(No Model.) 2 Sheets—Sheet 1.

F. BAIN.

MINING MACHINE.

No. 433,610. Patented Aug. 5, 1890.

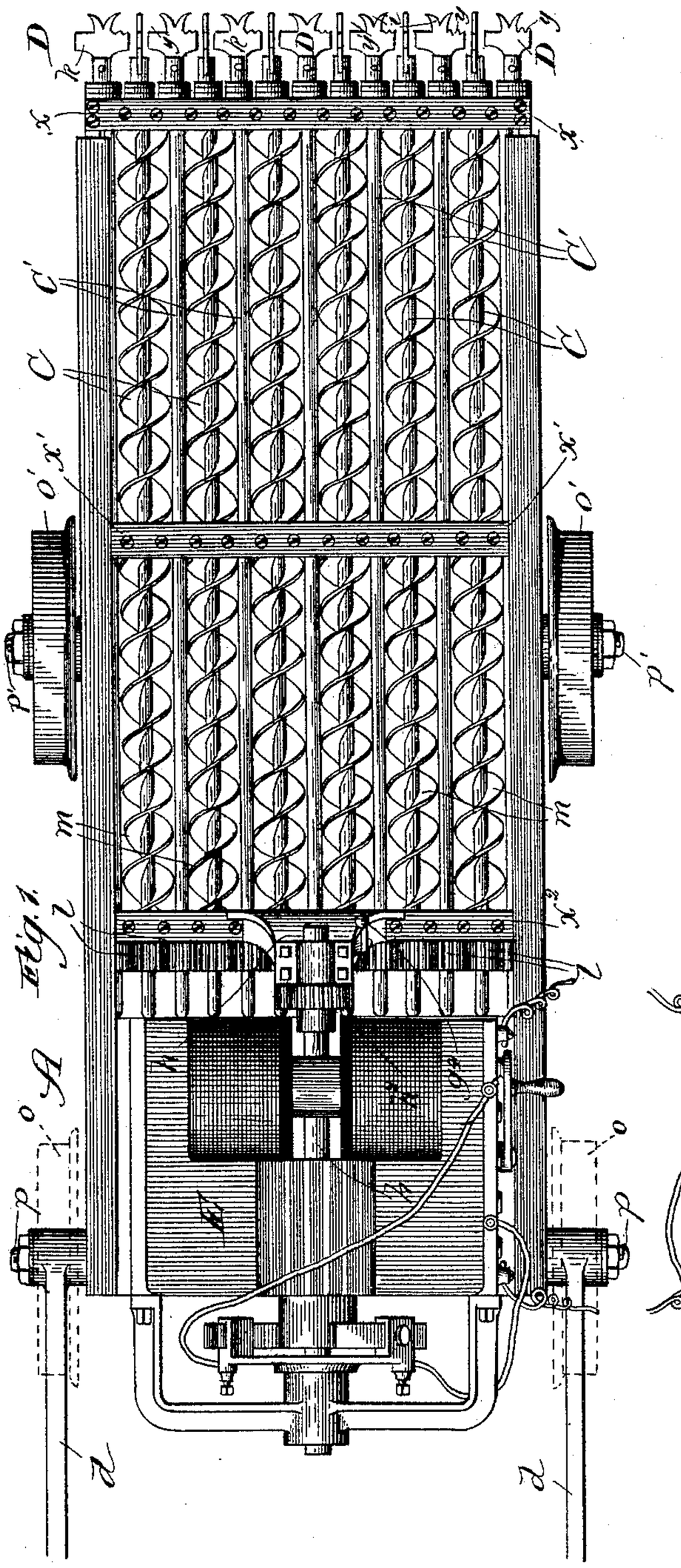

Fig. 1.

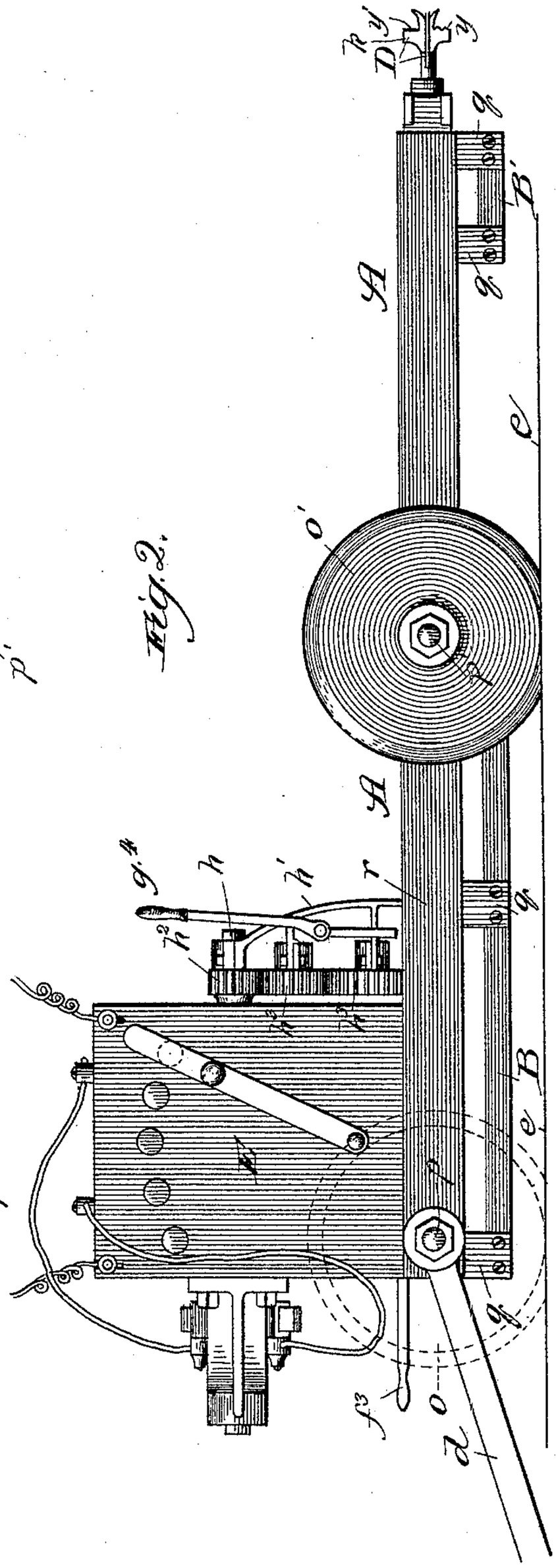

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

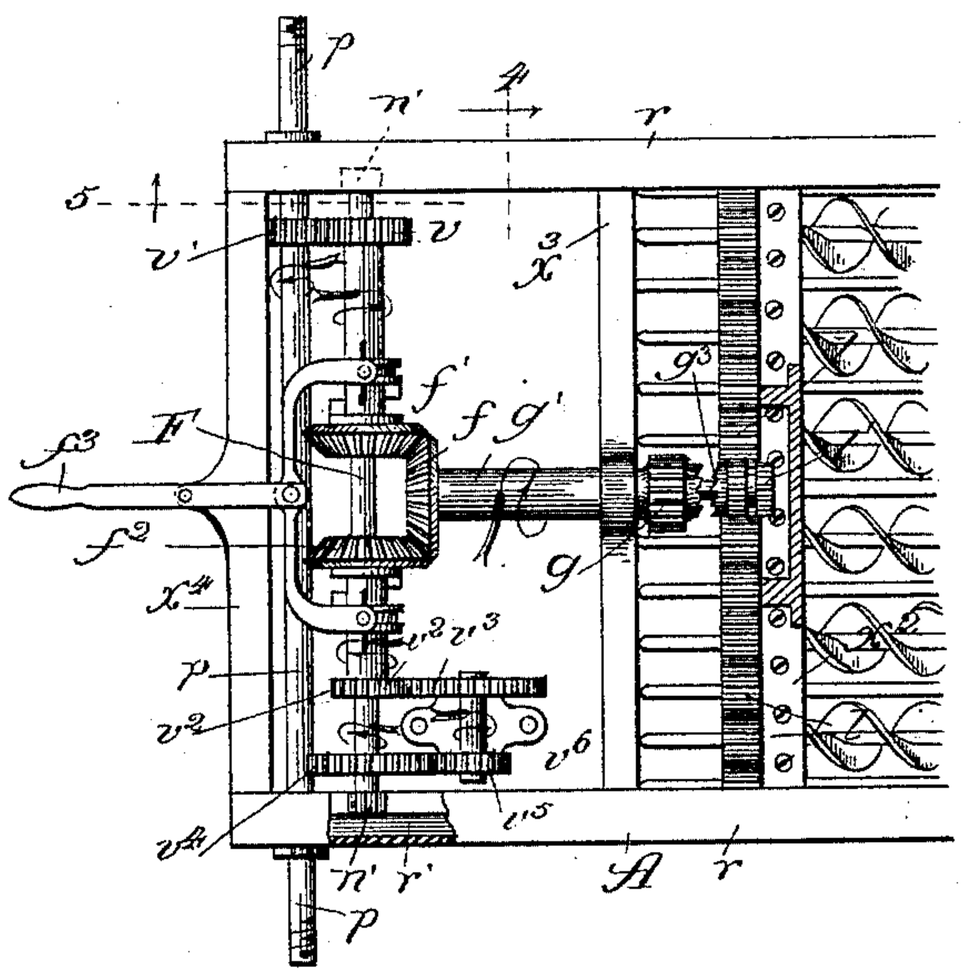


Fig. 6.

G

Fig. 4.

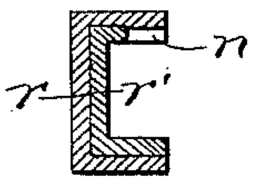
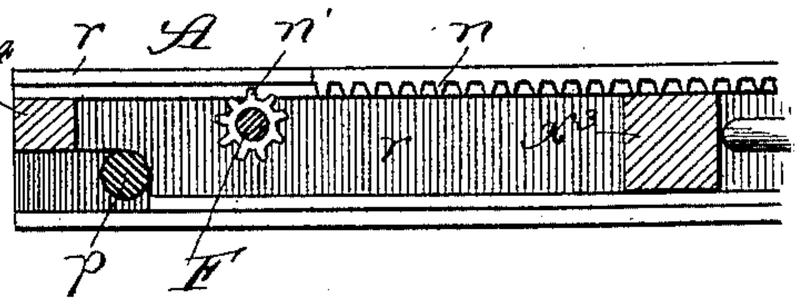


Fig. 5



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UNITED STATES PATENT OFFICE.

FORÉE BAIN, OF CHICAGO, ILLINOIS.

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 433,610, dated August 5, 1890.

Application filed February 17, 1890. Serial No. 340,799. (No model.)

To all whom it may concern:

Be it known that I, FORÉE BAIN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Mining-Machines, of which the following is a specification.

My invention relates to an improvement in the class of machines actuated by steam, compressed air, or electricity for use in mines, and more especially in coal-mines for the so-called "undercutting" operation, whereby a wall in the chamber of a mine of the material to be obtained (as coal) is undermined preparatory to dislodging it by blasting, which is commonly done on introducing the explosive into an opening or openings provided in the wall of material near the top of the chamber in or forming the mine.

My invention is designed particularly as an improvement on the kind of undercutting-machine for coal-mining involving a stationary bed or frame supporting a reciprocating frame carrying its own motor, which also forms the power for actuating the cutting mechanism.

The objects of my improvement are to provide a mining-machine of the class of that referred to, the construction of which shall render it comparatively light without depriving it of proper strength, which will operate to cut a continuous elongated opening, and which may be readily transported toward and from the work in the mine by the same power which actuates the cutting mechanism.

A further object is to provide a mining-machine, for the purpose stated, of generally improved construction and manner of operation.

In the accompanying drawings, Figure 1 is a plan view of my improved machine; Fig. 2, a view of the same in side elevation; Fig. 3, a section taken on the line 4 of Fig. 4 and viewed in the direction of the arrow; Fig. 4, a broken plan view of the rear portion of the machine with the motor removed, and showing a bearing detail in section; Fig. 5, a section taken on the line 5 of Fig. 3 and viewed in the direction of the arrow, and Fig. 6 a representation of the form of elongated opening produced by the cutting operation of the machine.

The frame of the machine is formed in two parts, one within the other, the outer being intended to remain stationary when the machine is operating, while the inner is movable longitudinally, the construction rendering the two frame portions "telescoping." To this end the outer frame A comprises the two sides r, formed of channel-iron, as shown, and fastened together by a platform B, extending below and between them toward the rear end of the outer frame, and a platform B′ at the forward end, the platforms being secured to depending pieces q, extending from the sides or parts r of the frame A. Near the rear end of the frame A is a rotary axle p, extending through its opposite sides and affording at its protruding ends bearings for wheels o, and from opposite sides of the frame A toward its forward end project bearings p' for wheels o'.

The inner frame A′ comprises two sides r' of channel-iron fitting in the sides r of the outer frame, which are provided along the inner edges of the under sides of their top or overhanging portions with racks n, extending from near the rear to the forward ends of the sides r. Cross-pieces x, x', x^2, and x^4 connect the sides r' together and form bearings for drill-spindles and other parts hereinafter described.

C and C′ are the drill-spindles supported in parallel series between the sides r' of the movable frame in the bearings x, x' and x^2, the spindles C alternating with the spindles C′ and being provided with conveyer-worms m. Behind the cross-piece x^2 the drill-spindles carry pinions l, all intermeshing in series across the machine, whereby adjacent spindles rotate in opposite directions. The rear ends of the drill-spindles are confined against a thrust-bar x^3, secured on the movable frame A′. The forward ends of the spindles C and C′ are provided with the bits or drills proper D, each comprising a blade k, having the point i projecting from its forward side, the front edge of each blade being preferably serrated, as shown at y, along one side of the point i and smooth along the opposite side thereof. The drills D are ar-

ranged with the blade of each at a right angle to the other, whereby each rotates through a portion of the plane of the one next to it; or, in other words, they overlap each other in parallel series.

E is the motor of any suitable construction and species, though preferably an electric motor supported on and movable with the inner frame A′. The driving-shaft h of the motor is supported at its inner end in a suitable bearing at the upper end of a bracket h', secured to the cross-piece x^2, and carries a pinion h^2, meshing, through a vertical reducing train of pinions h^3, (the reduction being, say, five to one,) with a pinion g on a sleeve g' of the central drill-spindle C′, which is extended backward beyond the others, with the thrust-bar x^3 forming a bearing for it, and carries at its rear end a beveled gear-wheel f. The inner end of the sleeve g' is formed into one part of a clutch g^3, the other sliding part of which is controllable by means of the lever g^4, and is formed with the circumferentially-grooved pinion l', meshing with the pinion l on the central drill-spindle C′.

F is a rotary shaft (suitably supported, as by hangers from the motor E, though no particular means of its support are shown,) provided at opposite ends with pinions n' in line with the racks n. Near one end the shaft F carries a pinion v, coinciding with a smaller pinion v' on the axle p, both the said pinions being rigidly secured in place. Near the opposite end of the shaft F are the rigid smaller and larger pinions v^2 and v^4, meshing, respectively, with a larger and a smaller pinion v^3 and v^5 on a counter-shaft v^6, the last-named pinion system forming a reducing-gear. At opposite sides of the center of the shaft F are the beveled loose pinions f' and f^2, provided with ordinary clutches, as shown in Fig. 3, controlled from the lever f^3 to cause one pinion f' or f^2 to be thrown into and the other out of mesh with the beveled pinion f.

The operation is as follows: Normally, or while the machine is out of operation, the inner frame A′ is withdrawn to the full limit into the outer frame A, the clutch g^3 is separated, the shaft F is back beyond the rear ends of the racks n (with which the pinions n' are then out of mesh) with the pinion v in mesh with the pinion v' on the axle p, and the machine is supported on the wheels o and o', which rest on a suitable (temporary or permanent) track e. The machine may then be readily moved to any part of the mine on actuating the motor E, which is done in the usual manner by connecting it with the line wires or circuit, as through the medium of any suitable trolley device, though I prefer to employ for the purpose a trolley mechanism of improved construction, not shown in the present connection, but forming the subject of a separate application, Serial No. 340,800, filed concurrently herewith on the 17th day of February, 1890. Rotation of the motor-shaft h turns the sleeve g' and beveled pinion f, and (depending on the direction in which it is desired to propel the machine) the pinion f, through a pinion f' or f^2, clutched through the medium of the lever f^3, turns the shaft F, causing the pinion v thereon, by its engagement with the pinion v', to turn the axle p, and thus drive the machine in the desired direction. When the machine has been thus brought into operative position, with the drills D close to the wall in which the undercutting operation is to be performed, it is suitably jacked up, to permit the wheels o and o' to be removed from their bearings and the machine lowered to rest at the platforms B and B′ on the floor of the mine, the motor E having been previously stopped. Then the machine is properly braced against backing under the strain of the drilling operation by suitable stay-bars d, applied, preferably, to the protruding ends of the axle p. The inner frame is then advanced (by hand) toward the wall-surface of the mine, whereby the pinions v and v' are separated and the pinions n' brought into engagement with their racks n above them. Then the lever g^4 is manipulated to engage the clutch g^3 and the lever f^3 to bring the pinion f^2 into mesh with the pinion f, when, by starting the motor E, the spindles C and C′ are rotated in opposite directions and the frame A′ slowly advanced as the drills cut deeper and deeper into the wall. As will be seen, owing to the overlapping arrangement of the drills or cutters D, whereby they cut through intersecting circular planes, the cut G they produce is of the continuous form illustrated in Fig. 6, and as it is formed the frame A′ is advanced unobstructedly with the drills into it. While the drilling operation proceeds, the worms m on the alternate spindles C carry the disintegrated material back from the work, whence it may readily be removed, owing to the free space provided underneath the machine between the supports B and B′. In case of variation in the resistance met with by different drills, owing to difference in the hardness of the material they encounter, the equal strain exerted against all the spindles by the thrust-bar x^3, prevents any tendency to lateral warping of the frame A′ by a difference in strain. When a cut of the desired depth has been produced, the frame A′ and parts it carries are withdrawn, and the machine may be shifted (as by the use of jacks) laterally of the position in which the described drilling operation was performed by it into a position to produce another such under-cut. The withdrawal is effected much more rapidly than the advance by clutching the beveled gear f', (thereby throwing the gear f^2 out of clutch.) After the desired number of elongated cuts G has been thus produced the blasting may be performed in the usual way on drilling the holes in the wall near the top or roof of the mine. I provide means for drilling the blasting-holes

actuated by the same power which moves the frame A′ and operates the drills D, and working simultaneously with the latter.

This improvement forms the subject of a separate concurrent application, Serial No. 340,801, filed on the 17th day of February, 1890.

As will thus be seen, my improved machine may be readily transported from place to place in a mine by the same power which serves to operate the cutting mechanism, and quite independently of the latter, which may therefore be at rest while the machine is being propelled toward or from the work, and this forms an important feature of my improvement.

What I claim as new, and desire to secure by Letters Patent, is—

1. A self-propelling mining-machine provided with running-gear for transporting it in the mine toward and from the work and to and from different locations in the mine, and cutting mechanism, and a motor supported on the machine and affording the driving-power both for its locomotion and for operating the cutting mechanism, and disconnected from the cutting mechanism when connected with the running-gear, substantially as described.

2. In a mining-machine, the combination of an outer frame A, provided at each side with longitudinal rack-bars *n*, and with running-gear for transporting the machine in the mine toward and from the work and to and from different locations in the mine, an inner reciprocating frame A′, carrying rotary cutters D, overlapping one another in their rotation, to cut through intersecting planes, and pinions *n′*, connected and movable with the frame A′, a motor E, supported on the reciprocating frame, and gearing for connecting the motor independently with the cutter-actuating mechanism and running-gear, substantially as described.

3. In a mining-machine, the combination of an outer frame A, provided at each side with longitudinal rack-bars *n*, an inner reciprocating frame A′, supporting rotary spindles carrying cutters D, overlapping one another in their rotation, to cut through intersecting planes, a driving-axle *p* in the frame A, having wheels *o*, pinions *n′* for the racks *n*, a motor E, supported on the frame A′, geared to the said pinions, and means, substantially as described, for transmitting at will the motor power to the cutters and reciprocating frame and to the axle *p*, substantially as and for the purpose set forth.

4. In a mining-machine, the combination of an outer frame A, provided at each side with longitudinal rack-bars *n*, an inner reciprocating frame A′, supporting rotary spindles carrying at their forward ends cutters D, overlapping one another in their rotation, to cut through intersecting planes, and geared together near their rear ends to rotate alternately in opposite directions, a sleeve *g′* on an extension of the central spindle provided with a pinion *g*, a motor E on the frame A′, geared to the pinion *g*, a clutch g^3 on the said central spindle, having one part on the said sleeve and the other part provided with the pinion *l′* in mesh with the intermeshing gearing *l* of the spindles, a beveled pinion *f* on the sleeve *g*, a rotary shaft F on the movable frame, having pinions *n′* at opposite ends for the rack-bars *n*, and loose beveled pinions *f′* and f^2, meshing with the pinion *f* and controlled by clutch mechanism, reducing-gear near one end of the shaft F and a pinion *v* near the opposite end thereof, and a driving-axle *p* in the frame A, having a pinion *v′* coinciding with the pinion *v* on the shaft F, the whole being constructed and arranged to operate substantially as described.

FORÉE BAIN.

In presence of—
J. W. DYRENFORTH,
M. J. FROST.