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COAL CUTTING MACHINE

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COAL CUTTING MACHINE

➤ **Definition of COAL CUTTING MACHINE (CCM):-**

A coal cutting machine (CCM) is to make a groove or cut 2 meter to 2.5 meter in depth & 125cm to 175cm height at a coal face. The cut is across the whole width of the gallery in board & pillar system & across the whole length of face in long wall mining.

➤ **Objects/Purpose of Coal Cutting Machine(CCM):-**

- 1) It gives extra free face for efficient blasting.
- 2) To increase coal output per blasting.
- 3) High rate of advance.
- 4) Straight & systematic advance.
- 5) Systematic roof support can be installed.
- 6) Roof is not damaged.
- 7) Less explosive is used.
- 8) More safety in gassy mines.
- 9) Dirt bands removed easily.

➤ **Classification of Coal Cutting Machine(CCM):-**

1) Depending upon the Position of Cut

- a) Under cutting coal cutting machine (CCM): It gives cut at floor level only.
- b) Over cutting coal cutting machine (CCM): It gives cut at roof level.
- c) Middle cutting coal cutting machine (CCM): It gives cut any where between roof & floor.

2) Depending upon Design

- a) Short wall coal cutting machine (CCM)
- b) Long wall coal cutting machine (CCM)
- c) Bent jib coal cutting machine (CCM)
- d) Arc wall coal cutting machine (CCM)
- e) Arc shearing coal cutting machine (CCM)

Many type of coal cutting machine have been designed and the process of development is continuous. The coal cutting machine which are generally used to give either an undercut, middle cut or side cut for making a free face for efficient blasting operation are as follows:-

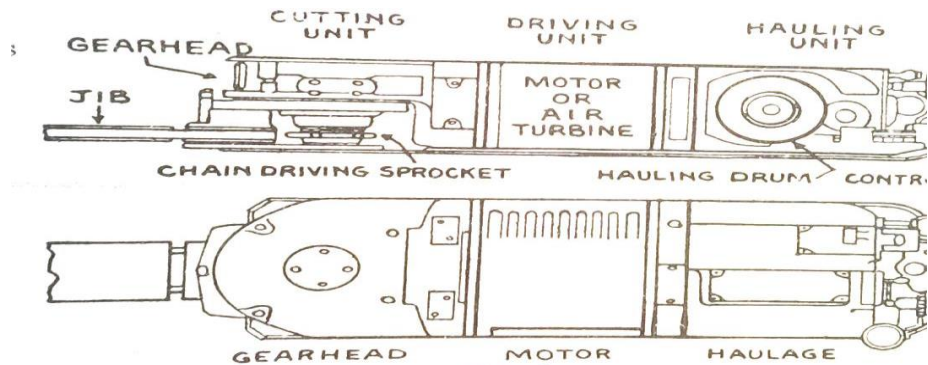
- 1) Long wall coal cutters.
- 2) Short wall coal cutters.
- 3) Arc wall coal cutting.
- 4) Arc shearer.
- 5) Percussive coal cutters.

1)Long wall coal cutter:-

The chain coal cutter this machine is built in three parts.

- a) The cutting unit.
- b) The hauling unit.
- c) The drilling unit.

a) The cutting unit:-



This comprises a cast steel gear head which encloses the reduction gear-usually a combination of spur and bevel gearing between the motor and the cutting chain driving socket. It serves also as a support for the cutting chain jib all shafts are carried on ball and roller bearing.

The jib can be locked in line with the machine for fitting or it can be swing to either side and locked (at rather less than 90° to the body of the machine) for cutting.

The length of the jib may be anything from 0.95m-30m, depending on the desired depth on many factors including the nature of the coal and its associated roof and floor, the thickness of the seam and facilities for clearance.

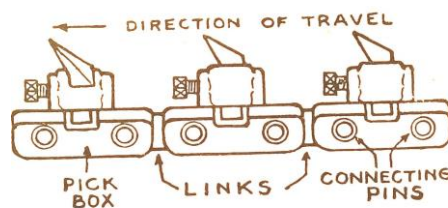
The cutting chain:-

It consists of a series of cast-hardened or alloy steel pick boxes, joined together by links and connecting pins in such a way as to resist all twisting and bending excepted that necessary for going round the jib.

In a given chain, all the picks at a given angle form a "line" of picks and the number of "lines" may be 7, 9 or 11. The angles of the picks and their arrangement in the chain & depend on the nature of the material to be cut.

Type of Picks:-

- a) **Throw Away Type:** These picks are made of high carbon steel;
- b) **Tipped Picks:** The tips of these picks are made up of tungsten carbide,
- c) **Reversible Picks:** It consists of two cutting tips made of tungsten carbide. It can be used for 100 to 200 cuts.



b) The hauling unit:-

In the machine being described, the haulage gear comprises two ropes drum one at each side of the machine. Driven by the motor through a series of straight cut at the end of the machine to facility turning and jibbing. In each drum carries 36.4m of 1.27 cm rope or 22.75m – 27.3m of 0.625 inch rope.

When fitting the haulage drum is driven through a different set of gears to give a rope speed some 7.5 m/m or more in some machines.

c)The Driving Unit:-

This occupies the central portion of the machine and may be either an A.C. Motor or a D.C. Motor or compressed air turbine. In mines where its use is permissible electrical is nearly always preferred because of the greater efficiency. In some mines however compressed air must be used for reason of safety although it is much noisier and create dustier condition at the face.

2)Short wall coal cutter:-

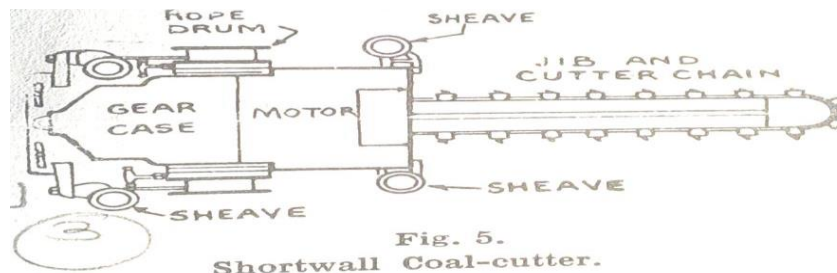


Fig. 5.
Shortwall Coal-cutter.

The machine is designed to cut a short wall face or a heading normally over 9 m wide. The job is usually attached rigidly to the body of the machine and it is of 2.286 m long to give effective cuts between 2.06 m to 2.133 m. It travels along the face, two ropes being provided one to haul the machine and the second to control the orientation of the machine. The machine has a three units-

- a) The motor
- b) The haulage gear unit
- c) Cutting unit.

The short wall coal cutters differ from the long wall type in that it is specially designed to sump straight in and cut across a short face only, being then withdrawn.

3)Arc wall coal cutter:-

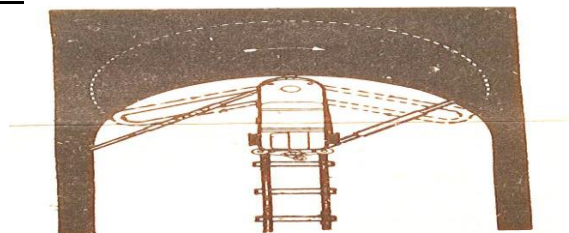


Fig. 8.
Arcwalling.

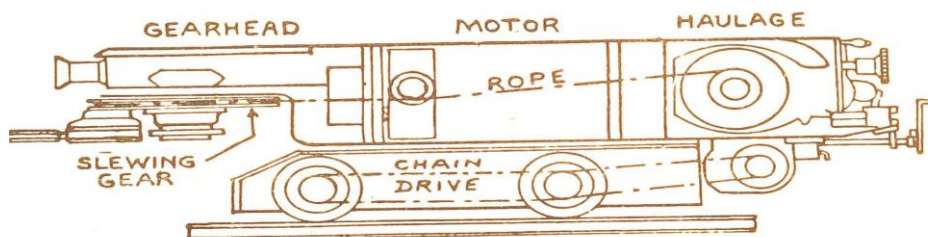


Fig. 7.
Arcwall Coal-cutter. (M. and C. Ltd.)

This is trolley, crawler, trolley or tyre mounted machine used for coal headings in development work and cut coal in the arc. Hydraulic rams are used to prevent the machine being pushed back from the face when the undercut is given by the jib (which can swing 90° on either side of the machine body) across the width of the face. Gearhead can be arranged for giving middle or top cut.

Machine Specification:-

Speed of a machine:-24m/min.

Length of the jib:-1.8-2.1m,

Depth of cut:-1.8-2.1m,

Jib radius:-2.55m.

4) Arc – shearer:-

This differs from an ordinary arc wall machine in that it is fitted with an adjustable gear head. Which enables the jib to be rotated in the vertical plane through any angle so as to cut horizontally either near that bottom or near the top of the seam or to shear the coal vertically at either side of the place.

It is therefore, sometime described as an arc shearer. An arc shearer may be mounted either on wheels or on crawlers, and it may be driven by an electric motor or a compressed air turbine. The machine is clearly more versatile than an arc wall and can therefore deal more successfully with the variable condition met with underground.

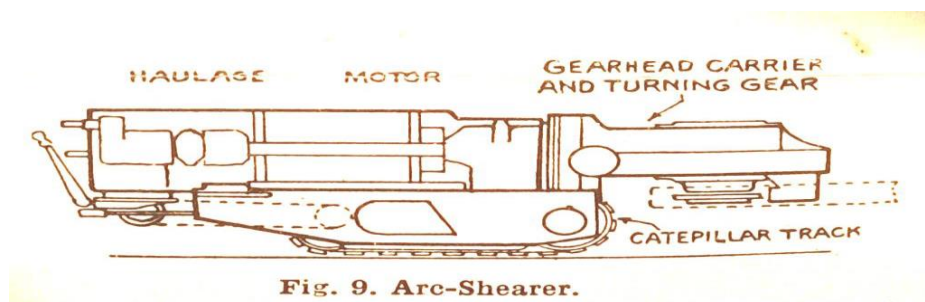


Fig. 9. Arc-Shearer.

5) Percussive coal cutters:-

These types of coal cutter is essentially a heading machine for use in narrow working and is adoptable to either undercutting, over cutting, nicking or breaking down the coal.

Such machine is likely to be more effective than the pneumatic pick where the coal is very hard nature or the cleavage planes are not well defined. A typical percussive coal – cutter driven by compressed air.

It thus provided an alternative to short wall or arc wall coal cutters in seams where blasting is undesirable.

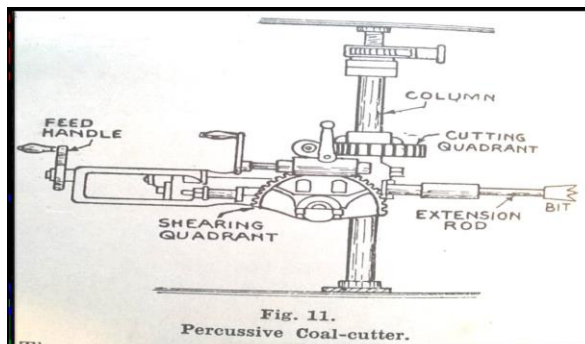


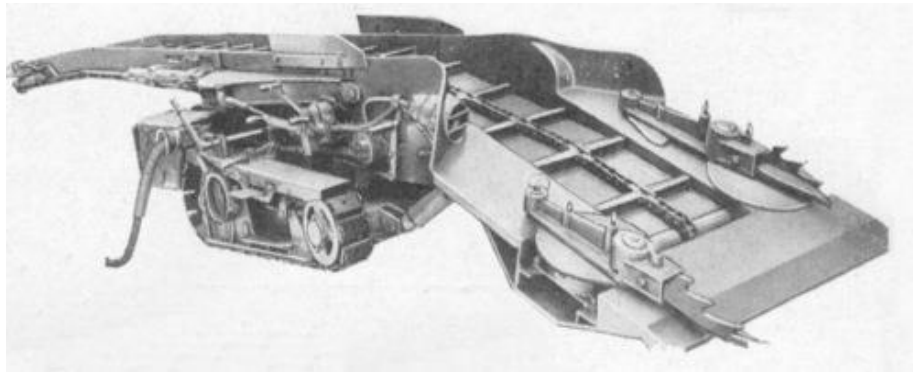
Fig. 11. Percussive Coal-cutter.

➤ Mechanical Loaders:-

1) Joy Loader:-

It is used for the loading of coal or rock from the face. It is having an apron plate over which two gathering arms are mounted in the eccentric. There is a chain conveyor to transport the coal from apron plate to discharge end. The discharge end of ladder can move in a horizontal and vertical plane.

The apron plate is lowered to touch the ground end at the same time the two gathering arm are rotating continuously. As soon as the apron plate is inserted in the blasted material & loads on the chain conveyor this is in motion. The chain conveyor transports the blasted material to the discharge end where it is loaded in the mine tub or conveyor etc. it is crawler mounted machine.

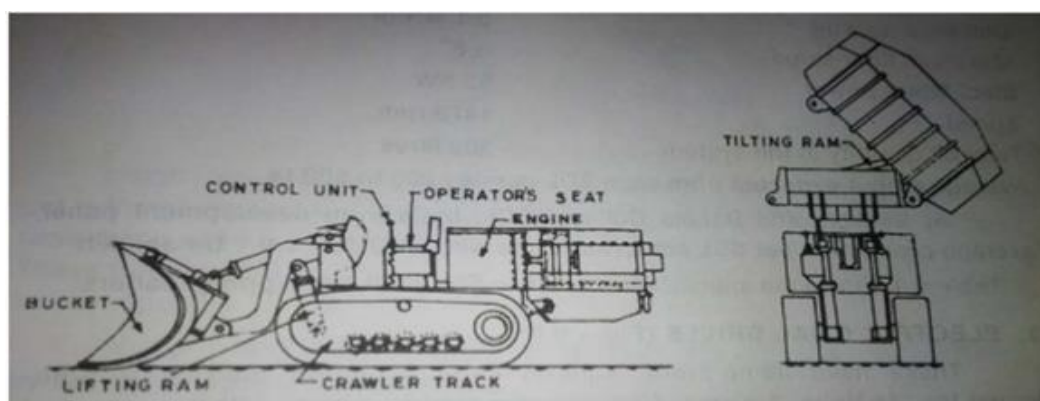


2) Side Discharge Loader(SDL):-

It is a popular coal loading machine of underground mines which can unload coal to the right or left of the machine. SDL takes blasted coal from the face with the bucket at front of the machine transport and dumps the coal onto chain conveyor, belt conveyor, tub or mine car. Being crawler mounted SDL can work in gradient upto 1 in 4.

The machine is powered by FLP electric motor and all movements of the bucket are done hydraulically for which hydraulic pack is mounted on the machine itself. SDLs are now manufactured by several companies in India in bucket capacities of 0.8m^3 , 1m^3 and 1.5m^3 . A 1.5m^3 SDL is powered by 65HP/550V motor. Width of the machine is only 1.8m (with bucket) making it suitable to take a right angle turn easily in a 3m wide gallery. Some SDL have cable reel for trailing cable.

SDLs are used both for development and depillaring, and are increasingly replacing manual loading. One SDL on an average, loads about 100TPD, but is capable of much more with availability of adequate blasted coal and evacuated capacity and efficient maintenance.



3)Load Haul Dumper (LHD):-

LHD is a tyre mounted loading machine which takes blasted coal from the face in its bucket, transport it over a distance and dumps it on the district chain or belt conveyor. Being tyre mounted, it runs faster than SDL (at speed up to 4km/hr) and the chain/belt conveyor could be kept as far away as 90m from the face. Power to the machine is fed by a trailing cable mounted on cable reel of the machine.

Being tyre mounted, LHD cannot work where gradient more than 1 in 6 or floor is weak and water seeps from the floor or drips from the roof. The bucket which is fitted in front of the machine is front discharge type. All movement of buckets is by hydraulic pushers.

LHD is made in two parts which are joined by a flexible joint and can rotate upto 100°, enable it to take a turn at a narrow gallery junction also. Depending upon the bucket has capacity 1.5m³, 2m³ or 3m³. The machine can work in seam height upto 2.4m. A 1.5m³ LHD is powered by 50HP/550V FLP(flameproof) motor.

For smooth working, galleries have to be maintained clear of fallen coal.

LHD is categorized into two types:

1. Diesel LHD
2. Electric LHD

Selection:-

It depends upon the following factors:

1. Size of operation
2. Length of haul
3. Height of seam
4. Operating condition



❖ **CONTINUOUS MINER:-**

This crawler mounted electrical machine cuts 10-12 tonnes of coal per minute. The machine has a cutter head in the front which can be raised or lowered. The cutter head has a number of drums with cutting picks. The cut coal falls into the conveyor at centre of machine which loads the shuttle car standing behind. Shuttle car when fully loaded, transport coal and drops it on to the district belt conveyor. In the meantime, another shuttle car gets loaded. CM remains temporarily stopped during changeover of shuttle car.

After advancing the gallery by 10m (cut out distance) CM moves to the next gallery, and roof bolting machine starts drilling/ bolting in the first gallery. Depending upon the model, CM can cut gallery height of 1.5 to 4.5m. It can be used for depillaring also.

Length of CM 10-11m, weight 5.-60tonnes, width of cutter head 3m.

Safety Features of CM:-

1. Radio remote operation (operation can operate the machine standing at a distance from it).
2. Pre-start warning single.
3. Break, light, automatic reversing alarm.
4. Automatic methane detector (which trips the power to the cutter head if CH₄ exceeds 0.5%).
5. Several water spray nozzles. CM stops cutting coal if water sprays is interrupted. Water spray reduces production of coal dust, prevents it getting air borne and ventilation area around the picks to reduce concentration of methane in air, and cools frictional sparks.
6. Master control switch for instantly switching off all operations.
7. Portable fire extinguisher.