by about five per cent. The matter is then worth investigating.

(2) That as far as its disturbing influence goes, it makes practically no difference whether the disturbing instrument has current through its coils or not.

(3) That two instruments placed a foot apart from each other in any position do not affect each other's readings by one-fourth per cent.

It is often convenient, however, if one person is reading both instruments, to have them as close as possible, and Mr. Stewart showed that the best position was either of these two.

It is best that the points *a b c* should be in the same straight line.

When this is the case neither instrument affects the reading of the other by as much as one-fourth per cent.

The maximum disturbance of five per cent. was reached as would be expected in this position.

We next wanted to find what effect would be produced by some things liable to occur in a workshop.

An ordinary twelve-inch file was placed in different position near a Weston instrument while measuring about half the amount possible. The file, when every part of it was at least four inches distant, produced practically no effect, but when placed thus, changed the deflection over four per

cent. An ordinary bench vise also acted just like the file, having no effect at four inches, but introducing an error of four per cent. when placed in position where it had its maximum effect.

The reason for this action is clear. Take the case of the file above. It evidently leads away from the coil a part of the lines of force due to the permanent magnet. There is then not so strong a deflecting force, and the reading is too small.

As to the effect of very powerful magnets, as those of a dynamo, we have not made sufficient experiments for publication.

Once in a while it is convenient to place three instruments together, and this arrangement gives an error of less than one-half per cent.

The observance, then, of very slight precautions, will allow us to place our instruments in any desired proximity without vitiating, to any appreciable extent, our results.