machine which drives home the wedges in true alignment. This machine is also comparatively economical relative to air-consumption during operation.

When coal is cut by machinery the methods at the face are different from those employed by the coal-hewer. The latter holes, cuts, hews, and fills his own coal, likewise sets the necessary timber to secure safety. Where machines are employed, there are three distinct operations in the production of the mineral, which are designated as follows: First, holing; second, blasting; third, filling. With reference to the first the machines are used, the operators and their assistants holing the places to a depth of 5 ft. These are followed by a shift of men termed "shooters," whose duty it is to effect the second operation by drilling the necessary shot-holes, charging same, and blasting down the coal previously holed. The shooters are succeeded by a shift of men called "fillers" who perform the third stage of the work, their duty being to fill away the prepared coal into the tubs. During the time the machine-operator is holing the coal, he gives the necessary attention to the spragging, &c., of the coal-face. Whilst filling is in progress, special men give attention to the trimming of any loose coal from the faces, likewise the setting of the timber required to render the working-places secure and safe. Apart from this curt reference to the different methods, the rest of the operations governing the transit of the mineral from the face to pit-bank are one and the same.

The seams at Westport collieries are of a richness and quality equalling the best of such in the mining world of to-day, but as the outcome of this there is a friableness which results in an undue percentage of small to large coal. With respect to this it has been claimed by the opponents of machine-application that excess of small is principally attributable to the use of machines. To those conversant with all details, that is known to be not so. As stated, the proportion of small is excessive, but it is not minimised in the tonnage which is hand-hewn, rather is the comparative result in favour of the coal won by machines.

When the method of coal-cutting by machinery is adopted in a mine, with machines of a type which may of themselves be quite suitable for the particular conditions of the seam to be won, there is yet another most important adjunct to their success—viz., "The man behind the gun." A machine-operator requires to be active and energetic, and imbued with a sense of fairness and justice equitable to both his employer and himself. No machine will be successful unless the operator takes an intelligent and conscientious interest in the particular work allotted to him. If he brings such commendable qualifications to bear on his work, he will assuredly give satisfaction to himself and his employer alike.

Another powerful argument in favour of machine-application, and one which should appeal strongly to the most rabid opponents, from a humane point of view, is the immunity from serious accidents at the face, as compared with those occurring to coal-hewers. The reason of this is obvious when it is understood, that much of the coal-miners' work is performed immediately at the face, and under conditions which necessitate his lying under masses of overhanging coal when he is engaged at deep undercutting. The machine performs this work during which time the operator is behind it, many feet distant from the face. This at once suggests the comparative degree of safety to the machine-operator as against the coal-hewer.

In all branches connected with coal-mining, the primitive methods and appliances at one time operative have practically become obsolete, and have been superseded by modern equipments with every success, with one exception—viz., that of the actual hewing of the coal, for which operation methods which can only be called antiquated are still in continuance. This condition must assuredly alter, as economic demands are requiring that improved methods at the coal-face shall supplant the old and arduous system of hand-hewing.

When the number of persons dependent, directly and indirectly, on the world's coal-mining industry is considered, every effort should be put forth to prolong the basis of that dependence, in the matter of improved methods whereby maximum extraction will be consummated, and at the same time the general safety of the worker be enhanced. The adherence to a stereotyped system which should be practically obsolete is to an extent very often continued subordinate to restrictive labour conditions, notwithstanding that such a method conduces to undue waste of wealth, which is diminishing yearly. Such a system and anything derogatory to its abrogation should be condemned. To insure the longest possible life, by winning the fullest quantity of this highly useful portion of the world's wealth from nature's limited storehouse, the old conditions must change, and those interested therein, one and all, should speedily recognise the fact, and without further delay face the situation unanimously and with equanimity on broad national grounds.

APPENDIX II.

THE VENTILATION OF MINES.

By ALEXANDER AITKEN, C.E., Manager Waimea-Kumara Water-races; and R. M. AITKEN, late Director School of Mines, Reefton.

THE following formula, for the calculation of quantities of air carried in air-courses of various lengths, forms, and areas, under different pressures, is a modification of the rules used in the calculation of quantities of water discharged by pipes and watercourses of various lengths, forms, and areas under different pressures and different gradients.

It appears that air can be treated as a fluid, and that the laws regulating the flow of water can be applied to all fluids, with certain modifications rendered necessary by the different character of