Improvements in Mine Equipment

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Editor's Note. This is the second in a series of articles tracing the process of mining in all its varying steps. The author of the article is a prominent English mining authority; the article itself is taken, as was the first one, *The Progress of Prospecting*, from the Centenary Number of *The Mining Journal of London.*

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In the scale of its operations and the importance of its products mining is man's greatest adventure with nature.

Once it was the heaviest form of labour, particularly favoured for slaves, convicts and our political opponents. With the passing of slavery and the advent of the cheap production of electricity and compressed air metal mining has now become, of all our major industries, the heaviest consumer of power per unit of raw material treated (20 to 50 kilowatt hours per ton). Cheaper power production and the increased use of power are the two most important factors in recent development. These, with larger and larger scale work reducing overhead costs and the increased use of labour-saving devices, have made possible the working of deeper and lower grade ore bodies at a profit. In turn these have led to the organization of larger financial units, more capital investment per unit treated, a higher degree of organisation, both financial and technical, together with less risk to the investor and a more certain market for the manufacturers of mining plant and supplies. This latter has led to keener competition for the markets involved and, in turn, to the supply of better and better products.

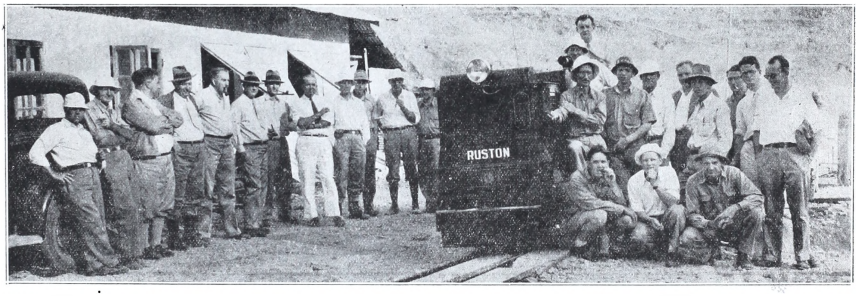
The most spectacular advance has been in the production of large units, giant hoists for great depths and pumping installations for the delivery of millions of gallons of water a day against heads of thousands of feet. These advances are more matters of engineering design and improvement in materials than of mining, although the development in the perfection of electric hoists has been of outstanding assistance to mining operations. The greatest advance in mining has been in the fundamental task of breaking ground, the cheaper production of more efficient and reliable compressors, rock drills, and steel, and the supply of a range of improved explosives for various kinds of ground.

Large scale mining has created a demand for large fans and large air compressors as well as for larger hoists and pumps. The reciprocating compressor holds its own on many large mines, but the turbo-compressor is favoured for units of over 5,000 k.w. Inter-cooler design has given most trouble in the development of this type. It is still possible to purchase a surprisingly unsatisfactory compressor from big firms who specialise in other lines, but experienced manufacturers seem to have approached the limits of reliability and efficiency possible with the generation of this form of power.

With larger installations a feature is the use of meters for measuring the amount of compressed air distributed to different sections of a property. The use of meters underground for measuring the distribution to different levels and working places is not so general owing to the high cost of some makes and the poor publicity obtained by others.

For small installations, particularly on isolated mines, oil engine-driven compressors have been developed to a high degree of reliability. The compression ignition or semi-diesel type of oil engine is most attractive because of the lower cost and greater convenience of heavy oil.

For work in the prospecting and development of new mining areas recent years have seen the perfecting of high speed engines working on this principle and the production of portable air compressors using oil fuel instead of petrol, which is so much more expensive. Portable sets of this type with a capacity of 340 cubic feet per minute, sufficient to operate a couple of drills a light hoist and a small pump are now specially manufactured for such work. During the present century improvement in the design and construction of rock drills themselves has also been considerable. The hand-held jack hammer capable of drilling over a foot a minute in hard



Looking over the only Diesel locomotive in the Philippines in underground work. This picture was taken at Big Wedge a short time ago, when mining men gathered to inspect the new fuel oil locomotive which Atok Gold bought for mine haulage. Left to right: V. A. Light, Benguet Consolidated mill staff; W. P. Hanley, Balatoc master mechanic; Read Miller, mine superintendent at Benguet Consolidated; J. B. Hoover, mining man of Baguio, director of several mining companies; F. W. Tuck, electrical and mechanical engineer of Benguet Consolidated; D. W. Butner, general superintendent of Balatoc; Roscoe Canon, mine superintendent at Itogon; J. B. Stapler, mine consultation department, Marsman and Company; Mark Hubbard, geologist, Benguet Consolidated; L. W. Buchanan, mine consultation department, Marsman and Company; F. B. Morehouse, general superintendent of Big Wedge for Atok Gold; Joe Fleming, assistant mine superintendent of Benguet Consolidated; at the right of the locomotive in front, left to right, Ralph Crosby, general superintendent, Suyoc Consolidated; H. E. Strong, accountant at Big Wedge; George Bell, mill superintendent at Demonstration; second row, Ward T. Graham, general superintendent of Baguio Gold; H. H. Booker, engineer-in-charge Keystone mine of Benguet Consolidated; Ralph R. Allison, general superintendent of Itogon; J. O. Enberg, mine consultation staff of Marsman and Company; Walter Neal, mine superintendent at Big Wedge; Hendrik Doornbusch, Itogon staff; R. Keeler; E. J. Sanders, Itogon accountant; in back of the second row is A. S. Schoenert, electrical superintendent at Itogon; back of him standing on the locomotive, is Charlie Stone, Baguio representative of the Manila Machinery Company.

rock has overtaken the advances made by the manufacturers of drill steel, although the latter have produced hollow steels of great strength with much increased freedom from breakage; two new steels of great promise have come from Sheffield in the last year. On the other hand, mounted hammer drills of much larger size have been perfected capable of drilling forty and fifty foot holes in hard rock, again with the help of the steel manufacturers.

A subject in this connection which has received considerable attention lately is the finishing of rock drill bits by hot milling. This practice has become general through the production of simple and robust machines for this purpose. Hot milling removes decarbonized metal from the cutting and reaming edges, thus making possible better tempering and sharpening of the bit.

The development of pneumatic picks for mining in some collieries and for trimming, and in metalliferous mines deserves mention.

The more rapid breaking of ground made possible by the use of better rock drills and better steel has concentrated attention on the use of loading machines and scrapers underground—the former more in collieries and the latter more in metalliferous mines, both in stopes and in drives. Scraper equipment of proved reliability and efficiency is now on the market and a considerable amount of "trade literature" has been published on the subject.

Where conditions permit, the use of portable conveyor belts at the face is still the easiest method of conveying and loading. Conveyor belting of extremely durable construction is now obtainable; the great objection to belt conveyors underground at all was their proneness to wear. In collieries, rope systems have been in use for many years for the main underground haulage, but in metal mines the transport underground of the loaded ore used seldom to be in trucks with a capacity of more than a ton or so each. With larger scale work and the construction of special haulage levels much larger trucks are employed requiring electric locomotives of considerable size.

Hoists or winding engines for raising the coal or ore to the surface have been improved greatly in speed, controllability and safety. The hydraulic clutch is one of the latest inventions to find acceptance in hoisting practice.

It should not be overlooked that a deep hoisting has been made possible as much by improvements in rope manufacture as by improvements in hoisting machines. Only about two generations ago a Commission decided that the limit of depth to which coal could be worked in Great Britain was 1,000 feet because materials did not exist from which ropes could be made to hoist from greater depths. Now ropes to hoist many tons from depths of over 5,000 feet are in use; the cold drawing process and other improvements in manufacture have made these possible. Now attention is being turned again to lightening the load by the use of duralanium cages and differently designed welded trucks or skips for use in the shaft itself.

With regard to surface equipment the use of manganese steel has been responsible for the greatest improvements in rock breaking equipment, which has changed little in design of late, but for crushing and grinding the Symons cone crusher with the barrel (Marci) or conical (Hardinge) type of ball-mill is becoming standard to the exclusion of the stamp and many older crushing and grinding devices, although the tube mill still holds its own for certain kinds of fine grinding.

Each successive year sees cheaper power generation and more ingenuity in the application of power to the service man. The high cost of the skilled miner in strikes and wages has already lead to his partial elimination in some mining fields and the substitution of mechanical appliances run by ordinary labour under "scientific management." This is a process which will go on unless it is brought to a stop by the world-wide economic problem of how to maintain markets and at the same time eliminate purchasers by the rationalisation and mechanisation of industry.

On the technical side progress is to be looked for both in the development of heading and stoping machines for hard rock, (these await the necessary metallurgical materials) and in safe

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"But we now here only," some intermediate point along the stick. March found this was accurate information.

With such directness the American régime began, that the subject of this sketch had a gallant part in at the outset, a useful part since. When Bangued was to elect a mayor, March called all voters to his headquarters and told all who wanted to vote for Isidro Paredes, Quintin's father, to step to the right. If anyone wanted to vote for Isidro's opponent, *if* anyone did, they could step to the left. As this, while simpler, differed only in detail from the Spanish elections, it was at once understood and accepted; and of course, Isidro was all but unanimously elected the town mayor.

So the story runs on, adventure after adventure. Yet there are young men who suspect that when oldtimers get together and recount the past, *the days of the empire*, they depart from strict accuracy and draw the long bow! Nothing of the sort. In the instant case, I have had the help of the history of the 33rd Volunteers, by the regimental historian, Guilford C. Jones; my own memory as a carpetbagging school teacher, and the chapters by Benton himself, published in *The American Oldtimer*. Often indebted to Benton for trade data, the *Journal* wishes him and Mrs. Benton many years of continued happiness together. They have been good folk to know. *W. R.*

Future for Chromite

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proximately one-third the figures used in making the estimates referred to.

As regards marketing, chromite, unlike gold, must be sold in a competitive market. Consumption and cost of production play important roles in producing profits. Statistics show that chromite consumption is expanding. New uses are constantly being discovered for its utilization. As an example, the last few months have seen an increasing demand for ferrochrome in the automobile industry due to the discovery that the addition of a small amount of chrome to the iron in the engine—a small amount added to the material formerly used to make forgings such as the crankshaft, permits the casting of those parts instead of forging. The addition of chromium to steel plays an important part in adding strength and decreasing weight—a characteristic which is increasingly being recognized and utilized by various industries. There is no doubt but that consumption is increasing and that we are in on the ground floor of a comparatively new and growing industry. With the acquisition of the data now being compiled it will be possible to intelligently negotiate contracts for ore and decide on the feasibility of constructing metallurgical or other plants to produce a saleable product to actual consumers. As previously pointed out, estimates of the cost of producing ferrochrome from Masinloc ore are decidedly favorable to that deposit.

So far no mention has been made of the use of Masinloc ore in the chemical industry. Exhaustive tests have been made in our laboratory which show conclusively that sodium bichromate can be produced at a cost which compares favorably with that of other producers.

Mr. Searfe's conclusions regarding your Masinloc chromite deposit may be summed up as follows:

1. There are a minimum of 10,000,000 tons of commercial ore positively in sight with possibilities of a considerably greater ultimate tonnage.
2. Exhaustive tests show conclusively that the ore:
   a. Is amenable to metallurgical treatment;
   b. Is excellent material for refractory purposes;
   c. Can be used in the production of sodium bichromate.

   All at a cost of production low enough to permit successful competition if necessary.
3. Once into production a long life is assured with an ultimate probable profit to be realized from these reserves far in excess of that which may be expected from other ore reserves now under development by the mining industry of the Islands.
4. We are on the ground floor of a rapidly expanding market and the development of new industry.

Improvement . . .

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dry mining and in cheap adequate air conditioning for great depths. These will render reciprocating electric rock drills immediately popular with a great saving in power and reduction in the cost of breaking. We may yet see the piping of liquid air instead of compressed air to the working faces in hot and deep mines, but for cooling and ventilation purposes instead of for power. Further improvements in scraper loading and more particularly in mechanical loaders are to be expected. Cheap light portable readily-joined metal belt conveyors would find useful application for gathering ore—the locomotive has inherent disadvantages. Present types of ropes and hoists do not appear to offer scope for any great improvement, although pumps and fans are still the subject of interesting innovations.

Many ore-dressing processes, particularly the crushing or disintegration of ores, offer a wide scope for technical advance.