

MODERN MINING MACHINERY**Чистов М. Н.**

The nature of the material, the topography and general conditions, the quantities to be handled, capital investment and engineering determine the methods of excavation and the selection of the machines. The problem of open-pit mining is economical and efficient handling of ore and of waste rock, which may be overburden or may be in part included within the ore mass. Open-pit mining calls for the use of modern excavating and transportation machinery and methods. Excavation involves the loosening and breaking by machinery or by drilling and blasting, loading, transportation and dumping.

Materials handled in open-pit operations range from alluvials, clays, and shales up to hard rocks. Excavation equipment falls into two groups: 1) excavators and loaders and; 2) excavators, loaders and transporters.

The machinery used in open-pit mining are the power shovel, dragline excavator, continuous-bucket excavator, and locomotive crane and bucket. The power shovel excavates from the level upon which the machine stands to a bank height determined by the highest position of the bucket; it loads into cars, trucks, belt-conveyer hoppers, or other units. The dragline excavator digs below its level, it can dig under water. The locomotive crane and bucket can excavate below the level and under water and can also excavate from stockpiles of low height. Of these three the power shovel can handle large, coarse rock and can excavate more compact materials than can the others; the dragline excavator is more effective over a wider range of loose rock and alluvials than the locomotive crane and bucket.

The modern power shovel is full-revolving, mounted on tractors and operated by electric motors, diesel engine or gasoline engine. It is a mobile unit moving under its own power and handled by one operator. Its principal motions are the swing about its axis, the crowding action of the dipper as it takes its load, the lifting action as the dipper cuts into the bank, the final swing to dumping position, and the operating of the dipper door to discharge the contents of the dipper. The dipper is provided with a cutting edge and with teeth for tearing and cutting into the bank and for handling coarse loose rock.

Shovels are available in a wide range of designs and capacities to meet most stripping conditions. For example, the giant shovel has a reach of more than 460 ft and is powered by fifty motors ranging from 300 hp. It will remove 3 million yd³ of overburden per month while working in banks more than 100 ft high.

The full revolving steel frame-and-boom dragline was developed in 1906 and the walking dragline in 1912. Since then the dragline excavators have been improved and electric, diesel and gasoline engine units are used as conditions require. Bucket capacities up to 25 cu. yd (weight 35 tons plus load 65 tons) and booms up to 250 ft in length represent the common size. The boom is mounted on a heavy steel frame that can be rotated 360 deg. The boom angle can be adjusted to digging conditions. Buckets vary in weight to suit digging conditions; heavier buckets with the weight concentrated close to the cutting edges are required for hard digging. The dragline is a versatile machine. It will dig noncoherent and well-fragmented blasted material but not coarsely broken or compact materials. It will excavate below water. Short-boom draglines are used for loaders, for trucks and cars. Long-boom draglines are used in coal stripping overburden excavation in soils, sands and gravels. Dragline are available in a wide range of sizes to meet varying conditions.

As has already been mentioned bucket wheel excavators of different types find wide application in mining operations. One of the latest types can work with a bench height of up

to 28 metres, a pit slope of 65° and a bench width of about 65 metres. Theoretical digging capacity is in the order of 4.500 to 3.600 cubic metres per hour. Bucket capacity is 820 liters. The number of buckets equals 22 and the length of bucket boom is 37 metres and the discharge boom length is 40.5 metres. Bucket wheel drive power is about 2 by 630 kilowatts.

A typical operation using bulldozers and draglines for stripping removes overburden consisting of medium hard shale and sandstone which is drilled and shot. Two heavy bulldozers remove the overburden to the spoil area. A diesel dragline with a 165-lt boom and a 14 ½-yd bucket follows the bulldozers and throws material as far away from the highwall as possible. The dragline casts an average of about 800 yd³/hr and the two bulldozers push this material to the spoil area.

Flat coal seams and steep slopes cause overburden thickness to increase rapidly as successive cuts advance into the hillside. To meet the difficult conditions the large walking dragline is most useful because of its dumping range. The disadvantage in using the large dragline is that it must have a suitable base to be mounted on and this is sometimes difficult to provide in rocky overburden. This factor must be considered in choosing between a dragline and a shovel.

Summing up, it is necessary to say that though all the equipment described remains in surface mining operations, various new developments are being introduced such as the hydraulic removal of overburden, different automated systems and others.