machines, from ten to fourteen feet in length, and their inclination is seldom less than one and a half inches, and reaches two inches per foot: both figures which, considering that the supply of water is mostly rather copious, are certainly not calculated to insure a satisfactory saving of the fine gold and amalgam escaping from the copperplates; irrespective of that, at some machines, the blankets are not, or have not been, washed frequently enough. Having herewith given my opinion on the point from whence at least the greater percentage of the loss in gold and mercury proceeds, I would recommend the exchange of the present appliances and system for, or respectively their modification according to, those for years successfully in use at the Port Phillip Company's works, Clunes—an establishment which in Victoria occupies the foremost place in satisfactory gold extraction, mainly because the practice there introduced of daily taking and assaying samples of the tailings serves not only for controlling and guiding the working of the appliances adopted, but in the case of any new invention in gold saving being tried, it affords also the best proof of the merits or otherwise of the latter. The system of appliances used at Clunes simply consists—starting from the battery—of three connected quicksilver troughs—the first with a 10-inch drop, the second with a 9-inch, and the third, or lowest, with an 8-inch drop—through which the material passes in succession, to run next over 24 to 27 feet of blanket-strakes, laid at a pitch of only one foot in 16, and ultimately to pass from the blankets through another quicksilver trough before it reaches the waste channel. This last trough is only cleared, however, at intervals of several months, whilst the upper troughs are cleared every week. In order to keep any coarse stuff from entering these latter, and also for even distribution of the material, a perforated plate is fixed right in front of the battery, through which both back and front discharge pass on to an apron which leads it (the material) into the first trough. An important part of each trough is the splash-board, which, reaching down to within about one and a half inches of the bottom (of the trough), near to the surface of the quicksilver, compels the material, in its drop, to pass more or less through the latter before rising over the lip of the trough. All the troughs are supplied with tapholes on one side, by means of which the quicksilver and amalgam can be drawn off when required. The whole system will be easily understood by reference to appended Plan I., Fig. 1, which represents a longitudinal section, whilst Fig. 2 is a section of the troughs on a larger scale, with the principal measurements marked. As to the blanket-strakes, their small inclination requires the supply of water to be up to eight gallons per stamp-head per minute, according to the nature of the stuff, in order to keep them free from sandy settlement. The rate at which the blankets are washed at Clunes is generally the upper row every hour, the second row every two hours; and of the remaining length of the strakes the blankets of the upper half every six, those of the lower half every twelve hours. Considering the nature of the stuff of the Otago reefs, I think, however, that, partly because the more or less slimy stuff from the mullock reefs renders the surface of the blankets quickly inactive, partly on account of the great amount of pyrites contained in the quartz, a more frequent changing of the blankets than the above is advisable.

Touching the treatment of the blanket-sand, the method in use at most of the machines, viz., by revolving barrel and shaking table, gives, if properly carried out, the most satisfactory results, and deserves, therefore, general adoption. In the proper working of the barrel, upon which depends most, certain rules require to be followed, however, and as I had no opportunity of judging of the mode of operation at any of the machines, I give the following particulars on this head for comparison and guidance. Assuming the barrel to be about 4 feet long by 2 feet in diameter, it should be charged with 8 to 10 cwt. of damp sand, and 2 to 300 lbs. of mercury, and set to revolve for about 8 hours at a speed of from 14 to 16 revolutions per minute. After this, it should be filled with hot water and set to revolve again for another 4 hours at the rate of 5 or 6 revolutions per minute, when the operation is finished, and the charge—quicksilver first—may be drawn off. Having been informed that at several of the machines the practice is followed of putting round stones or pieces of iron into the barrel, in order to grind the sand finer and aid the amalgamation of the gold, I have to remark that I consider this proceeding likely to prove more harmful than advantageous, on account of the large quantity of pyrites generally present in the sand, which through the grinding is very likely to sicken or flour the mercury and amalgam, and this invariably is followed by a loss of mercury and gold afterwards. A determination of the exact loss of mercury in this and the main gold-saving process by carefully weighing the metal at short intervals, is not practised, as far as I could glean, at any of the machines, but as it is of the greatest importance in testing the comparative efficiency of the amalgamating appliances, it ought certainly not be neglected in future.

Having herewith noticed all the principal points touching the saving of gold from the crushed material, it remains to draw attention to the saving and treatment of the pyrites, which, as already mentioned, occurs in greater or less abundance in most of the quartz reefs of the province. Although small experiments have as yet been made of the pyrites of but a few of the reefs, and trials on the large scale of that of only one reef (Southberg's Reef, Skipper's Creek) proving the payably auriferous character of the ore, still I think there can hardly be a doubt, judging from Victorian experience, that the pyrites of all the other auriferous reefs of the province is more or less payably auriferous also; and it would be highly advisable, therefore, after the truth of this supposition has been established by fire assays*, to take early steps towards the concentration of and the extraction of the gold from the ore.

* A good practical experiment for determining the quantity of gold in pyrites is the following:—Weigh a good average sample of the dry ore—say about 2 lbs.—and roast it perfectly *sweet* (on a shovel over a fire will do), *i.e.*, till no more smell of arsenious and sulphurous acids is perceptible on stirring. Place the roasted mass into an iron mortar, mix it with so much water that it just packs or forms a *very stiff* paste, and add a tablespoonful of quicksilver. The mass has now to be rubbed with the pestle for so long till all the quicksilver has disappeared, *i.e.*, has been broken up into nearly microscopical particles, which are evenly distributed all throughout. A second similar amount of quicksilver may be worked through in the same way, and then hot water, a little soda, and a larger amount of quicksilver—about five or six tablespoonfuls—are added, and the mass gently stirred for some time, in order to allow the fine particles of the quicksilver to settle down and unite with the large lot at the bottom just put in. Now follows the careful washing away of the red oxyde of iron slime in an enamelled iron dish, and ultimately the retorting—at not too strong heat—of the whole of the quicksilver collected. From the weight of the gold left behind—if any—the contents of gold per ton of the ore can of course easily be calculated. This experiment closely imitates the process to be adopted on the large scale, and, if carefully executed, gives within 80 to over 90 per cent. of the fire assay