developed world a significant proportion of production comes from large dia. holes (over 100 m to 300 m), Indian mines still operate below 100 m holes. Generally, the drills used are also of conventional type, though some mines have introduced jumbo hydraulic drills. In recent years, blasting techniques have improved with the use of ammonium nitrate based explosives. The bulk of production comes from bord and pillar mining, although this mechanisation is of a recent origin. The mining and allied equipment used are also of smaller size. For example, load-haul dumpers (LHD) are of the size of below $5m^3$ and are mostly operated by energy-intensive diesel. Most of the mines continue with the technology introduced in mid-'70s and early '80s. In the last decade or more, little or no new technology has been imparted into the coal mining operations.

In contrast, the opencast mining technology is somewhat better, having been introduced later. Even here, the mining operations are carried out with shovels (power and hydraulic) of smaller capacity. Dumpers of over 100 ton capacity are few. Recently, however, with Australian assistance the Piparwar mine (Bihar) has introduced modern technology.

The need to increase production and meet domestic demands at economical prices has necessitated a closer examination of the technological needs of India's mining sector.

Continuous Excavation

Continuous excavation method is being successfully deployed at Neyveli lignite mines. Efforts are also being made to select coal mines amenable to the introduction of "Bucket Wheel Excavator" (BWE) system. At Niljai mine under Indo-German collaboration, continuous mining is to excavate top on soil and 30 m sandstone layer with BWE.

Combined Mining Systems

Conventional mining equipment is being teamed with continuous transportation systems (usually a belt conveyor) to provide combined mining systems. For softer rocks, feeder breakers are used. In the coal mines, feeder breakers (manufactured by Ingersoil Rand, Bharat Westfalia, Larsen & Toubro (L&T), Eimco Elecon, etc.) are used to crush the large coal lumps followed by transportation by trucks or by conveyors.

The most modern coal mining and beneficiation complex of India at Piparwar owned by Central Coalfields Ltd. (CCL), an Indo-Australian joint venture, has been designed under collaboration with White Industries Ltd. The complex has an in-pit crushing and conveying system i.e. 'combined mining systems'. In addition to yielding higher productivity, this system will enable the mine to achieve an Output per Man Shift (OMS) of 31 t. The salient features of this 6.5 Mt ROM coal mine are presented in Table 1.