E. O'TOOLE.

EXCAVATING MACHINE.

APPLICATION FILED AUG. 17, 1910. RENEWED OCT. 19, 1911.

1,011,995.

Patented Dec. 19, 1911.

5 SHEETS—SHEET 1.

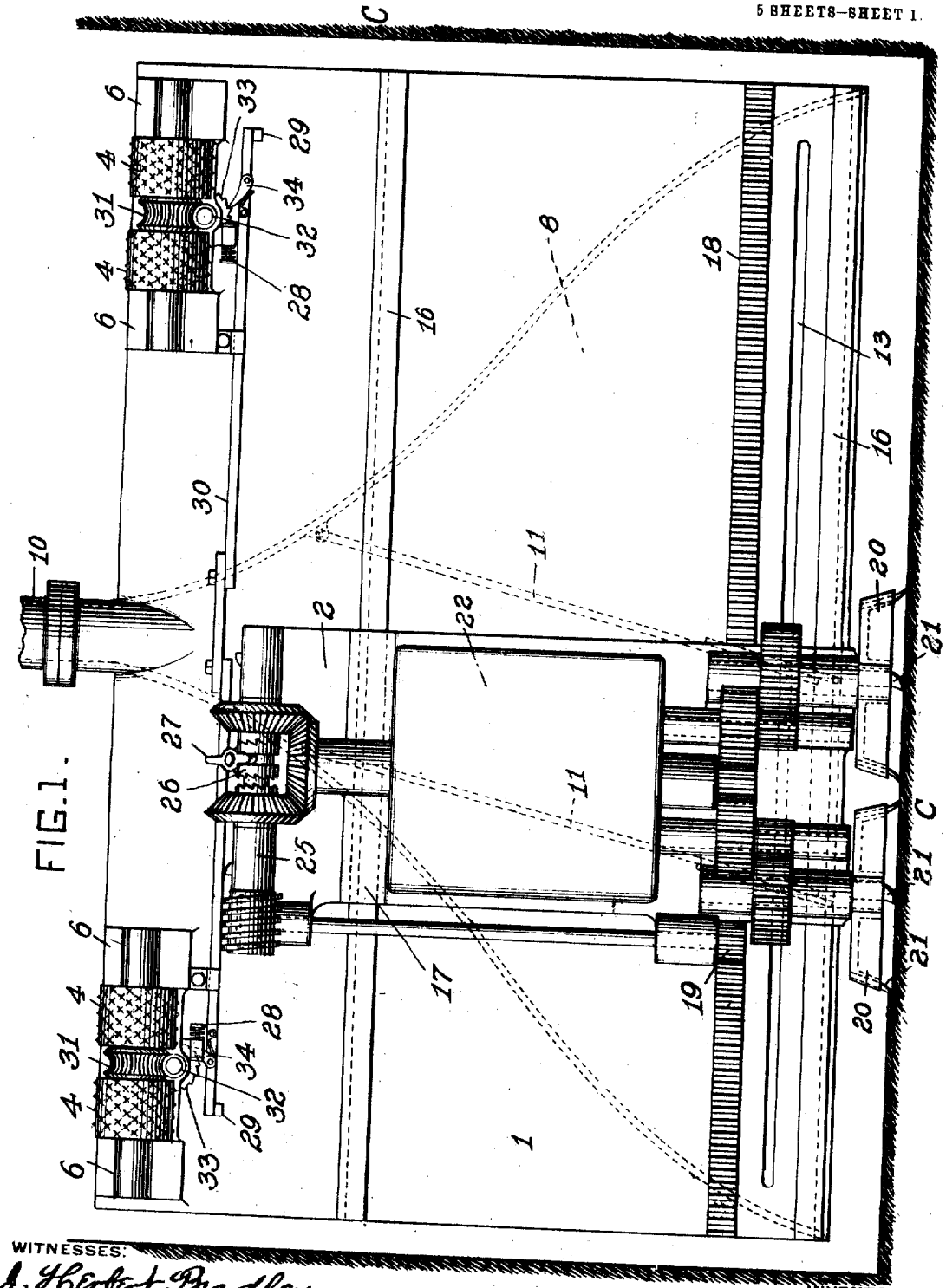

FIG. 1.

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5 SHEETS—SHEET 2.

FIG. 2.

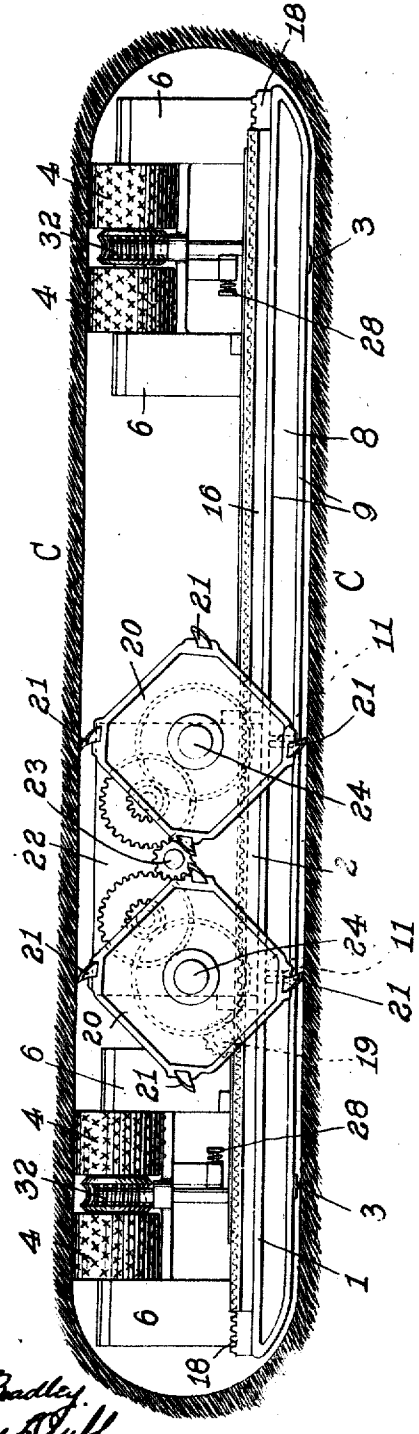
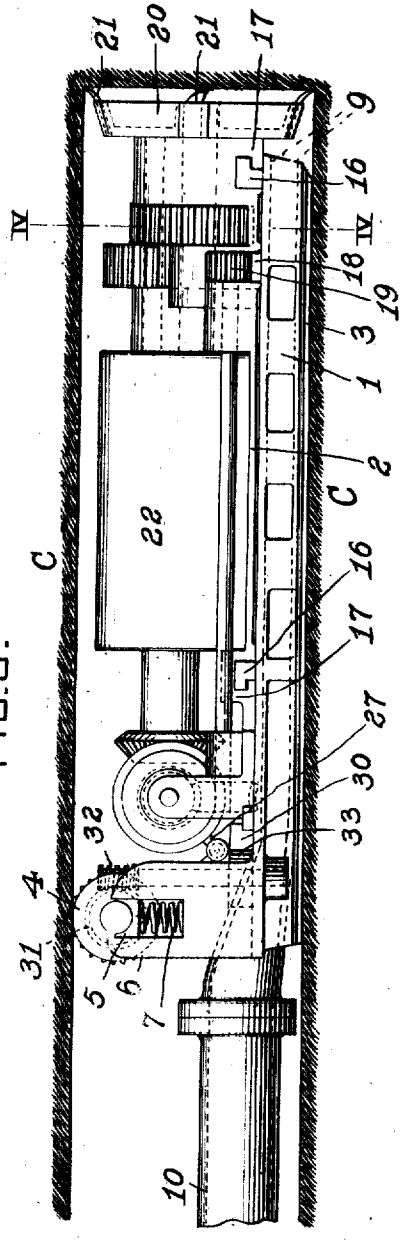


FIG. 3.



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6 SHEETS—SHEET 3.

FIG. 7.

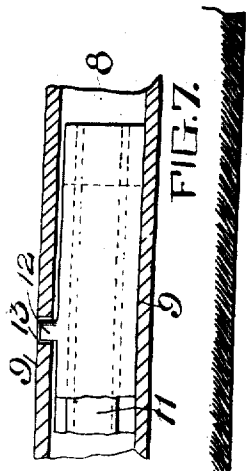
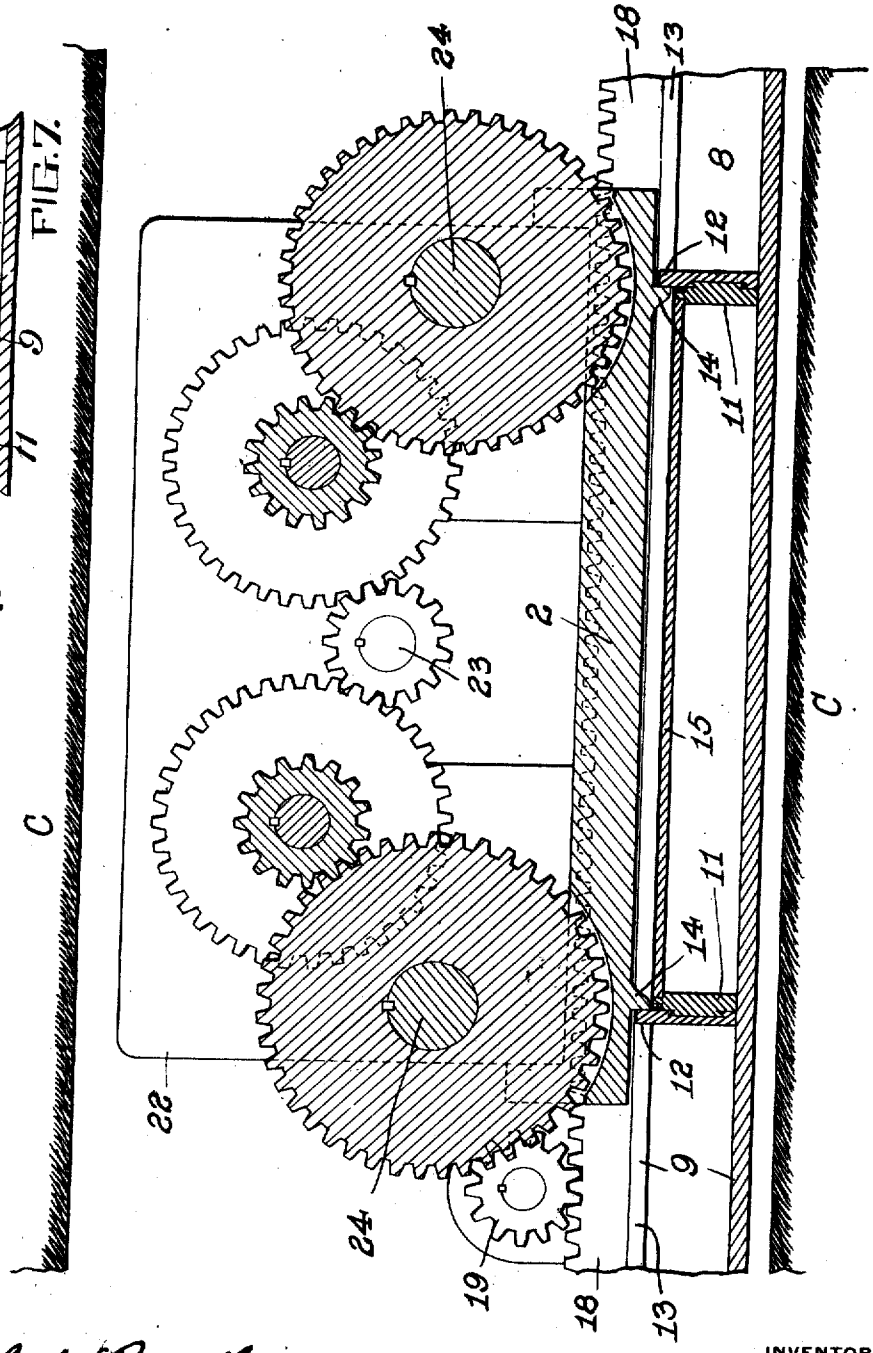


FIG. 4.



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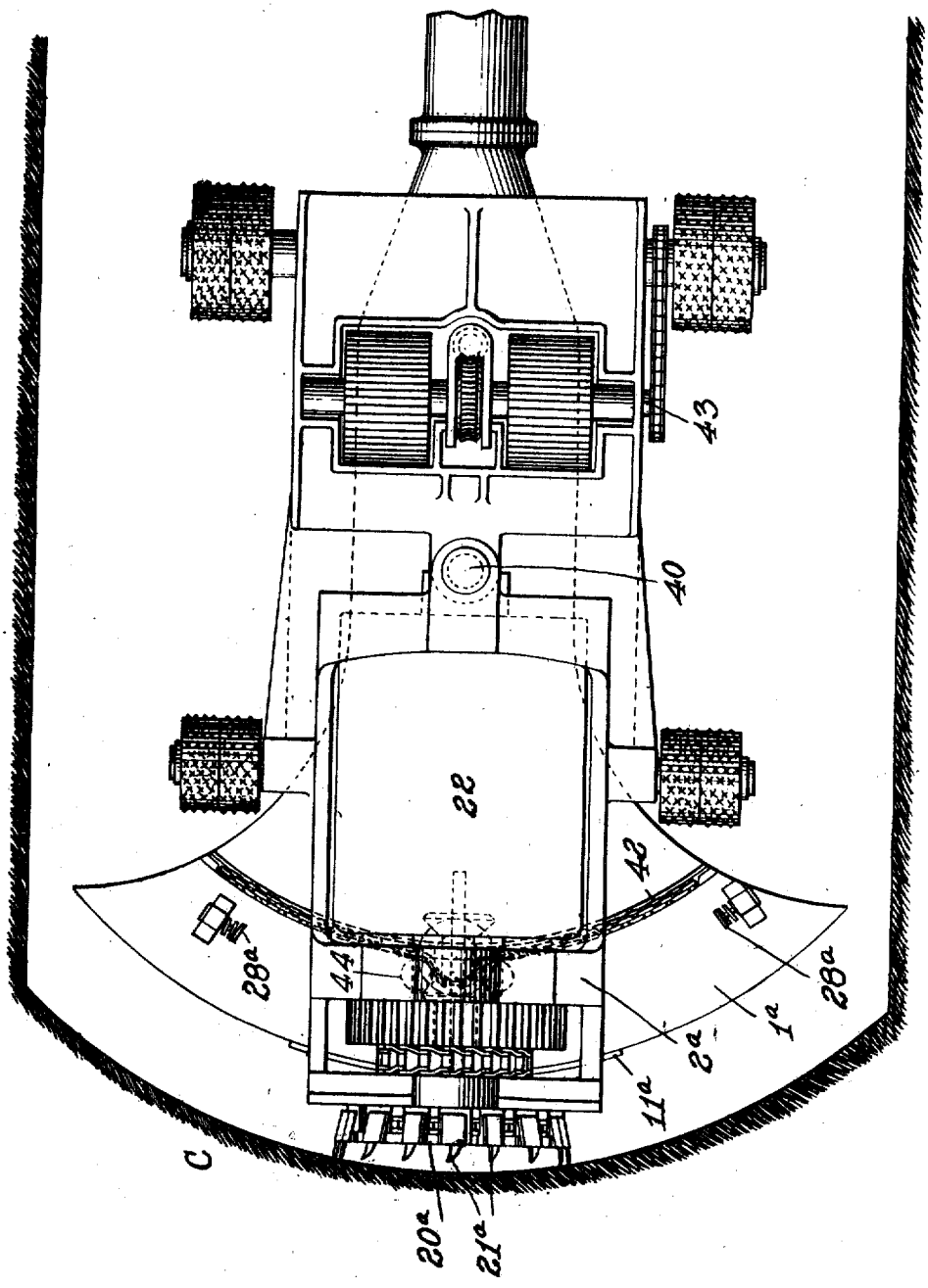
6 SHEETS—SHEET 4

FIG.5.



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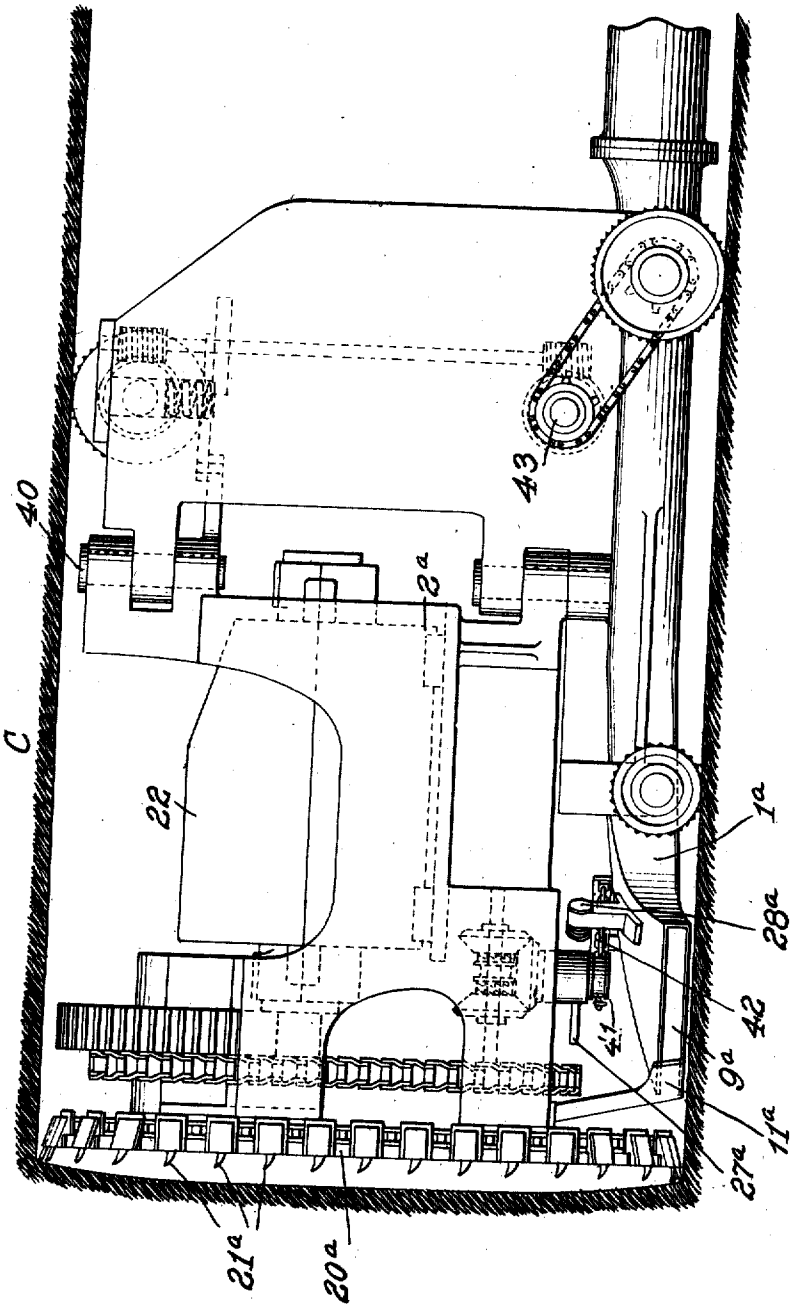
5 SHEETS—SHEET 5.

FIG. 6.



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UNITED STATES PATENT OFFICE.

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EXCAVATING-MACHINE.

1,011,995. Specification of Letters Patent. Patented Dec. 19, 1911.

Application filed August 17, 1910, Serial No. 577,587. Renewed October 19, 1911. Serial No. 655,641.

To all whom it may concern:

Be it known that I, EDWARD O'TOOLE, residing at Gary, in the county of McDowell and State of West Virginia, a citizen of the United States, have invented or discovered certain new and useful Improvements in Excavating-Machines, of which improvement the following is a specification.

My invention relates to improvements in the structure and organization of excavating machinery; and the objects are simplicity of structure and efficiency in service.

I have applied my invention to machinery for mining coal, and in this specification I shall illustrate it in such application, but it will be understood that the invention is not limited in its applicability to excavating machinery of any one form of type.

In the accompanying drawings which form part of this specification, Figure 1 is a plan, Fig. 2 a front elevation, and Fig. 3 a side elevation of a coal-mining machine embodying my present invention; Fig. 4 is a view in vertical section on a plane indicated at IV—IV, Fig. 3. Fig. 4 is drawn to larger scale than the other figures, and portions of the machine as it is there shown are broken away. Fig. 5 is a plan view of a machine embodying my invention but illustrating modifications in structure; Fig. 6 is a view in elevation of the modified machine of Fig. 5; and Fig. 7 is a view showing the pin of the extensible wings extending through a slot in the bed of the machine.

In the drawings the machine is illustrated in operative position in a mine cutting, and the adjacent mine walls are shown in section. Parts which are repeated in the several figures bear the same reference numerals in each case.

The machine consists essentially of a bed plate 1 (hollowed and shaped for purposes hereinafter to be described) and of a cutter frame 2, carried upon the bed plate. The bed plate 1 is provided beneath with longitudinally extending skids 3, adapted to bear upon the floor of a mine chamber or cutting, and to afford a bearing upon which the entire machine may advance as the mining operation progresses. The bed plate carries also, on transversely disposed axles, traction wheels 4, of suitable size and configuration and suitably proportioned and arranged with respect to the other parts of the machine, to bear upon the roof of the mine chamber or cutting, and by their turning to cause the bed plate with the parts which it carries to move upon its skids. These traction wheels are arranged at opposite sides of the bed plate, and preferably their axles are carried in journal bearings 5, movable in housings 6, and backed by springs 7 (as particularly illustrated in Fig. 3), so that the traction wheels 4 are held by spring pressure to engagement with the surface upon which they bear.

The hollow chamber 8 within the bed plate 1 opens at the forward end of the machine in an orifice 9 which extends substantially the entire width of the machine (see Fig. 2), and this hollow chamber opens rearwardly to a suction pipe 10. As indicated by dotted lines (Fig. 1), the side walls of the chamber 8 preferably flare from the suction pipe connection to the intake. The newly-mined coal is carried away from the cutting through this hollow bed plate by suction properly applied through the pipe 10. A pair of wings 11 pivoted at their rear ends in opposite sides of the throat of chamber 8, and pivoted at their forward ends to the reciprocating frame 2, swing within the chamber as the cutter frame reciprocates. They extend vertically from floor to roof of the low chamber 8, and they serve to narrow the passageway for the coal therethrough. The particular construction of these wings will be understood by comparing Figs. 1 and 4; each is made in two extensible parts, one part being pivoted rearwardly to the bed plate and the other forwardly to the frame. The forward pivot pin 12, shown in section on Fig. 4 and Fig. 7, extends through a slot 13 in the bed plate into which depend lugs 14 from frame 2, and a connecting bar 15 causes the wings 11 to swing in unison.

The frame 2 moves transversely upon bed plate 1, and to that end the bed plate may be provided with rails 16 and the frame 2 with slide bearings 17 (see Fig. 3). The means preferably employed for moving frame 2 laterally upon these rails are a rack 18 carried by the bed plate and a pinion 19 carried by the frame. The frame 2 carries at its forward end the cutting instrument, this preferably consists of two heads 20 rotatably mounted in the frame, and armed

peripherally with cutting teeth or picks, 21. This cutting instrument travels with the frame 2 transversely upon bed plate 1, and as it travels it cuts away coal from the breast against which it is set. The coal, as it is cut, falls to the orifice of the chambered bed plate, where it is caught by the suction current and drawn away between wings 11 through pipe 10. The rotation of the cutter heads 20 is conveniently effected by a motor 22 carried on frame 2, the armature shaft 23 of the motor being geared, as is illustrated in Fig. 4, to the shafts 24 of the cutter heads.

It is preferred to drive the frame laterally to and fro upon the bed plate from the same motor 22. To this end, the shaft of pinion 19 may be geared to the armature shaft of the motor, as is illustrated in Fig. 1. In that figure further means are illustrated for automatically effecting reversal in the turning of pinion 19, and causing the frame to reciprocate throughout its desired range of travel. To that end, a shaft 25, geared to the shaft of pinion 19, is arranged to be connected with the armature shaft of motor 22 through a sliding sleeve 26 which forms part of a reversing gear mechanism, such as is illustrated in Fig. 1. This sliding sleeve is provided with a finger 27 which, as the frame 2 approaches the limit of its traverse, engages alternately stops 28, 28 carried by the bed plate 1, and such engagement effects the shifting of sleeve 26 to its alternate positions. In this manner the desired to and fro movement of the frame 2 is effected, being, as has been explained, preferably coördinated with the rotation of the cutter heads.

It is further desirable to effect the advance of the entire machine as the frame reciprocates to effect the cutting, and my invention further consists in providing automatic means for such advance, and in arranging such means to operate in coördination with the reciprocation of the cutter frame already described. To that end, advance movement may be imparted to the machine from the same motor 22 which causes the cutter frame to travel upon the bed plate 1. As the frame 2 oscillates, it engages, near the limits of its traverse, stops 29 upon a bar 30, and shifts the bar 30 longitudinally, first in one direction and then in the other. The traction wheels 4 are preferably arranged in pairs, as illustrated in Fig. 1, and between each pair and mounted on a common axle with the traction wheels, is a worm wheel 31 A worm gear 32 with a ratchet 33 upon its shaft drives the worm wheel, and pawls 34 upon bar 30 drive the ratchet. Thus the reciprocation of frame 2 imparts intermittent advance to traction wheels 4. It will further be observed that, as the frame bears upon a stop 29 at one side of the machine and shifts bar 30, it is the pair of traction wheels at the opposite side which is turned; so the machine advances, engaging the roof above and the floor below, in a slightly zig-zag course, and the depth of the cut in each reciprocation of the cutter frame increases as it progresses from zero at one side to a predetermined maximum at the other.

In the drawings, the walls of the chamber, in which the machine is placed in operative position, are indicated at C.

The mode of operation has been indicated in the foregoing description. As the cutter heads turn and cut away the coal, the frame reciprocates, and the whole machine intermittently advances; thus the coal is cut away and the wall upon which the machine acts recedes under a continuous automatic operation. The coal cut away falls to the mouth of the chambered bed plate, and is drawn away by suction through the pipe 10, by means which form no part of my present invention.

The machine of Figs. 5 and 6 differs from the machine of Figs. 1 to 4, inclusive, particularly in that the cutter-carrying frame which moves upon the bed plate, instead of reciprocating in right line movement, reciprocates upon a pivot With this explanation it is believed that the machine of Figs. 5 and 6 will not require detailed explanation. In this case the bed plate 1^a has a receiving orifice 9^a which extends in a curve of which the center is coincident with the center 40 of pivotal movement of the reciprocating cutter-frame 2^a. The frame 2^a in this case is provided with a single cutter-head 20^a and the cutters 21^a, as will be observed, are mounted on a sprocket, but the detailed construction of the cutter-head forms no part of my present invention. Suffice it to say that, as in the other case, the operation of the cutter head cuts away the coal and causes it to fall in front of the receiving orifice 9^a of the bed plate 1^a. As in the other case, the motor 22 which drives the cutter head is effective also to reciprocate the cutter-frame, and to this end a sprocket whose position is indicated by dotted lines in Fig. 5 driven from the motor 22, engages a chain 42, whose opposite ends are secured to the bed plate beyond the desired limit of traverse, the chain 42 is held in engagement with the sprocket by means of idlers 41, one on either side of the sprocket, and the direction of rotation of the sprocket is automatically reversed by the engagement of a finger 27^a carried by a reversing gear structure with a stop 28^a, which is mounted on the bed plate. In this case, that is in the case of the machine of Figs 5 and 6, I have not shown any coördination of the advance of the machine upon its traction wheels and the reciprocation of the cutter

frame upon the bed plate. I have shown a shaft 43 from which the traction wheels may be driven, and it will be understood that this shaft may be moved in any desired manner and in any preferred coördination with the remainder of the moving parts of the machine, as may be desired.

In the machine of Figs. 5 and 6, it will be observed that no wings are employed within the chambered bed plate, such as are indicated at 11 in the drawings which illustrate the form of machine first described, to limit the effective size of the pneumatic passage. In this machine of Figs. 5 and 6 however an apron 11^a is present which covers a portion of the orifice 9^a of the bed plate, and reduces the effective size of the orifice. In the reciprocation of the cutter this apron moves from side to side, and in its traverse uncovers at one time and another the entire extent of the orifice 9^a. I prefer to have this apron lie immediately behind the cutter head as the drawings show. However, as noted above, the detailed construction of the cutter head does not form a part of my present invention.

It will be observed that the wings 11 of Figs. 1 to 4, and the apron 11^a of Figs. 5 and 6, are alternative means for reaching the same end, namely, the reduction of the effective area at any given time in the operation of the machine of the orifice 9 or 9^a. This provision is made to the end that the power of the air current in drawing the coal away from the cutter shall be made more effective.

The machine is primarily designed, as will be understood by those familiar with the subject, for cutting coal in relatively low seams, or for undercutting relatively thick seams.

While I have, in the foregoing specification, described with some particularity the organization of my machine, I do not intend thereby to limit my invention in its broader aspects to those specific details. As I have already stated my invention is embodied in the coal-mining machine shown and described, but I do not intend to limit my invention particularly to that one application.

I claim herein as my invention:

1. In an excavating machine the combination of a bed-plate, a cutter-head reciprocatory thereon, said bed-plate being provided with a passageway for excavated material and with an intake extending beneath the path of reciprocation of said cutter-head, and means for causing a forward feed of said bed-plate, said feeding means being effected by the reciprocation of the said cutter-head, substantially as described.

2. In an excavating machine, the combination of a bed plate and a cutter reciprocatory thereon from side to side, said bed plate being provided with a passageway for excavated material and with an intake to said passageway, said intake arranged beneath the cutter and extending substantially throughout the range of its lateral reciprocation, substantially as described.

3. In an excavating machine, the combination of a hollow bed plate open anteriorly and united posteriorly to a suction pipe, a cutter-armed frame reciprocatory upon said bed plate, and a pair of passage-forming wings arranged within said bed plate and pivoted posteriorly to said bed plate and anteriorly to said cutter frame, substantially as described.

4. In an excavating machine, the combination of a bed plate provided at opposite sides with traction wheels and provided with a passageway for excavated material, a cutter frame reciprocatory thereon, and a driving mechanism for each of said traction wheels, the driving mechanism for each of said wheels operated by reciprocation of said cutter frame to the opposite side of said bed plate, substantially as described.

5. In an excavating machine, the combination of a bed plate provided with a passageway for excavated material and with skids beneath engaging the floor of a cutting and traction wheel above engaging the roof of such cutting, a reciprocatory cutter-armed frame carried on said bed plate, and means for turning said traction wheels by the reciprocation of said frame, substantially as described.

6. In an excavating machine, the combination of a bed plate, provided with a passageway for excavated material, a cutter frame movable transversely thereon, a rack on said bed plate, a pinion rotatably mounted in said frame and by rotation effecting movement of said frame upon said bed plate, a rotary, pick-armed cutter head carried by said frame, said pinion and said cutter head connected to a common source of power and rotating in unison, substantially as described.

7. In an excavating machine, the combination of a frame, a pair of rotary pick-armed cutter heads mounted on parallel shafts therein, and geared to rotate in unison from a common source of power, said frame movable upon a bed plate and in movement causing the shafts of said cutter heads to move transversely in their common plane, said bed plate provided with a passage for excavated material, and with an intake extending beneath the path of movement of said cutter heads, substantially as described.

8. In an excavating machine the combination of a bed plate and a cutter frame reciprocatory thereon, a pair of cutter heads carried by said frame, said bed plate being provided with a passageway for excavated material, and a pair of passage

forming wings therein, pivoted at opposite ends to the said bed plate and the said frame, substantially as described.

9. In an excavating machine the combination of a bed plate and a cutter reciprocatory thereon, said bed plate being provided with a passageway for excavated material, and with an intake orifice to said passageway, the intake orifice being arranged beneath the cutter and extending substantially throughout the range of its reciprocation, and means for making effective a portion only of the area of the orifice at any given time in the operation of the machine, substantially as described.

10. In an excavating machine the combination of a bed-plate, a cutter-head reciprocatory thereon, said bed-plate being provided with a passageway for excavated material and with an intake extending beneath the path of reciprocation of said cutter-head, a pair of passage-forming wings pivoted at opposite ends to said bed-plate and said cutter-head, and means for causing a forward feed of said bed-plate, said feeding means effected by the reciprocation of said cutter-head, substantially as described.

In testimony whereof, I have hereunto set my hand.

EDWARD O'TOOLE.

Witnesses:
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J. E. FLEXNER.