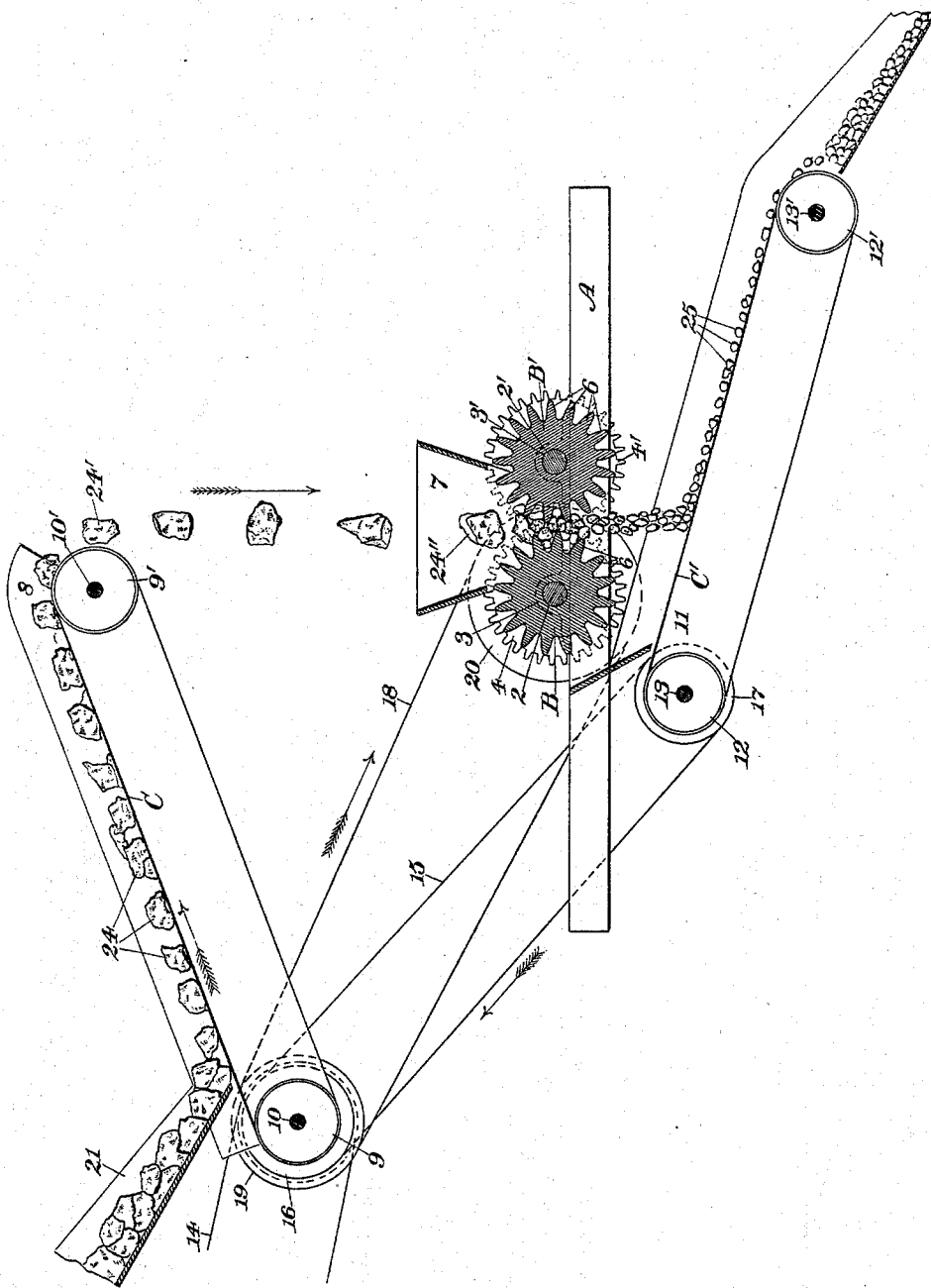


(No Model.)

E. B. COXE.
COAL BREAKER.

No. 527,411.

Patented Oct. 16, 1894.



Witnesses:

J. L. Edwards Jr.
Fred. J. Dole.

Inventor:

Eckley B. Coxe.

By his Attorney,

F. A. Richards.

UNITED STATES PATENT OFFICE.

ECKLEY B. COXE, OF DRIFTON, PENNSYLVANIA.

COAL-BREAKER.

SPECIFICATION forming part of Letters Patent No. 527,411, dated October 16, 1894.

Application filed May 17, 1894. Serial No. 511,551. (No model.)

To all whom it may concern:

Be it known that I, ECKLEY B. COXE, a citizen of the United States, residing at Drifton, in the county of Luzerne and State of Pennsylvania, have invented certain new and useful Improvements in Coal-Breakers, of which the following is a specification.

This invention relates to methods of and apparatus for breaking coal, the object of the invention being to furnish an improved method and apparatus whereby lumps of anthracite and other coal may be effectively broken or reduced to required sizes and at the same time obviate the waste consequent to methods and apparatus in common use. To accomplish this end I employ means whereby the lumps of coal are made to have a traveling movement of predetermined maximum velocity and whereby the lumps are grasped sidewise and broken up while in motion without affecting or impeding their velocity or traveling movement, as will be hereinafter described.

In the drawing accompanying and forming part of this specification, I have shown in sectional side elevation one form of apparatus embodying my present invention, said figure illustrating the method of breaking coal in accordance with this invention.

In the method of breaking coal as heretofore practiced, it has been customary to feed the coal through a chute or hopper in a continuous stream directly and indiscriminately to the break-rolls without due regard to the separation of the lumps of coal or to their velocity, as compared with the peripheral velocity of the break-rolls, and after being subjected to the action of the rolls, the coal was delivered to a rigid metallic or wooden chute or spout set below said rolls at an inclination to a horizontal line, whence it was carried off. Owing to their brittle nature, the lumps of coal, when striking against each other and against the teeth of the rolls while being fed thereto, are "chipped" or have relatively small fragments broken off. This fractional disintegration or chipping off of small fragments is further augmented as the coal drops from the rolls upon the rigid chute, and in striking each other as they slide down said chute. This fragmental breaking up or partial disintegration of the coal, while rela-

tively small, and not important in a single or separate lump, amounts to a large quantity in the aggregate, and the sum of this loss sustained by such breaking up (these fragments having only a very small market value), bears quite a large percentage to the entire output. Therefore any method for lessening this fractional breakage or waste, from an economical standpoint, is of a special value in the art; and it is the chief object of my present invention to produce the best practicable results in the breaking of the coal with the least possible amount of waste, to secure the greatest output of coal of marketable sizes from a given quantity of coal in its unbroken condition.

The coal-breaking apparatus shown in the drawing consists of a frame A, which may be of any suitable construction for carrying the operative parts, two adjacent break-rolls B and B' revolvably connected for coincident movement, two carriers or conveyers C and C', one of which is located with its discharge end above and remote from the break-rolls and is adapted for delivering the lumps of coal to the break-rolls with a falling movement of predetermined velocity, and the other of which is located with its receiving end below the break-rolls, and is adapted for disseminating the broken coal, spreading it in a thin layer as it drops from the rolls and for carrying the same away, and means for rotating the break-rolls at a peripheral velocity equal to the velocity of the falling coal and for imparting a traveling movement to one or both of the two conveyers, as will be hereinafter more fully described.

The break-rolls B and B', which may be of any usual or suitable form, are herein shown as the ordinary fluted rolls with V-shaped breaking-ribs or teeth 6, said rolls being shown carried by horizontally disposed shafts 2 and 2' journaled in bearings 3 and 3' upon the frame A and connected together for coincident movement by intermeshing gear-wheels 4 and 4', which gear-wheels are or may be secured to the shafts 2 and 2' in any suitable manner. A hopper 7 is shown provided with its discharge end adjacent to the upper edges of the rolls and in position to insure the delivery of the lumps of coal between the rolls in case any of the lumps should be accidentally thrown

out of alignment with the breaking faces of said rolls.

In the form thereof herein shown, the two conveyers C and C' are in the nature of endless traveling belts, the one C being located with its discharge end 8 above and remote from the two break-rolls B and B', said endless conveyer being carried over pulleys or rollers 9 and 9' secured to shafts 10 and 10' respectively, the shaft 10 in the organization herein shown, constituting the main driving shaft. The conveyer C' is located with its receiving end 11 below and in near proximity to the break-rolls B and B'; this conveyer-belt C' being carried over the pulleys or rollers 12 and 12' secured upon the shafts 13 and 13'. The shafts 10 and 10', 13 and 13' will, in practice be supported in suitable bearings at their ends which bearings may be secured to or form a part of the frame work A, a portion, only, of which frame work is shown in the drawing.

In the drawing the rolls B and B', and the two conveyers C and C' are shown driven from the main shaft 10, said shaft being driven by means of a belt 14 extending over a pulley upon the main shaft and extending to any suitable source of power. (Not shown.) A belt 15 extends from the pulley 16 upon the main shaft over a pulley 17 upon the shaft 13 of, and imparts a traveling movement to, the conveyer C' and another belt 18 extends from a pulley 19 upon the main shaft over a pulley 20 upon the break-roll shaft 2 and furnishes power for driving the two break-rolls.

It will be obvious that the general organization of the two conveyers and break-rolls may be modified without departure from my invention.

For convenience the upper conveyer-belt will be herein referred to as the "feed-conveyer," and the lower conveyer-belt will be referred to as the "discharge-conveyer."

The feed-conveyer C, will be supplied with lumps of coal 24 from hopper or chute 21, located adjacent to the receiving end of said conveyer, and will in practice preferably be set at an inclination to a horizontal line, as illustrated in the drawing, with its discharge end just far enough above the break-rolls that when a lump of coal 24' falls from the discharge end of the belt it will descend with an increasing velocity, the maximum of which velocity (or its velocity when it reaches the break-rolls at 24'') shall equal, or approximately equal, the peripheral velocity of the feed rolls, which rolls will in practice be rotated at a certain given peripheral velocity. The coincidence in velocity of the falling coal at the time it reaches the rolls and the peripheral velocity of said rolls may be readily established after the well known manner of measuring the velocities of falling and revolving bodies, the distance through which the coal travels after leaving the feed-conveyer being gaged by the height of the feed-

conveyer with relation to the break-rolls, to insure a maximum velocity to the lumps of coal, which will coincide with the peripheral velocity of the break-rolls.

By the employment of a continuously traveling belt, as shown and described, for feeding the lumps of coal to the break-rolls, the lumps of coal are delivered to the rolls separately and with uniform speed, and in consequence of the acquired velocity of each lump, when it reaches the break-rolls, being substantially equal to the peripheral velocity of said rolls, said lump does not strike a blow against the teeth of the rolls as it enters the same, but is grasped sidewise by the rolls, broken thereby, and carried through said rolls without affecting or decreasing the velocity acquired by said lump before entering the rolls. Thus it will be seen that the lumps are successively and separately subjected to the action of the break-rolls, (one lump being broken before the next succeeding lump enters the rolls,) thus preventing the liability of crowding the rolls by feeding the coal faster than the rolls can break it, and also obviating fractional breakage, by preventing the lumps from striking against each other and against the teeth of the rolls while being fed thereto.

Another important factor in my present invention is the means employed for carrying off the coal from the rolls after it has been reduced to marketable sizes and for preventing fractional breakage or partial disintegration during this operation. This means consists of the discharge conveyer C' and its driving mechanism. This discharge conveyer C' which, as before stated, is in the nature of an endless belt, will have sufficient resiliency or flexibility to yield slightly as the broken coal drops upon it from the break-rolls, B, B'.

To insure the carrying off of the broken coal as fast as it is delivered from between the break-rolls, and at the same time spread the coal in a thin layer, as at 25, preferably one lump thick, to thereby prevent the lumps of coal from striking each other as they are delivered to the discharge-conveyer, said conveyer will have a continuous traveling movement imparted to it in excess of the traveling movement of the feed-conveyer and of sufficient rapidity to carry the lumps of coal away from the line of delivery before the next succeeding lumps come in contact with those lying upon said conveyer. At the discharge end of the conveyer C', is a chute for carrying the coal in the usual manner. By this construction and organization it will be seen that the reduced lumps of coal, owing to the elasticity of the discharge conveyer, will not be broken or "chipped" as they are delivered from the break-rolls, as they do not strike a rigid surface and are not allowed to come in contact with one another either as they are delivered upon the conveyer or while

being carried forward by the conveyer, which is a great desideratum as the coal cannot in any possible manner be injuriously affected while being carried away from the rolls thus obviating the loss sustained by coal-breaking apparatus of ordinary construction employing rigid metallic chutes or spouts for discharging the coal after it leaves the break-rolls.

Having thus described my invention, I claim—

1. The herein-described apparatus for breaking coal, it consisting of two remotely-disposed conveyers, one of which constitutes the feed-conveyer and is located with its delivering end above a pair of break-rolls, and the other of which constitutes the discharge-conveyer and is located with its receiving end below said break-rolls, a pair of break-rolls intermediate to said conveyers, means for rotating said rolls at a given velocity, and means for imparting a traveling movement to the feed-conveyer so as to deliver the coal to the break-rolls at a maximum velocity coinciding with the peripheral velocity of said break-rolls, substantially as described.

2. The herein-described apparatus for breaking coal, it consisting of two coal-breaking rolls supported for coincident rotation upon a suitable frame-work, a coal-feeding conveyer supported with its discharge-end above and adjacent to the coal-breaking rolls, a yielding discharge-conveyer located with its receiving-end below and adjacent to said rolls, and means for rotating said rolls and for imparting a traveling movement to the two conveyers at such predetermined velocity that the feed-conveyer will be adapted for delivering coal to the break-rolls at a velocity substantially coinciding with the peripheral velocity of said rolls, substantially as described and for the purpose set forth.

3. In a coal-breaking apparatus, the combination with a pair of coal-breaking rolls and with means for driving said coal-breaking rolls at a predetermined peripheral velocity, of an endless carrier or conveyer located with its discharge-end above, remote from and in substantial alignment with the adjacent faces of said rolls, and means for imparting a traveling movement to said conveyer of such velocity relative to the peripheral velocity of the break-rolls as to secure to the coal delivered from said feed-conveyer to the break-rolls a velocity substantially coinciding with the peripheral velocity of said break-rolls, substantially as described and for the purpose set forth.

4. In a coal-breaking apparatus, a pair of break-rolls, in combination with a conveyer having its discharge-end above and remote from said rolls and adapted for delivering the lumps of coal with a falling movement and at an approximately-predetermined velocity to the break-rolls, and means for imparting a peripheral-velocity to the break-rolls, sub-

stantially equal to the maximum velocity acquired by the falling coal when the same reaches the rolls, substantially as described and for the purpose set forth.

5. In a coal-breaking apparatus, in combination, a pair of break-rolls, a feed-conveyer located with its delivering end above and in substantial alignment with the breaking faces of the rolls, a yielding conveyer located below said rolls and means for actuating said rolls and conveyers, substantially as described and for the purpose set forth.

6. In a coal-breaking apparatus, the combination with a pair of break-rolls driven at a given peripheral velocity, of means adapted for delivering lumps of coal separately and successively to the rolls by a falling movement of a maximum velocity equal to the peripheral velocity of the rolls, and means for receiving, spreading and carrying forward the coal as it is discharged from the rolls, substantially as described and for the purpose set forth.

7. In a coal-breaking apparatus, the combination with a pair of coal-breaking rolls adapted for rotating at a given peripheral velocity, of an endless traveling feed-conveyer located with its delivering end above its receiving end and above the break-rolls and means for imparting a traveling movement to said conveyer so as to deliver the coal to the break-rolls at a maximum velocity coinciding with the peripheral velocity of said break-rolls, substantially as described and for the purpose set forth.

8. In a coal-breaking apparatus, in combination, a pair of coal-breaking rolls, means for rotating said rolls at a given peripheral velocity, an endless traveling feed-conveyer located with its delivering end above its receiving-end and above the break-rolls, means for imparting a traveling movement to said conveyer at such velocity relatively to the peripheral velocity of the break-rolls as to deliver coal to the break-rolls at a maximum velocity coinciding with the peripheral velocity of the break-rolls, an endless flexible discharge-conveyer located with its receiving end below said break-rolls, and means for actuating said discharge-conveyer so as to spread and carry forward the coal as it is discharged from the rolls, substantially as described and for the purpose set forth.

9. The herein described method of breaking coal, it consisting in feeding lumps of coal separately and successively to a breaking apparatus with a falling movement of predetermined maximum velocity, and grasping and breaking said lumps without decreasing or affecting their maximum velocity, substantially as described and for the purpose set forth.

10. The herein described method of breaking coal, it consisting in imparting a traveling movement to the lumps of coal and feeding them separately and successively with a falling movement at a predetermined maxi-

mum velocity to a pair of break-rolls; rotating said break-rolls at a peripheral velocity coinciding with the maximum velocity of the lumps of coal as they successively reach the rolls, so as to grasp and break said lumps without decreasing their velocity, and subsequently receiving, spreading and carrying off the coal after it passes the rolls, with a continuous traveling movement, substantially as described and for the purpose set forth.

ECKLEY B. COXE.

Witnesses:

STEWART F. MACFARLANE,
ELLIOTT A. OBERRENDER.