

Men may be paid wages for working a given time; or they may have a contract let to them and be paid according to weight or measurement; or their remuneration may depend on the value of the mineral obtained, as in the case of tributes.

Wages are generally paid to surface laborers, engine drivers, stokers, millmen, carpenters, blacksmiths, foremen, and for any dangerous work that requires special supervision. When working for wages, men tend to idle their time and require good supervision in order that a company shall get what it pays for. A uniform wage is unfair since it puts good and bad men on a dead level, and tends to drag the good men down to the standard of the inferior men. Wages men seem to work with their hands only, and as little as possible with their heads and the main idea of many is to do as little work as possible, this is especially noticeable in the 'grave yard' or night shift. In new districts, when high wages have to be paid to assist the men to overcome the high expenses incidental to a new field, a strike with the bitterness it always engenders is almost sure to arise when the conveniences of civilization make high wages no longer a necessity.

It is advisable to have a pair of good men to whom you pay a little more than the usual wage, so that they can be put to work at different faces and determine what a fair day's work should be in any particular place. Or one may change pairs of men about who serve as checks one against the other, especially if the pairs are of different nationality, as then competition sets in. Wages men often do not take the trouble to report any change in the country or lode before they timber up; or they may purposely cover up an indication in the hopes of getting that portion of the mine on tribute at some future date. Neither do wages men do such clean work as tributors unless well supervised.

Some managers in order to save themselves trouble let all mining work on contract. At times this is advisable, at others it is not.

When labor is scarce and labor conditions have to be fulfilled, men who are sure of regular work on wages are not likely to take contracts except on very favorable terms to themselves. It is competition or want of work that obliges men to accept contracts on terms acceptable to mine owners. Contractors do not require the same amount of supervision as wages men, so there is a saving in that respect, especially when the work is scattered. It must not be thought that an advantage to the employer is a loss to the contractor, for a contractor by using his head and working harder than for wages may earn more money per week than a daily wage. It is useless letting contracts to inferior men, they cause endless trouble by being obliged to do their work over again in a miner-like manner, or more likely they throw the contract up altogether. If a contractor only makes £1 a week instead of £2 10s. it does not mean that the mine saves that amount, on the contrary it generally means that the work is delayed. Contracts are good for straight ahead work which can be estimated, such as sinking, or driving in barren rock, known by Cornish miners as 'tut work.' When commencing a shaft, the soil and soft rock should be removed by wages men, otherwise contractors may throw up their contract as soon as they reach hard rock, and make very good wages out of the seventy-five per cent. they generally have advanced to them.

Stopping is not so often let on contract; when it is, it is let at per fathom long and high for the width of the lode, or a standard price may be paid for a given width, and so much extra for anything over that. If very wide, the ore may be paid for at per cubic fathom, or in the case of coal at per ton, weighed at the surface. The contractors generally deliver the ore at the bottom of the shaft. In some places, especially when machines are used, men are paid according to the number of feet drilled which have to be pitched as the underground boss directs. When mining ore on contract since the contractor is only interested in the quantity, and not the quality of the ore, he mixes everything up together.

It may be a matter of policy to let a contract, as when the contract is finished it is a good chance to get rid of an undesirable man, who might cause trouble with his mates if discharged while working for wages.

It is usual for the company to provide tools and materials for contractors and to debit them with the cost. This is the cheapest and most convenient way for the contractors, and gives the company a check on the contractors who are apt to annex the tools and stores of wages men working near them. Trucking is sometimes let on contract.

Tributing gives the miner a chance to make money without any capital of his own, for he uses the company's plant. It is a species of gamble in which he backs his opinion against that of the manager. Working miners can make ground pay that a company cannot, for they only have to make wages and do not have to pay for management, or much dead work as a rule. A tribute is practically the sub-letting of a mine, or portion of a mine for a royalty, and tends to development observation in men. Tributes may be advantageously let in honeycombed surface workings, at the end of a mine's life when there are gleamings to be had, when necessary to keep up labor conditions, and when it is required to prospect for new bodies, in which case the outcrop of a deposit may be cut up into blocks of suitable size, and alternate blocks let, while those between are retained by the company, so that if anything good is found some is sure to occur in the company's blocks, or at any rate below the depth limit of the tribute.

Tributors require careful looking after or else they will soon ruin a mine by picking out the eyes and leaving the workings in an unsafe condition, so that the last stage of that mine is worse than the first. A tribute may be let for a certain period during which a given number of men must be constantly employed, or a block of ground generally bounded by certain levels is let to a party. The ore is treated by the company, or at least is disposed of by the management, so that the mine owners can deduct their proportion from the proceeds. Any slags or tailings left on the company's property belong to the company, if not removed within a given time, so as to avoid future disputes. Tributes are generally paid on the gross yield, as if on the net, all sorts of expenses would be put forward by the men to reduce their liability. It is no easy matter to draw up an equitable sliding scale of royalty, whereby both mine owners and tributors receive a fair proportion of increased ore values. It is difficult enough with a gold ore, but is still

worse when we have to deal with mixed metals which not only vary in their percentage, but the market value of which changes daily. The men soon find out what grade of ore pays them best, and if it is to their advantage to send poor ore to the mill, they will go so far as to dilute their rich ore with mullock ; or it may pay them better to pick out the richest ore, and if they cannot dispose of it without the mine owners knowing, it may suit them to have it treated by itself. Two parties, one on rich the other on poor ore, let at high and low rates respectively, may combine to exchange ore so that the former will get better terms than they agreed to. Taking men as we find them, tributing has a tendency to make them what we may call smart.

As the cost of labor is one of the, if not the largest item of expense on a mine, it becomes obligatory to reduce this as far as possible, not necessarily by cutting down the wages of the men, but by employing machinery to do the mechanical part. Workmen have always objected to the introduction of machinery at first, for they look upon machines as ousting them from positions. So far as certain individuals are concerned, this may be true ; but looking at the matter as affecting the welfare of the community, machinery is of great assistance to the mining industry. Take a rock drill or coal cutter ; they do the most severe part of a miner's work, but they require skilled men to direct them, and these men earn more than they would if they simply used hand tools. Since these machines do a given amount of work cheaper than hand labor, they may drive men away from certain faces, but since they work cheaply, one is enabled to extract ore that it would not pay to touch otherwise, so by placing large quantities of low grade ore at the disposal of a manager, more men can be employed and the life of a mine extended. It simply means that the old fashioned miner must advance with the times ; if he refuses, then he gets out of date and will have to give place to those who accommodate themselves to circumstances. Those collieries that produce the cheapest coal, other things being equal, will not only keep their trade but increase it, and when coal is cheap, it enables those who own factories, to produce their goods at a lesser cost.

The introduction of any new class of machine, especially if it is expensive, is looked upon with disfavor both by proprietors and men. The proprietors do not want experiments tried at their expense, to bother with the training of men to run the machines, or risk the unknown quantities of cost of repairs, and depreciation of plant, for it generally rests with the first users to discover practical defects that do not appear on paper. The men are generally prejudiced against any innovation, especially if they think it may work against their personal interests, they therefore do not take the trouble to work a new labor-saving device properly, and sometimes go so far as to wreck it. In the latter case it looks as if they feared its success.

Mining machinery should be strong and simple in construction, with as few parts as possible. Miners are not trained mechanics, and are apt to be rather rough with machines placed in their charge. The patent medicine to which they pin their faith is a striking hammer, it either kills or cures.

The first cost of a machine too often governs its selection, either because one cannot afford a better class of machine, or else because he who makes the selection understands nothing about it, and thinks he is doing a good stroke of business by buying the cheapest on the market. Inferior machinery made of bad material, of wrong design, with too little metal in the bed-plates, etc., may compete with better class machinery in first cost, but are more expensive in the long run, when we take into consideration the cost of repairs, the shorter length of life, and the expense of delays and stoppages due to repairs. Such machinery goes to build up the scrap heaps at mines, and too often the purchase of inferior machinery has so handicapped a mine that it has had to close down. There are times when a machine is only required temporarily and it is not worth while purchasing a first-rate one, as its value would have to be written off long before the term of its natural life. In such cases a machine of inferior make may serve the purpose, or even a second-hand machine; but second-hand machines cost more before they are pulled down and re-erected than is generally admitted; parts get broken or lost, the various portions are not properly marked for reassembling, and when erected a machine is often found to be unsuitable for the work required of it. Second-hand machinery is mostly obsolete, and has been discarded by more advanced mines; it generally does inferior work, and is frequently located in some out-of-the-way place from which it costs more to fetch than the extra price of new machinery, while the cost of re-erection is likely to be more for second-hand than for new machinery, and frequently the first cost of machinery is but a small part of the total cost of erection. Above all, beware of second-hand boilers unless their past history is known, too often they are not worth the cost of erecting.

One obtains a great deal of valuable information from trade catalogues. The manufacturers of machinery for similar purposes are very good in discovering defects in each others make, and being experts in such lines they have opportunities of comparing advantages and disadvantages that a mine manager may not have. Interested statements, however, must be taken with the customary grain of salt, as some of these are misleading. Take for instance the number of inches an air hammer will drill in a given time, this varies with the depth, for as the drill steel increases in length, and consequently mass, since the force of the blow does not increase in proportion, much of the energy is absorbed in heat and vibration, so the last few inches at the bottom of a four foot hole are not drilled so quickly as those at the commencement. Many supposed advantages put forward by manufacturers in support of their machinery are unimportant, and figures of comparative tests may be misleading, for though one machine may do the best work when new, it may come last after a little wear. The life of a machine, its consumption of power, the cost of upkeep are all items to be considered.

Too often mine managers instead of specifying exactly what they want, send incomplete information to manufacturers and call for tenders. Suppose, for instance, it is desired to erect an ore dressing plant, and instead of having proper plans and specifications drawn up, samples of the ore are sent round to the various manufacturers. These

manufacturers may honestly do their best, but they are not fully acquainted with local conditions, cost of carriage, water supply, contour of country, etc. They have their own patent machinery to push, which presumably they consider as good if not better than that made by rival firms ; so as to keep down the price, they use their stock patterns instead of making modifications, and if they have no regard for their good name may allow for inferior material in their quotation. In this way machinery is often supplied that is of no use whatever to a mine, whereas if only it was made perfectly clear what was wanted, and the quality of material desired in its construction all manufacturers could tender on the same footing. It is hardly likely that any one firm makes everything that is required in such a plant, so if someone outside a manufacturing firm, who understands the local conditions designs a plant, he can put into it machinery made at various works according to its suitability for the purpose in hand, selecting so far as possible stock patterns so as to reduce the cost.

Buying machinery involves more than judging quality and price, one should thoroughly understand the conditions under which it has to work in order to appreciate the value of different designs. Hoisting engines are not economical engines to work when we compare their consumption of steam with ordinary stationary engines used for constant driving purposes. Hoisting engines work intermittently and within a few seconds have to start slowly, accelerate and stop. A fly wheel is dangerous, except when applied as with the Ilgner electric hoists, and then it is not a part of the engine proper. Condensing is seldom done unless there are other engines in the neighbourhood, and only the larger engines are compounded. Yet there are other ways in which fuel may be economised, the cages and ropes may be balanced, careful driving may avoid the absorption of too much power by the brakes, and with some systems of winding there is less mass to be set in motion and stopped. In some collieries they do not trouble much about saving fuel as they reckon that the slack from the mine costs them nothing ; but this is incorrect. The slack has a certain market value, besides the more slack they use, the more labor is necessary to handle it.

One should avoid spending an undue amount of capital on the surface and at the same time starve the underground workings. It may satisfy visiting shareholders to see the wheels go round of some magnificent machine, but it is extravagant to erect expensive machinery for a mine that has not been sufficiently proved, or which is expected to be short lived. Whatever plant is erected should be good, in order to secure efficiency, but not too good. When a deposit has been proved, and permanent machinery erected, the plant, without being excessively large should be capable of an increased output in case of necessity, and should be laid out in such a manner that extra units can be added as required. A machine should not be worked too near its breaking strain, otherwise the cost of upkeeping will be too great. In many cases one can manage for a time with the existing power plant by making certain alterations. For instance, the drilling capacity may be increased by employing air hammers in many cases where reciprocating rock drills are now employed and use much more air, also more attention may be paid to leakages of air along the mains, and the engines and compressors if simple, may be compounded.

It is only a matter of time before machinery gets out of date, and although when carefully looked after a machine may be in good working order, still improvements made in say ten years time may make it advisable to throw out the old time machine and instal one of a new type, so that one can compete with others. It requires a good deal of pluck to do this, and in many cases the destruction of a plant by fire proves to be a benefit to the operator, if he has the means to start anew. He can then rectify old errors; the original plant which possibly was added to from time to time and crowded into a small space, can be laid out properly by employing high pressure steam, the size of the power plant may be reduced, so that after all the new plant will cost less than the old one did. It is advisable to have good tools; busy men have no time to tinker with poor machinery, and for good work the machinery must be kept in good order. A machine may be costly, but its cost may be justified by advantages under certain conditions.

When two different types of machines do the same amount of work for the same cost, if one works quicker than the other it may pay to replace the slower machine, for it means that one of the quicker machines will do more work than one of the slower machines, therefore yielding profits sooner than otherwise.

Some ores may be capable of successful treatment by several processes. In such cases one must take local conditions into consideration, so as to be able to determine which process will give the greatest profit.

One must beware of freak machines. Even if the manufacturer of a new machine guarantees to take no pay unless his machine is successful, the mine owner is still a loser should it turn out a failure, for there is the cost of erection to be considered, the waste of time, general inconvenience, and loss of confidence through the failure to obtain promised returns.

There are fashions in machinery. Some energetic agent pushes his machines which are adopted in some mines, and then other managers, want them, whether they are suited to their requirements or not. Local prejudice often determines the type of machine that is ordered, and managers may send to a distance for a machine that may be manufactured just as well nearer home.

Some machines are made unnecessarily strong and heavy, consuming too much power to work them, but more frequently they are made too light. When constructing a plant, the capacity of different machines that have to work together are often out of proportion. The boilers may be too far away from the engines, and there may be unnecessary bends in steam and water pipes. A machinery site may be badly located so that material has to be elevated instead of being given a natural fall. Shafting and pulleys may be so badly arranged that strains are not well balanced, and the belting may be too long or too short. In fact every possible kind of mistake has been made in the past, and will doubtless be repeated by others in the future, who do not profit by the experience of their predecessors. When selecting a machine, the main points to consider are not only first cost, but also efficiency, economy of operation, and the maintenance.

Repairs, whether to machinery or anything else, should be effected as soon as required. Putting off the evil day only makes matters worse.

A mine manager should practice economy, and supervise the costs of every department, and constantly try to improve any weak points. As labor is the chief item of expense he should effect economies in labor, not by reducing the wages of the men but by increasing their efficiency. The men should thoroughly understand that the success or failure of the mine affects their interests, and the manager can lead a good example by taking an interest in and properly attending to his work. The development work should be kept well ahead of the productive work, and a mine should enter on its producing stage as early as possible, so as to save interest on the capital expended, which in the meantime is lying idle. The man who has the knowledge and can apply it, can act promptly in cases of emergency, is a good organizer and uses tact and judgment, is the one who is most likely to be successful when he takes a position as manager.

