(No Model.)

3 Sheets—Sheet 1.

E. B. COXE.

COAL BREAKER.

No. 350,814. Patented Oct. 12, 1886.

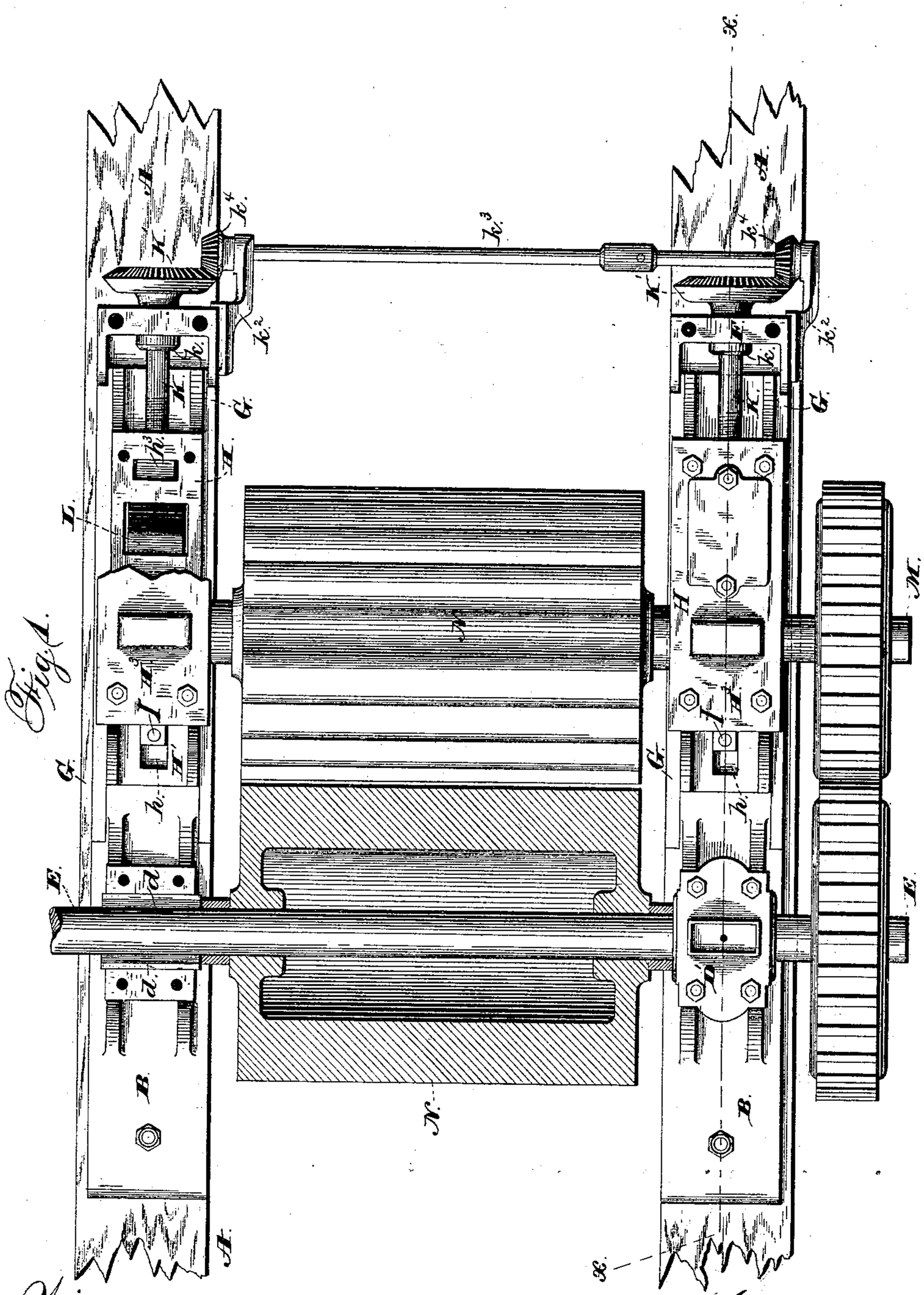

Fig. 1.

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(No Model.)

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Fig. 2.

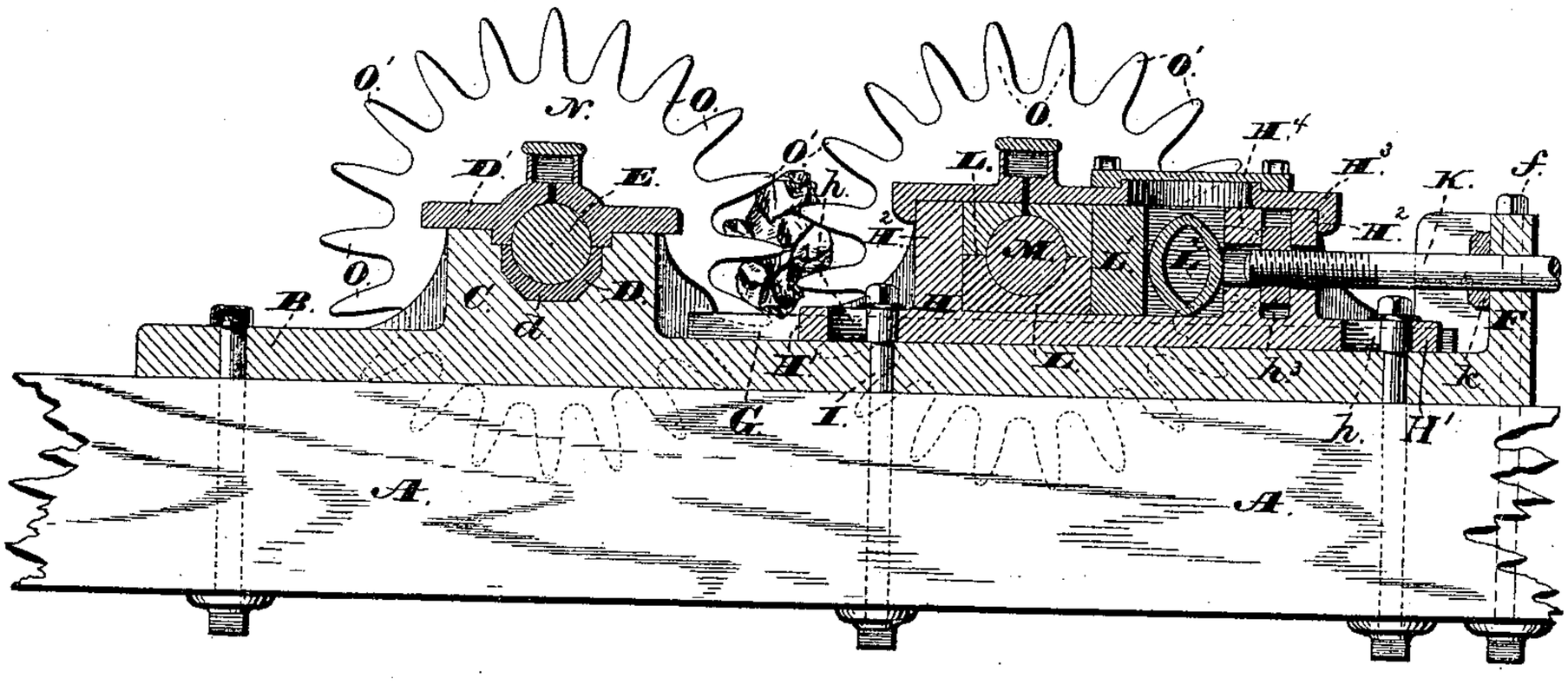
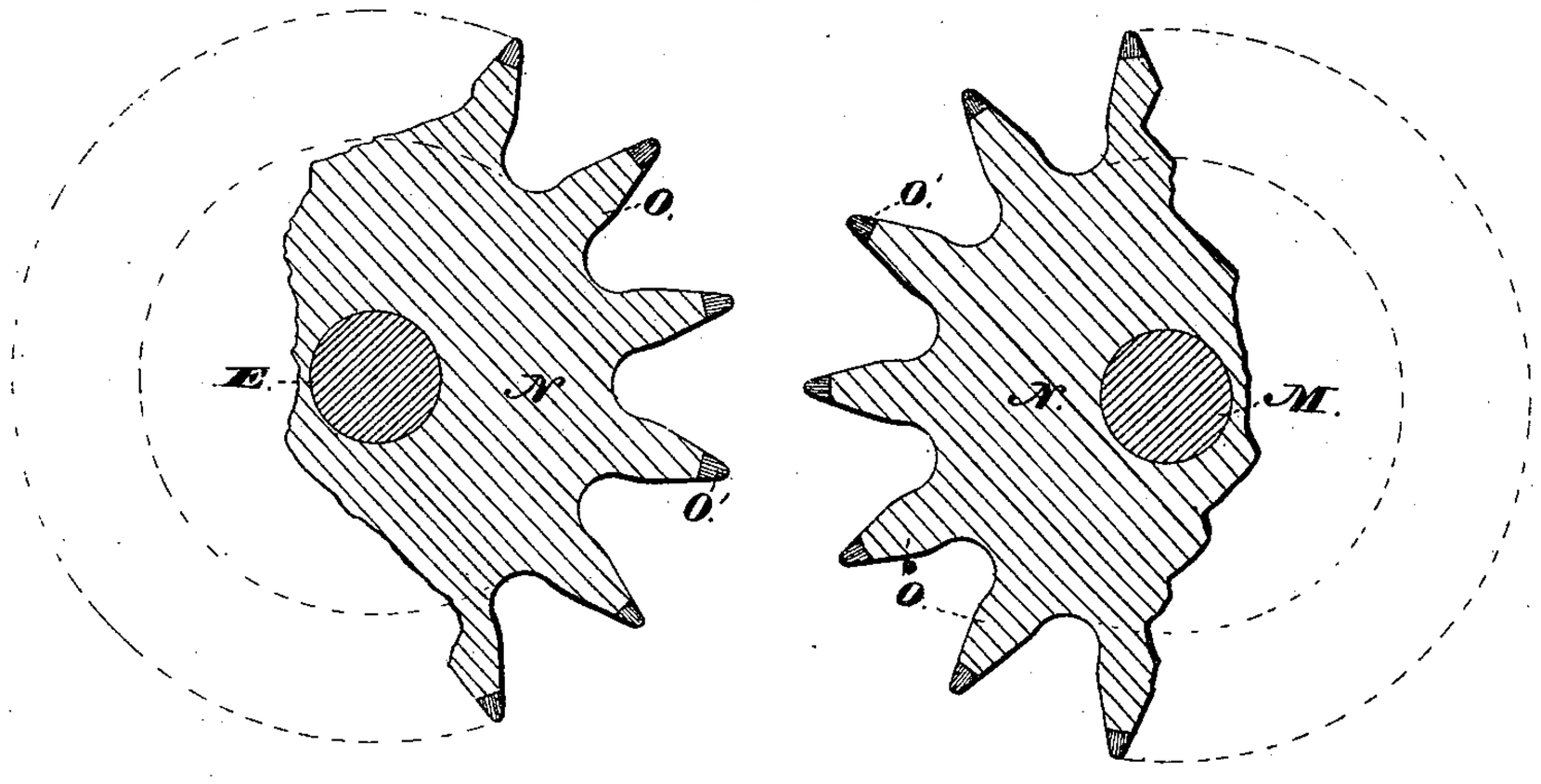


Fig. 3.



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3 Sheets—Sheet 3.

E. B. COXE.

COAL BREAKER.

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Fig. 4.

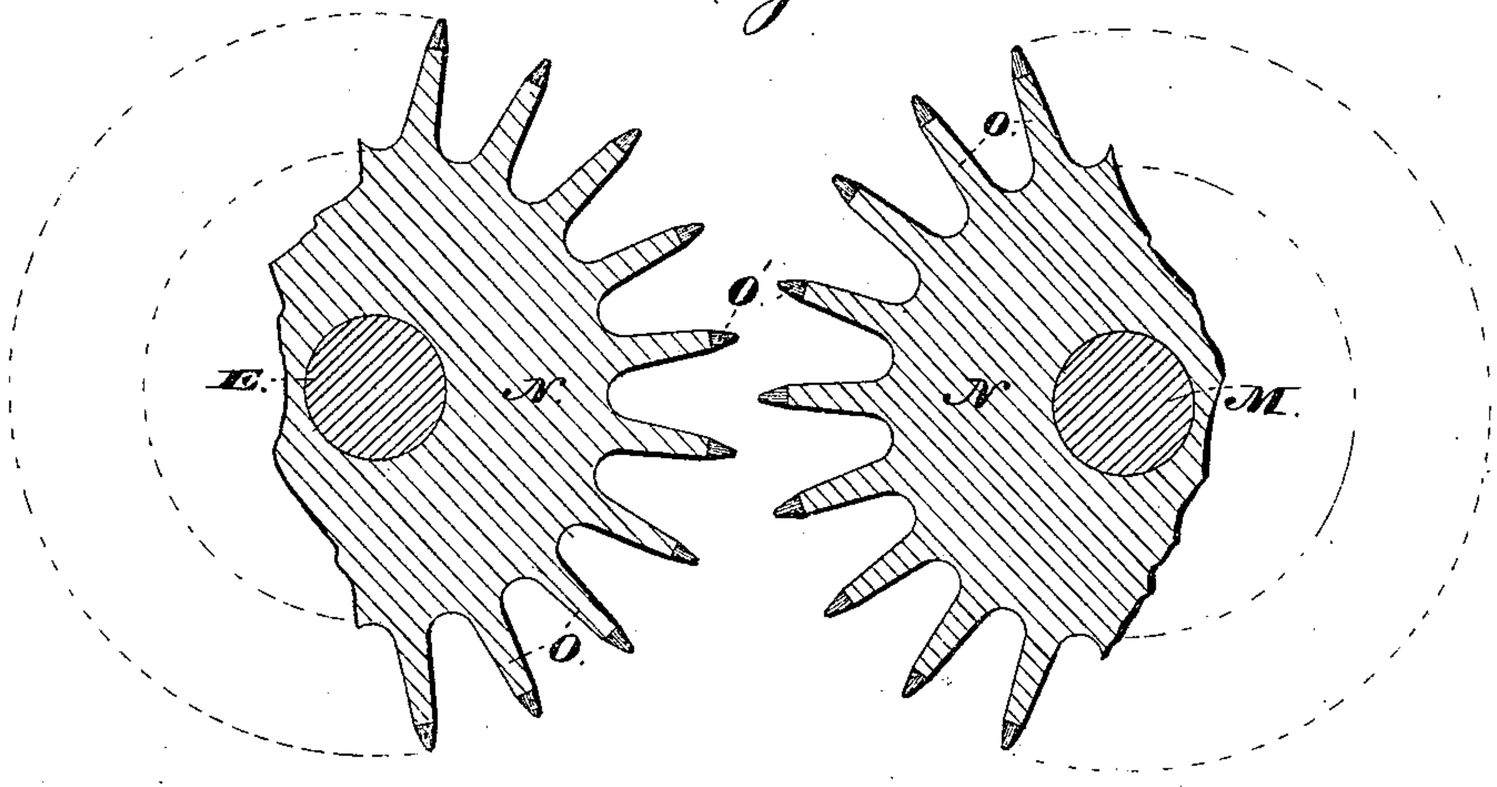
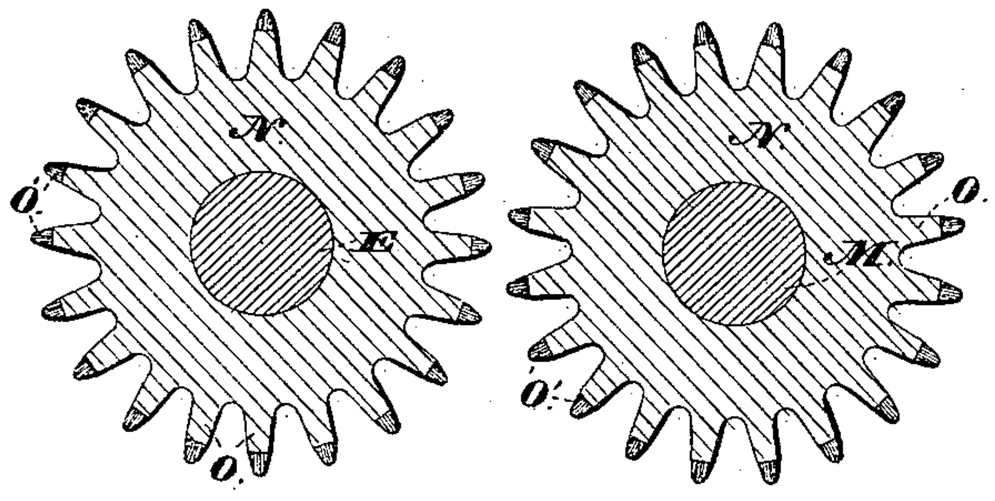


Fig. 5.



Witnesses:
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UNITED STATES PATENT OFFICE.

ECKLEY B. COXE, OF DRIFTON, PENNSYLVANIA.

COAL-BREAKER.

SPECIFICATION forming part of Letters Patent No. 350,814, dated October 12, 1886.

Application filed October 20, 1884. Serial No. 145,988. (No model.)

To all whom it may concern:

Be it known that I, ECKLEY B. COXE, of Drifton, in the county of Luzerne, and in the State of Pennsylvania, have invented new and useful Improvements in Coal-Breakers; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 shows a plan view of my coal-breaker; Fig. 2, a vertical sectional view of the same on line *x x* of Fig. 1; Fig. 3, a detail sectional view of portions of the rolls used in breaking lump coal; Fig. 4, a similar view of the rolls used in breaking steamboat-coal, and Fig. 5, a similar view of the rolls used in breaking broken and egg coal.

Letters of like name and kind refer to like parts in each of the figures.

Heretofore rolls have been used for breaking up anthracite coal, consisting of cylinders with pointed teeth either cast upon them or inserted in them. Sometimes the teeth on one roll were placed opposite the teeth on the other, and sometimes opposite the spaces thereon. In the one case, where the lump of coal would be caught between two pointed teeth pressing on opposite sides, the lines of fracture of the lump radiated in both directions from each point of pressure, and the result was that much of the coal was broken into dust, or pieces so fine as to be almost worthless. In the other case, where the lump was caught between a tooth on one roll and a plane surface on the other, the lines of fracture radiated from the point upon which the end of the tooth pressed, and much dust and coal too fine to be useful was the result here also. Smooth and corrugated rolls have also been used to crush stone and ore.

The object of my invention is to provide a coal-breaker which will avoid to a great extent the defects of the machines heretofore used, and will make it possible to break up anthracite coal into certain desired sizes, known as "broken," "egg," "stove," and "chestnut," of which the latter two are the most valuable, with the production of a minimum amount of pea, buckwheat, or dust; and to this end my invention consists in the machine and the rolls constructed and operating as hereinafter specified and claimed.

In the drawings, A A designate the upper side frame-beams of the machine. Upon these beams are bolted or otherwise secured the metal plates B B. Each of these plates, near one end, is provided with an upwardly extending portion or block, C, the upper portion of which is formed with one-half of a journal-bearing, D, for the end of shaft E. As usual, this lower half-bearing is lined with Babbitt metal, as shown at *d*. The upper half of this journal-bearing is formed by the plate D′, bolted to piece or block C, and provided, as shown, with suitable means for keeping the shaft end and box properly oiled. At its other end each plate B is formed with a vertical extension or flange, F. Two bolts, *f f*, pass down through this flange, one near each side of plate B, and through the beam A, and are provided with screw-nuts and washers on their lower ends bearing against the lower side of the beam.

The plates B B are each provided on the sides of their upper faces with the vertical parallel ribs or flanges G G. Between these flanges on each plate fits and slides the lower portion of the movable journal-box H. At its sides this box overlaps and rests upon the upper faces of these flanges. At each end the lower portion of the box is extended to form a plate, H′, which is slotted at *h*.

To keep each box H down in place on the plate B, two bolts, I I, are provided, fastened below to the side beam and passing up through plate B, and the slots in each of the plates H′ H′ projecting from the base of the box. Each of these bolts, where it passes through the slot in the plate H′, is squared to fit such slot, the lower end of such squared portion resting on and serving with the other bolts to fasten plate B in place. The extreme upper ends of bolts I I are formed with heads overlapping the upper surface of plates H′ H′. With this construction each box is held firmly down in place, while being capable of being slid longitudinally along the plate B.

The box H, which is formed of the bed-plate and the two ends H^2 H^2, cast thereon, and the cover H^3, bolted thereon in any desired way, is also provided within, near its outer end, with the rigid upwardly-projecting part H^4, between which and the end of the box is held the nut h^3. Through this nut is tapped the

screw-threaded end of screw K, which passes through an opening in the outer box end. The outer end of the shank of this screw is journaled in an opening through the lug or flange on plate B, and is provided with a bevel gear-wheel, K′, on the outer side of and bearing with its hub against said lug. This prevents any inward longitudinal movement of the shank or shaft of the screw. Longitudinal outward movement of the same is prevented by a collar, *k*, pinned on the screw-shank, as shown, just inside of said lug or flange. With this construction, if the screw be turned in either direction, the box will evidently be correspondingly slid along over its plate B, either toward or away from the fixed bearings described.

To cause the screws to be turned equally, so that the boxes on both sides shall always be equally moved in either direction, I journal in suitable lugs or ears, k^2, on the plates B B a shaft, k^3, which carries at each end a beveled pinion, k^4, meshing with bevel-wheel K′. This shaft can be provided, as shown, with an enlargement having holes for the insertion of the end of a bar or rod to turn the shaft, or it can be squared for the proper engagement of a wrench therewith.

At the forward end of box H, and bearing against the inner face of the box end, is the journal-bearing L, which is not fixed rigidly in said box, but can slide therein. It is kept in its forward or inward position, as indicated in Fig. 2, by means of a block, L′, bearing against its outer or rear side, said block being forced forward by a spring, L^2, between said block and the rigid part H^4, inside of the outer end of the box.

Instead of a spring there may be placed in the same space a piece of pipe or some other form of material which will crush when undue outward strain is brought to bear on the journal-bearings, or a block of rubber may be used. In these adjustable and movable bearings are journaled the ends of shaft M, parallel with shaft E, already described. Upon these shafts are fixed the rolls N, preferably of the same diameter. They are of iron, and are cast with the longitudinal ribs O, the outer ends and edges, O′, of which are chilled. The main portion of each rib is of considerable height, so as to bring the bearing-edges well out from the body of the roll. The ribs are set some distance apart, so as to leave spaces between them, which, on account of the height of the ribs, will be large enough to allow pieces of the lumps as broken to drop between the ribs, out of the way of the edges of the ribs on the other roll. The rolls as shown in the drawings are preferably made hollow. The main or lower portion of each rib is made with sides parallel or nearly parallel with the radial plane passing through the edge of the rib. With this formation of the main portions of the ribs there will be left between the ribs the desired large and deep spaces, for the purpose hereinafter to be set forth. The faces of the outer chilled portions of the ribs are inclined toward each other, the extreme outer edge thus formed being slightly rounded, so as not to dull or break readily. The rolls are set so that arcs of revolution of the rib-edges on the different rolls will not touch or intersect, but, as shown in the drawings, will be at some distance from each other. The rolls are so geared together that as they revolve toward each other the ribs on one will come opposite the spaces between the ribs on the other. As shown in the drawings, the meshing gear-wheels on the shafts are of the same size, thus insuring that the rolls shall rotate with the same speed, and the ribs on one shall always come opposite the spaces between the ribs on the other.

The rolls which I use for breaking lump-coal are preferably about twelve and a quarter inches in radius from the center to the edge of the ribs, and are set about twenty-seven and a quarter inches apart from center to center. For these rolls the ribs are of a slightly different shape from those which I use on the other rolls. From the rounded edge each rib slopes away on each side beyond the chilled portion to a point a little more than half-way to the base of the rib. From this point each rib-side is made substantially parallel to a radial plane from the axis of the roll through the edge of the rib. On this sized roll I use only thirteen ribs.

To break steamboat-coal, I make the rolls about thirteen inches in radius from the center thereof to the edge of a rib, and set the rolls about twenty-six and a half inches apart from center to center. The ribs in this case are about four and a half inches in height and are twenty in number.

For breaking broken and egg coal, the rolls are twenty-ribbed, about eight inches in radius from center to rib edge, and are set sixteen and a half inches from center to center.

As shown in Fig. 2, when my rolls are in operation, the lumps to be broken are fed in between them, and while supported at or near its ends upon two of the long sharp ribs of one roll each lump is struck and pressed upon at or near its middle by one of the sharp ribs on the other roll. The result is that the lump is broken in two and not crushed, and little or no dust is formed. The line of fracture is a clear clean one straight through the lump, and there are no radiating lines of fracture, as in machines using rolls as heretofore made.

There is another very great advantage in using my rolls operating as described. As is well known, many of the lumps are composed partly of slate and partly of coal. As the slate and coal break in different ways and have different lines of fracture, if the lumps are broken, as by my rolls, by bending or crimping them, it has been found that the slate and coal separate in the breaking, so that the pieces of slate can easily be removed from the pieces of broken coal.

My rolls as constructed, with the edges only

of the ribs chilled, are hardest just where the most wear comes, while the main supporting parts of the ribs are of softer, tougher, and less brittle material.

If any undue strain comes upon the rolls and shafts, as when any lump of material too hard to be safely broken gets between the rolls, the safety device described hereinbefore will operate and allow the movable roll to yield and move away from the other to let the obstruction through and to prevent any injury to the roll-ribs.

Where desired, as being advantageous for some kinds of coal, I contemplate running the rolls so that the ribs on one will come opposite those on the other.

As already indicated herein, the rolls of each pair are rotated so that the ribs on one shall come opposite a space between two of the ribs on the other. The spaces between the ribs on each roll are made so deep that as the rib on one roll is brought around opposite a space on the other by the rotation of the rolls the distance from the edge of such rib to the bottom of the opposing space is greater than the distance between such rib edge and the edge of either of the nearest ribs on the other roll. If the distance between the edge of the rib and the bottom of the opposing space were equal to or less than the distance between the edge of the rib and the edges of the ribs on each side of the space, the lumps of coal would be finely crushed and ground between the bottom of the space and the opposing rib. With my construction this fine crushing and grinding are avoided, for the broken pieces can drop down into the lower portions of the spaces between the ribs, out of the way of the edges of the ribs on the other roll.

I do not claim as my invention any of the means shown and described for adjusting the distance between the rolls, or the safety devices shown and described for preventing breaking of the ribs on the rolls. Such adjusting means and safety devices are merely shown in connection with the rolls as they would be in a complete machine. Any other forms of them can be used, as desired, with my rolls without departure from my invention, which, as set forth in the claims, has to do merely with the rolls and their construction and the gearing used with them.

Having thus fully set forth the nature and object of my invention, what I claim is—

1. The coal-breaking roll provided with longitudinal ribs having their outer portions beveled to form edges, and their main portions or supporting parts made parallel or nearly parallel to radial planes through the edges of the ribs, substantially as and for the purpose described.

2. The coal-breaking roll of cast-iron, provided with longitudinal ribs having their outer parts beveled to form edges, and chilled, and the main or supporting parts of unchilled iron, and with sides substantially parallel to radial planes through the edges of the respective ribs, substantially as and for the purpose described.

3. In combination with means for rotating them at the same speed, the two rolls having longitudinal ribs so arranged that the ribs on one come opposite the spaces between the ribs on the other, and having the spaces between the ribs of such depth that as a rib on one roll comes opposite a space on the other the distance from the edge of such rib to the bottom of the space is greater than the distance from such edge to the edge of either of the ribs inclosing such space, substantially as and for the purpose described.

4. In combination with the two rolls of equal diameter provided with longitudinal ribs so arranged that the ribs on one roll come opposite the spaces between the ribs on the other, and having the spaces between the ribs of such depths that as a rib on one roll comes opposite a space on the other the distance between the edge of the rib and the bottom of the space is greater than the distance from such rib-edge to the edges of the ribs inclosing the space, the shafts of the rolls set so that the arcs of travel of the ribs on the two rolls will not intersect, and means for causing the shafts to rotate at the same speed, substantially as and for the purpose described.

In testimony that I claim the foregoing I have hereunto set my hand this 6th day of October, 1884.

ECKLEY B. COXE.

Witnesses:
ARTHUR MCCLELLAN,
WILLIAM I. HOCH.