

12 inches wide, and the hind wheels have a wide gage to give the utmost stability to the vehicle. The front wheels are narrower in gage, in order to allow sharp locking for turning corners with precision and safety.

The wagon bodies are built of bullet-proof steel one-quarter of an inch thick and absolutely Mauser-proof. The lower part of the body is made a fixture to the frame. The upper portion is formed of three flaps on each side hinged to the lower part of the body, and made either to fix up when required or to close down in the form of a ridge. The steel of which the flaps are made is impervious to rifle fire at a range of one hundred yards. By forming a ridge, when closed down, very slight damage can be inflicted by rifle fire, since the bullets strike the object at a sharp angle, and simply ricochet.

When the flaps are open, the wagon can be utilized for the accommodation of men, who, if necessary, can maintain a fire upon the enemy through the small loopholes which are provided. As in the case of the locomotive cab, these loopholes are fitted with shutters, which are made readily adjustable, so that any sized opening may be obtained. Our illustration of the complete train comprehensively shows how this idea is successfully carried out. The wagon next to the engine has the flaps closed down, as would be the case if the vehicle were carrying ammunition or stores. The movements of the flaps are actuated from the steel ribs by check ropes. The second vehicle shows one flap let down; while the third wagon shows the flaps open, and also the arrangement of the adjustable shutters.

The brake power, which is powerful and ample, can be applied either from the exterior or the interior of the vehicle, whichever occasion demands. A spring coupling-bar is provided for every wagon, also suitable coupling arrangements at the tail end, either for yoking up to another wagon, or for engaging with the trail end of a howitzer, as shown in our illustration. Each wagon is equipped with a pair of incline ramps or trackways which are intended to facilitate the loading of the vehicle with a howitzer, naval gun, etc.

ELECTRICAL COAL-MINING MACHINES.
BY FRANK C. PERKINS.

Because of their compactness and the ease with which they can be manipulated, electrical coal-cutting machines have won their way into extensive use, and have served to greatly increase the output of those mines in which they are employed. The electric motor as applied to chain coal-cutting machines is both economical and safe, and facilitates greatly the rapid placing of the product on the market. It may be of particular interest to look into the actual working conditions of this type of machine as shown in the accompanying illustrations.

The Longwall coal-mining machine is generally used where the space for operation is limited and there is a call for an especially compact machine. The illustration, Fig. 3, shows a machine whose total height is only 18 inches; its width, without wheel, 3 feet 9 inches; and its length over all, 8 feet 2 inches. The entire machine is built of steel, and the cutting is done by means of cutters inserted in the periphery of a horizontal cutter wheel. This wheel swings on a bearing, so that it is adjustable in a horizontal plane, being so arranged in order to follow the variations in the floor of the mine. As a single rail only is required, it is known as the single-track Longwall machine. The accompanying illustration shows the method of bracing the track on which the machine runs, and also shows the cutter in the wheel and the bevel gears by which it is driven. The wheels will undercut 3, 4, 5 or 6 feet in depth with a kerf or width of cut of about four inches. The electric motor required for a machine of this type is much more powerful than those found necessary in the chain coal-cutting machines described later. The speed of cutting can be varied according to the character of the material in which the cutting is be-

ing done, and can be changed without stopping the machine.

The Jeffrey electric chain-cutting machine, seen in Fig. 2, was photographed as it was making a cut in one of the mines of the Pocahontas District in West Virginia. This shows a very deep vein, where there is plenty of

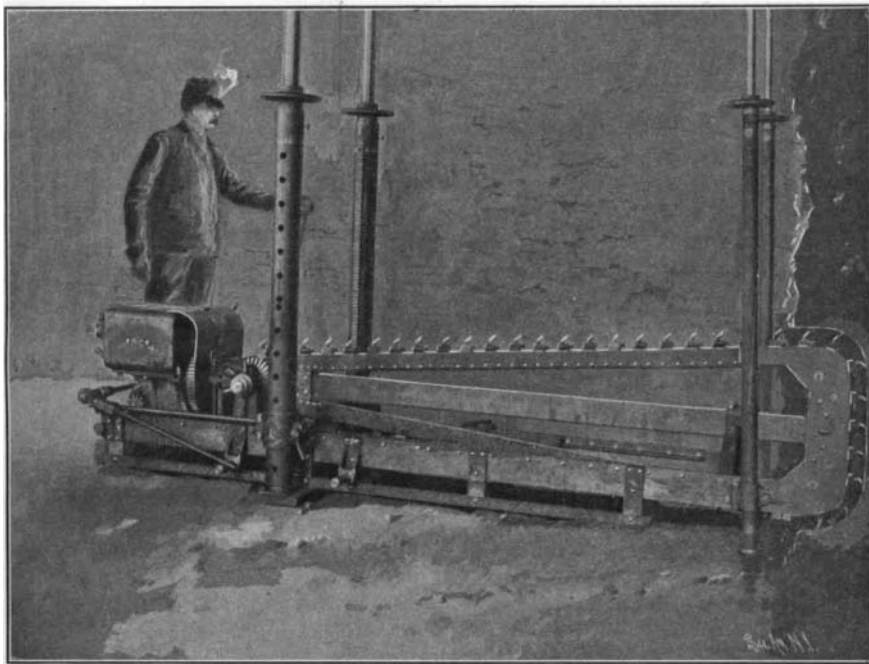


Fig. 1.—ELECTRIC, CHAIN, CUTTING MACHINE MAKING VERTICAL CUT.

room to work; but where the veins are very low, the cramped condition of the miners renders the operation of the machine more laborious. These electric chain coal-cutting machines are built up of three distinct parts, including the electric motor and carriage, the outside frame, and the inside or cutting frame. The motor is of the multipolar type, having ironclad armature and two field coils. The field frame is of cast steel and surrounds the field coils and armature, pro-

a forged steel center rail, a cutter head, and two steel guides in which the cutter chain runs. This chain machine is built to undercut 5 feet deep and 44 inches wide. It can be used in different veins of coal varying in thickness from 2 to 3 feet, as the height of the machine over all is only 18½ inches. The motor is of the multipolar type and is used on circuits of 220 or 500 volts potential.

In using these coal cutters the only preparation necessary is the stringing of the wires. Then the machine, mounted on its truck, is taken into the room where the cutting is to be done and delivered to the face of the coal, the truck running on the wooden rails or temporary track usually used for mine cars. The rear end of the truck is lifted, and the machine slides off into place and is then in position to begin cutting. The cable is connected to the motor and reel terminals, and by means of the starting switch the machine is put in operation. The rooms are seldom more than 25 feet wide. The machine is placed in position at the left hand rib, and the front jack is screwed securely to the face of the coal and the rear jack to the roof, as shown in Fig. 2.

It requires about four minutes to make a cut and about one minute to withdraw the machine, after which the jacks are loosened and the machine is then moved over for another cut, this being repeated until the entire width of the room is undercut 5 or 6 feet deep. After the machine is started, it continues to advance until the full depth of cut is made, when it is automatically thrown out of feed and is ready to reverse and withdraw from the cut.

There are many districts in the coal-mining regions where the formations are such that the coal will be produced in better condition when sheared than when undercut; and in many other cases the formation requires not only shearing but also undercutting. When shearing is found necessary, a machine of the type shown in Fig. 1 is used. The machine is built on the same general plan as the undercutting chain machines, except that the center or cutting frame is located in a position normal to that of the undercutter, the shaft of the armature being parallel to the center rail. A power raising device may be attached to this machine for elevating and lowering it from top to bottom.

When shearing a room or entry with machines of this class, it is necessary to raise the machine to the top of the vein, and the best results are usually obtained by making the first cut at the top and then letting the machine down far enough to make another cut. Illustration Fig. 1 shows this machine in position making a lower cut, and also shows to good advantage the two main columns (located at a point representing the balancing position), to which the frame is clamped tightly in order to hold it in place when cutting. The front end of the machine is also steadied by two auxiliary columns, and it will be noticed that the four columns can be varied in length according to the thickness of the vein in which the machine is working.

It is usually found possible to cut from 50 feet to 100 feet of entry per day of ten hours, the exact figures depending upon the character of the coal and the condition of the mine. A single cut is three feet high, four inches wide and from five to seven feet in depth.

There is no question that the introduction of electrically operated tools in mines has demonstrated the many advantages in utilizing the power of the engines, boilers and dynamos on the surface and transmitting the current by cables to the points in the mines where power is required.

THREE thousand bronze tablets containing the records of Rome from the foundation of the city to the time of Vespasian are known to be buried in the marshes near Ostia. They were saved from the fire which destroyed the Capitol in the year A. D. 69. The Italian archæologist, Signor Maes, wishes the Italian government to drain the marshes and hunt for the tablets.

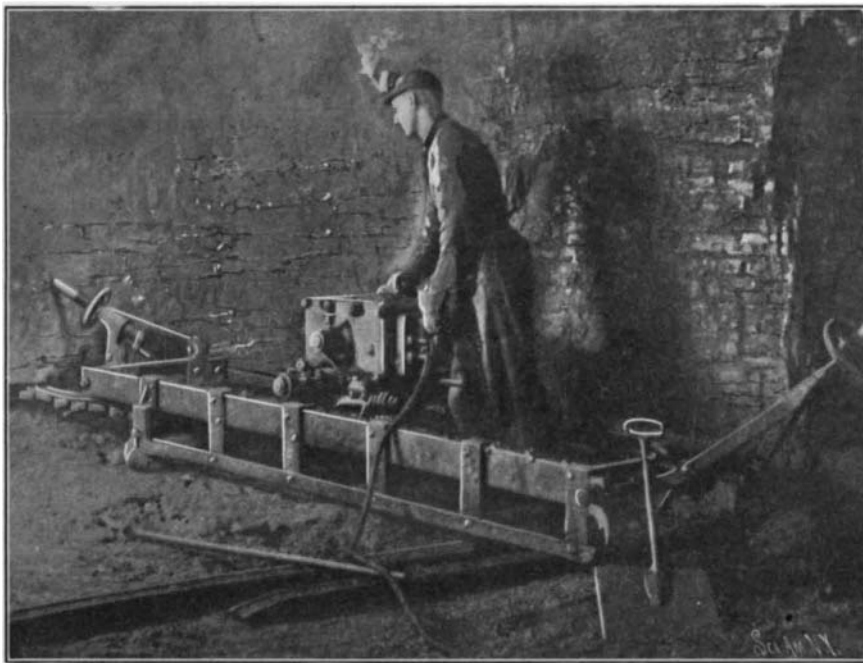


Fig. 2.—ELECTRIC, CHAIN, CUTTING MACHINE UNDERCUTTING THE COAL.

tecting them from injury. The bearings are lined with bronze bushings, no babbitt being used. The carriage is made of cast steel, with motor supports made solid with the body. It also contains the main drive-shaft bearings. The outside or bed frame consists of two steel channel bars, firmly fastened together by means of heavy steel braces. A stout steel casting joins the channel bars at the front of the bed frame and forms the guide for the inside frame.

The inside frame, called the cutter frame, consists of

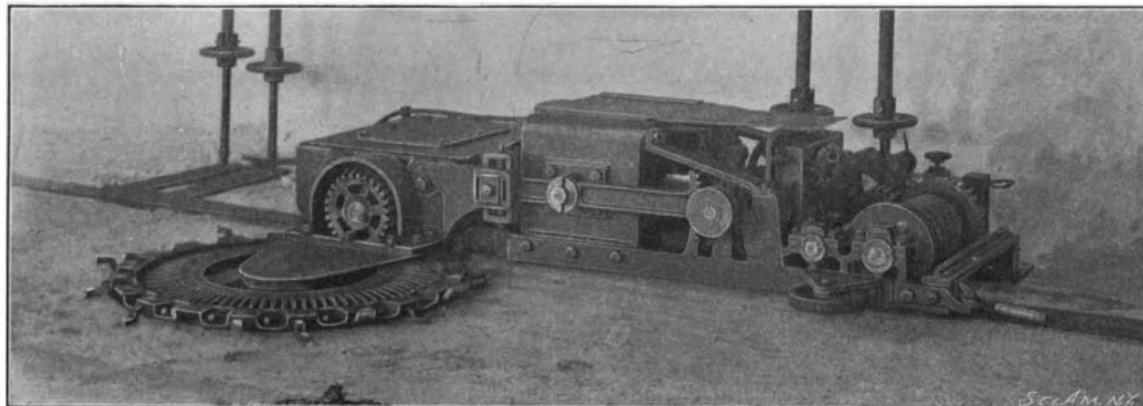


Fig. 3.—LONGWALL COAL-CUTTING MACHINE, WITH HORIZONTAL CUTTING WHEEL.