ANNEXURE B.

(1.) REPORT ON A KONIMETER TEST OF MINE-DUST IN THE WAIHI AND WAIHI GRAND JUNCTION MINES.

METHOD OF TAKING AND EXAMINING SAMPLES.

The principle on which the konimeter is based consists in causing a definite volume of the air to be tested to impinge at a high velocity through a small nozzle against a glass slide thinly coated with vaseline. The dust is caught on the surface of the vaseline, forming a small circular spot, which is examined under a microscope, and the dust-particles counted.

It was found advisable to have the coating of vaseline as thin as possible, the best results being obtained by spreading a very small quantity on a warmed glass slide with a round glass rod. In cold weather it was necessary to warm the instrument and slides before going underground, in order to prevent the deposition of moisture, which causes the spots of dust to be patchy and difficult to count. As a rule six samples were taken on each slide in two parallel rows.

In the microscopic examination a ½ in. objective was used with an eye-piece magnifying eight times, the magnification being about 150 diameters. To facilitate counting, two spider lines making an angle of 18° with each other were fixed on the diaphragm of the eye-piece, so that a count of the dust in both the sectors thus formed was one-tenth of the total dust in the spot. A micrometer was also placed in the eye-piece to enable the size of the particles to be estimated.

CLASSIFICATION OF DUST.

Examination of dust from silicotic lungs has revealed the fact that the particles are invariably extremely small, averaging 1·2 microns in diameter and rarely exceeding 5 microns. (NOTE: 1 micron = $\frac{1}{1000}$ millimetre = $\frac{1}{25000}$ in. approximately. The minuteness of these particles will be best appreciated by comparing them with human-blood corpuscles, which are from 7·5 to 8 microns in diameter). Hence the dust may be classified, according to its size, into injurious and non-injurious dust, the former including all particles up to 5 microns in diameter, and the latter the particles over 5 microns.

This division, although in the right direction, seems to me not altogether satisfactory, in that it makes no distinction between the effect on the lungs of a particle 1 micron in diameter and of a particle of 5 microns, although the latter weighs 125 times as much as the former. Suppose, for example, two spots each gave counts of 300 particles under 5 microns per cubic centimetre, but in one sample the particles averaged 3 microns while in the other they averaged 1 micron: both samples would be returned as equally injurious, whereas the dust in the former would weigh many times as much as that in the latter; and it seems reasonable to suppose that it is not the number of particles, but their mass, that determines the degree of silicosis produced. It would be too tedious to count the number of particles of various diameters in each spot in order to estimate their weight; and, in any case, even this would not give a correct value for the harmfulness of a particular sample of dust, as it does not take into account the relative chances of the larger and smaller particles of being caught on their way to the lungs. The data available tend to show that proportionately more of the larger particles than of the smaller do not reach the lungs, and this will to a considerable extent counterbalance the fact that no allowance is made in the count for the difference in weight of the particles.

This point has an important bearing in relation to the different character of the dust produced by the "wet" and "dry" machine drills respectively. The axial water-feed drills produce dust of a greater degree of fineness than those with solid steel. This may be seen clearly by comparing the micro-photographs of the dust from the Ingersoll wet and dry stopers. The former contains a large proportion of particles round about 1 micron in diameter, while the latter has a considerable proportion of particles 3 and 4 microns in diameter. The counts of injurious particles are approximately the same, but the weight of the dust produced by the dry stoper is undoubtedly much greater. It does not follow, however, that this dust is more injurious, as it is almost certain that a much smaller percentage of the particles in it would reach the lungs.

RESULT OF TESTS.

In all over two hundred samples were taken and examined from the two local mines, and most of the results are summarized in the attached table. Although the tests should extend over a considerable period to enable definite conclusions to be drawn, it may safely be said that they show that in the two mines sampled the amount of harmful dust in the air under ordinary working-conditions is small, and much less than that contained in the South African mines. In fact, in places other than closed ends, the amount is as a rule no greater than might be present in air on the surface on a windy day. This satisfactory state of affairs is no doubt primarily due to the effective measures taken to lay the dust by water-jets wherever it is produced, as in drilling, blasting, &c. Other contributing causes are the large volume of circulating air required by the New Zealand Mining Act (150 cubic feet per man per minute, compared with 30 cubic feet in South Africa), and the large amount of water in the reef-system and consequent humidity of the air-current, producing rapid precipitation of the dust.

Some of the figures, however, emphasize the absolute necessity for keeping the working-places damp when drilling and shovelling, and for laying the dust produced by blasting, by means of some device such as an atomizer.