

(No Model.)

2 Sheets—Sheet 1.

B. F. ASPER.  
COAL MINING MACHINE.

No. 329,526.

Patented Nov. 3, 1885.

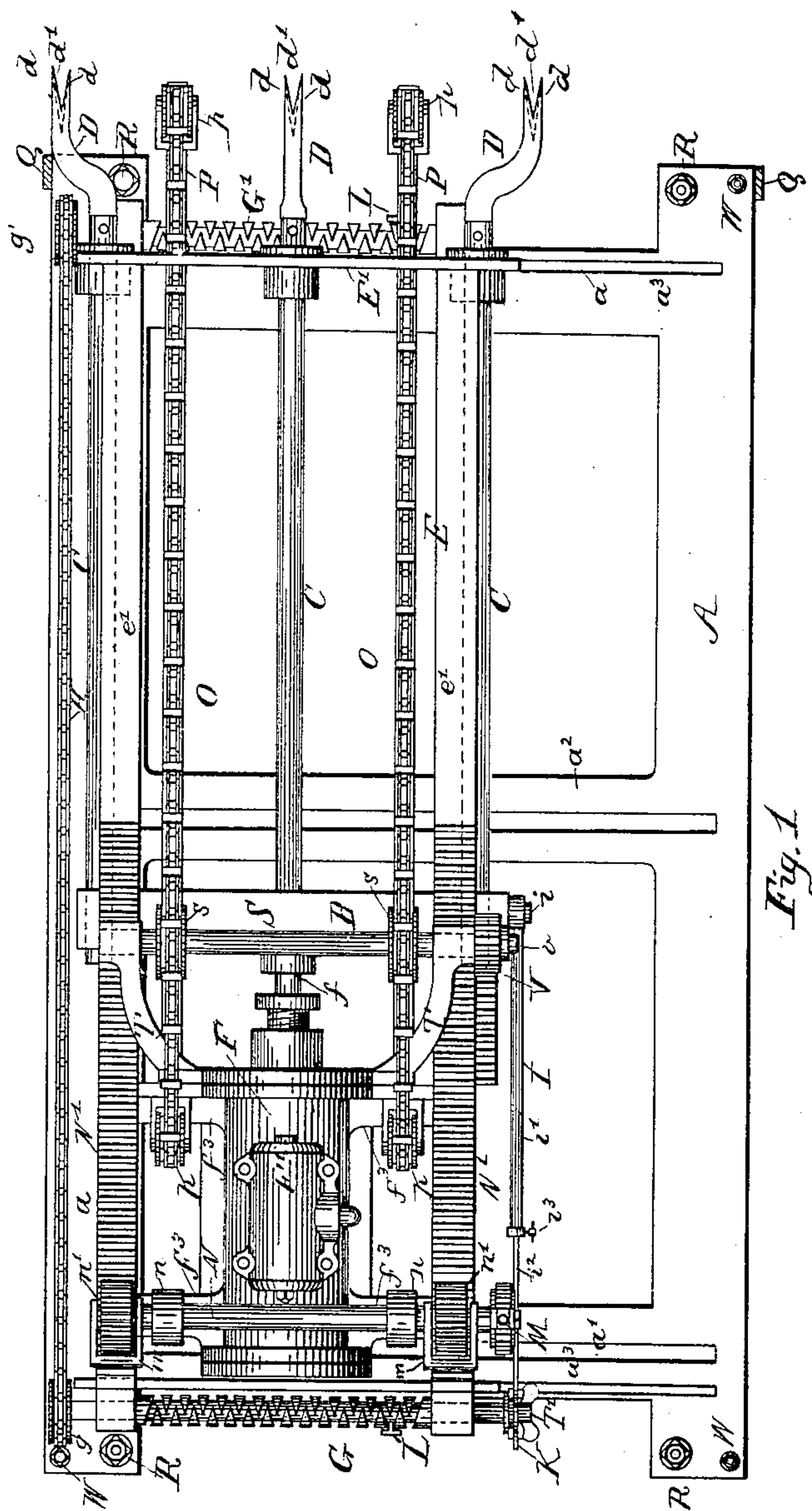


Fig. 1

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by Connolly Bros. Atty's.

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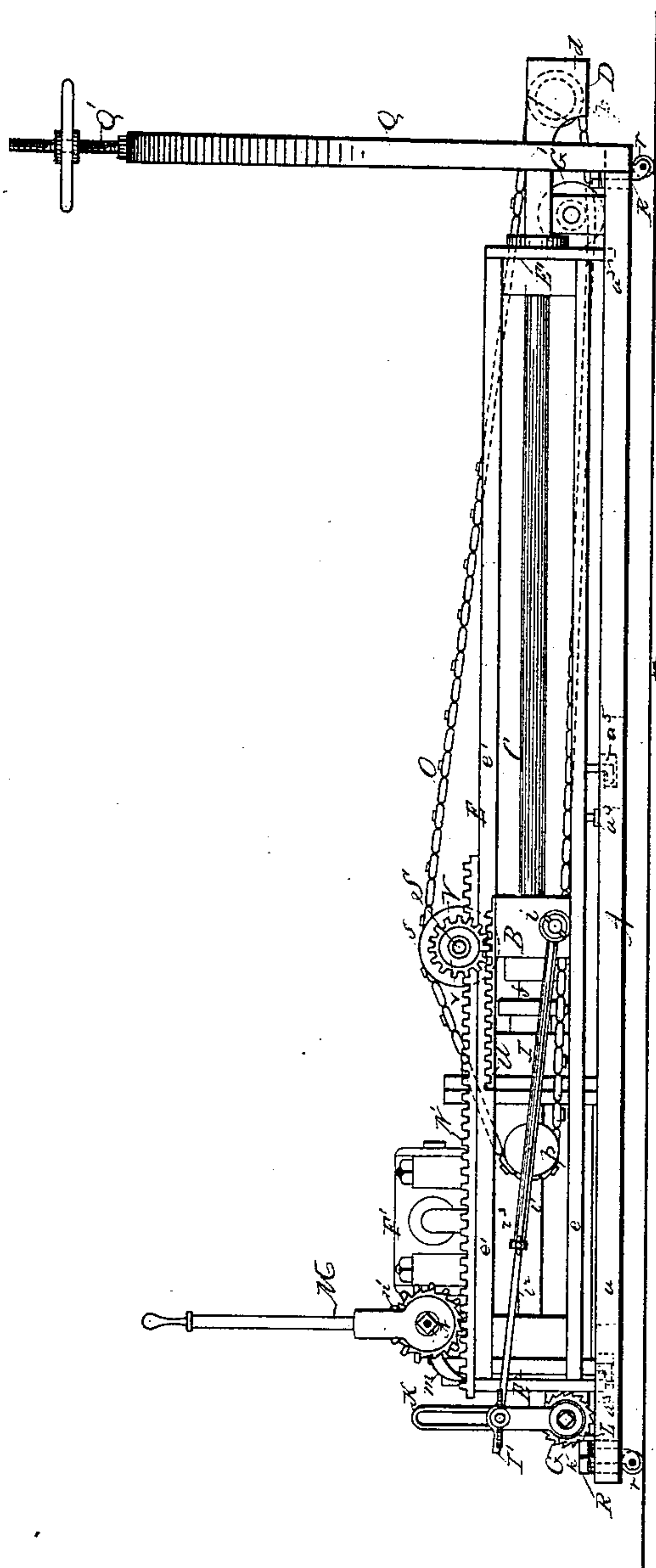


Fig. 2

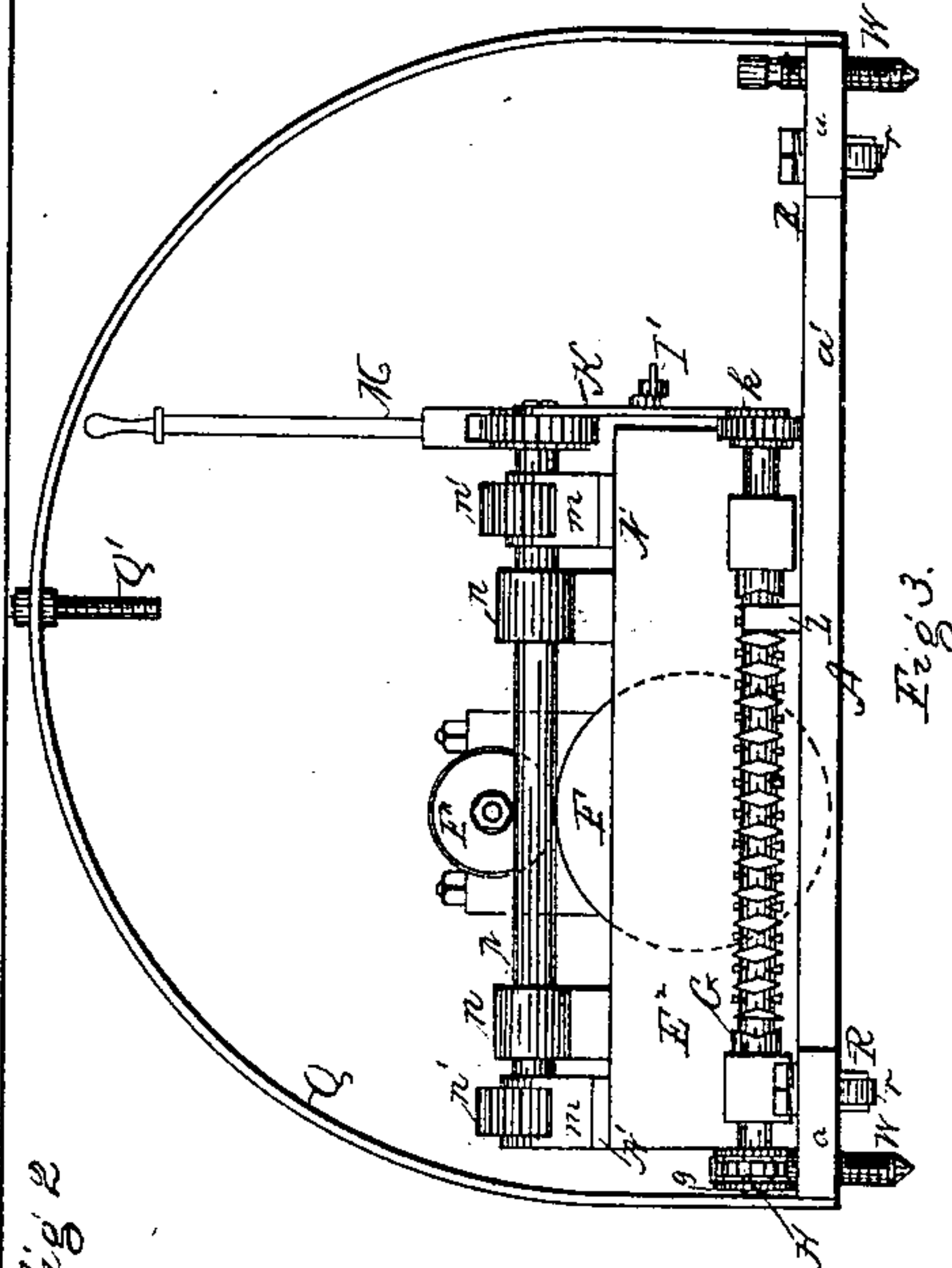


Fig. 3



Fig. 6

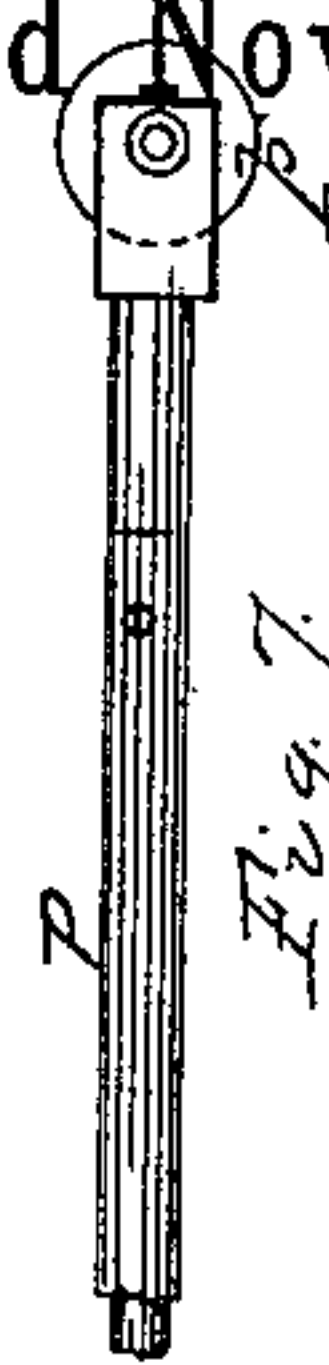


Fig. 7

FIG. 8.

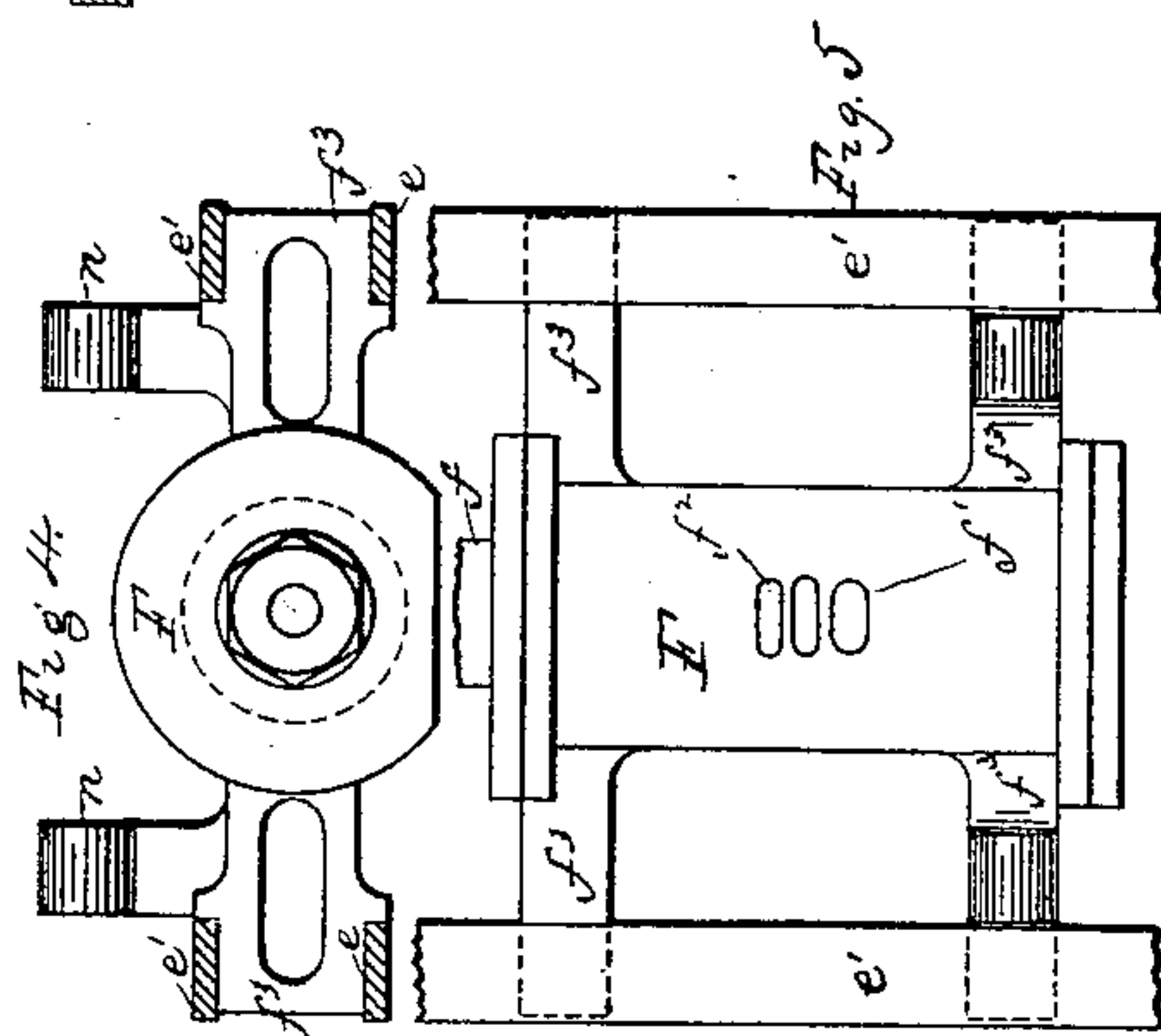


Fig. 4

Fig. 5

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# UNITED STATES PATENT OFFICE.

BENJAMIN F. ASPER, OF PITTSBURG, ASSIGNOR TO JOHN C. GRADY, TRUSTEE, OF PHILADELPHIA, PENNSYLVANIA.

## COAL-MINING MACHINE.

SPECIFICATION forming part of Letters Patent No. 329,526, dated November 3, 1885.

Application filed December 2, 1884. Serial No. 149,299. (No model.)

*To all whom it may concern:*

Be it known that I, BENJAMIN F. ASPER, a citizen of the United States, residing at the city of Pittsburg, in the State of Pennsylvania, have invented certain new and useful Improvements in Coal-Mining Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, reference being had to the accompanying drawings, which form part of this specification, in which—

Figure 1 is a plan view; Fig. 2, a side elevation; Fig. 3, an end elevation. Figs. 4 and 5 are details of the cylinder. Figs. 6 and 7 are details of the drill-rods and chain-rods, respectively; and Fig. 8 is a detail in section.

My invention has for its object to improve the efficiency, lessen the cost of manufacture, simplify the construction, and reduce the height and weight of coal-mining machines.

My improvements relate to that class of coal-mining machines in which are employed reciprocating picks or cutters and scraper-chains, and in which said picks and chains are given a lateral reciprocating motion, so as to traverse the face of the coal-vein, and are caused to move gradually onward or forward to follow up the cut as the latter grows deeper.

My improvements relate to a new kind or form of machine of this class; and they consist in the novel construction and combinations of parts hereinafter fully set forth and specifically claimed.

Referring to the accompanying drawings, A represents the bed of the machine, which comprises side bars  $a a$ , and end bars,  $a' a'$ , all arranged horizontally. Said frame has also a cross-piece,  $a^2$ , which, with said end bars, forms ways or slides for a carriage or frame supporting a cylinder and appurtenant parts, hereinafter specified.

B represents a transverse bar, to which are attached rods C C C, carrying at their outer or forward ends picks or cutters D D D. Said rods have supports in bearings in the front side of a frame, E, supported on the base A. Said frame consists of two vertical transverse ends,  $E'$  and  $E^2$ , connected by longitudinal side bars  $e e e' e'$ , which are parallel with the side bars of the bed A. The side bars  $e e$  of the frame E are raised slightly above the side

bars  $a a$  of the bed A, while the side bars  $e' e'$  are a sufficient distance above to leave a space for the backward and forward movement of the pick-bar B, which reciprocates in the direction of the length of the machine between the said bars  $e e$  below it and the said bars  $e' e'$  above it, said frame-bars forming ways or guides for said pick-bar. The ends  $E' E^2$  of the frame E rest upon the cross-bars  $a' a'$  of the bed A, and move transversely of said bed, as hereinafter described, in grooves  $a^3 a^3$  in said cross-bars. Studs  $a^4$ , which project downwardly from the bars  $e e$ , rest upon the cross-bar  $a^2$  and prevent the frame from being sprung downwardly at its middle. L-shaped brackets  $a^5$ , attached to the frame E, pass into grooves in the cross-bar  $a^2$  and in one of the end bars,  $a'$ , and so prevent the said frame from lifting off the bed A and from moving backwardly thereon, while permitting lateral motion of said frame E on the bed-piece A. The pick-bar B is designed and adapted to be moved forward and back, so as to communicate a longitudinally-reciprocating motion to the rods C C C. To produce such motion, said pick-bar is connected directly to the piston  $f$  of a steam-cylinder, F, so that the bar and its pick-rods partake of the motion of the piston. It is desirable that the rods should move forward with all the velocity possible, so as to give a very forcible rapid blow; and it is also desirable that the return motion should be slow or gentle, to avoid all unnecessary jarring of the machine. Hence the steam-ports  $f' f^2$  between the cylinder F and its valve-box  $F'$ , are made different in area, that one  $f'$ , which admits steam from the box to the cylinder to produce the forward stroke of the piston, being larger than the port  $f^2$ , through which steam enters the cylinder from the box to produce the return-stroke of said piston.

To communicate a lateral motion to the picks or cutters so as to cause them to traverse the face of the vein and produce an open cut all the way across the same, I provide two screws, G G', each of which is double threaded—that is, has both a right-hand and a left-hand thread. One of these screws is located in the front and the other in the rear, as shown, with their longitudinal axes transverse



of the machine, said screws being mounted in bearings secured to the ends  $E' E''$  of the frame E, on which frame the cylinder F is supported. Said cylinder is cast with lateral extensions  $f^3 f^3$ , which fit between the side bars of the frame E, so that said cylinder will partake of the lateral motion of the frame derived from the screws G G', and may also be moved longitudinally on said frame, the side bars of which latter afford guides or ways therefor, as well as for the pick-bar. Said screws G G' are caused to move together and at an equal rate of speed by means of a drive-chain, H, running over sprocket wheels or toothed pulleys  $g g'$  on the shafts of said screws. Motion is communicated to the rear screw, G, by means of a pitman or connecting rod, I, attached at  $i$  to the pick-bar B and at  $I'$  to a slotted rock-arm, K, swiveled on the screw G, and provided with a pawl-and-ratchet connection,  $k$ , so that on the forward motion of the pick-bar said arm K will be drawn forward, turning freely and without clutching on the screw-shaft, while on the return-stroke of the pick-bar and slotted arm the screw will be clutched and turned, the operation being similar to that of a ratchet-drill, and the screw being rotated while the picks are making their return stroke. By adjusting the connection  $I'$  up or down in the slot in the arm K the extent of revolution of the screws and of the traverse of the carriage or frame E resulting therefrom may be varied, and by disconnecting the pitman or rod I from said arm the movement of the screws and the traversing of said carriage or frame may be suspended, this being sometimes desirable where it is wished to continue the cutting at a particular point longer than usual. The rod I is longitudinally adjustable or extensible, so as to permit it to be varied in length as the cylinder is advanced on the frame E, as hereinafter set forth. To cause the rotation of the screws to effect the traversing motion of the carriage or frame E with cylinder, &c., rigid stationary nuts or followers L are employed, said followers being in the form of forked standards secured to the bed A, and engaging, as shown, with the threads of the screws. The rotation of the screws is always in one direction; but as said screws are double-threaded, when the follower reaches the end of one thread of its screw it enters the groove of the other thread, thereby reversing the motion of the carriage or frame, so that the latter reciprocates laterally, the movement being slow and by intermissions or steps. The length or extent of each step depends on the adjustment of the connecting-rod I in the slotted arm K. As the cut made by the picks or cutters gradually increases or deepens it is necessary to follow the same up, and this is done by moving the cylinder and pick-bar forwardly on the frame E toward the cutting end of the machine. This is accomplished by the manual movement of a lever, M, connected to a shaft, N, having bearings  $n n$  on the cylinder-casting, with pin-

ions  $n' n'$ , gearing with racks  $N' N'$ , fastened to the bars  $e' e'$  of frame E. Said shaft N carries pawls  $m m$ , which fall into the racks  $N' N'$ , and operate as dogs to prevent recoil of the cylinder when the picks strike a blow, and also on the return motion of the piston. When the cylinder and pick-bar have been moved forward as far as possible by means of the lever M, if it be desired to carry the cut still farther in the vein, the pick-rods may be extended by the addition of sections, or said pick-rods may be and are made telescopic and lengthened out as occasion requires. The scraper-chains O O, which have separable links, are carried on rods P P, supported at their forward ends in the forward end,  $E'$ , of frame E, and at their rear ends supported in and attached to lateral extensions  $f^3 f^3$  of the cylinder. Said chain-rods pass through openings  $b b$  in the pick-bar B, as it is not necessary they should move therewith, but they move forward when the cylinder is advanced by means of the lever M. The chain rods have at either end pulleys  $p p$ , over which said chains run, and are made in telescopic sections, so as to be extended correspondingly with the pick-rods, the chains being lengthened by the addition of links. Motion is communicated to the latter by reason of their engagement with the sprocket wheels or toothed pulleys  $s s$  on a shaft, S. Said shaft is supported in bearings on the ends of arms T, secured to the cylinder-casting, and is given an intermittent rotation by means of a rack, U, fastened to the pick-bar B and moving therewith, and a pinion, V, on said shaft S, gearing with said rack and having a clutch,  $v$ . On the backward motion of said rack U the pinion V is clutched fast on its shaft, and causes the latter to rotate, while on the forward motion of said rack the pinion is loose and therefore turns without imparting motion to said shaft S or to the scraper-chains. The bed A is provided at each of its four corners with screw-posts W W, which afford it support when the cutting is proceeding and by means of which it may be adjusted to any required altitude and inclination.

To hold said machine steady, it is provided with a strong bow or arch, Q, connected at its lower ends to the bed A, and at the center of its arch with an adjustable screw-standard, Q', whose upper end is designed to be fastened to the roof of the mine.

When it is desired to transport the machine, screw-casters R are inserted in threaded openings in the four corners of the bed A and turned down until their rollers  $r$  meet the floor of the mine, when, the turning being continued, the whole machine will be bodily raised to any required extent, and may then be rolled along as needed. The threaded caster-holes pass completely through the bed-bars, and the rollers  $r$  are of less diameter than said holes, so as to pass through the same; hence the casters may be inserted and withdrawn from the top, thus saving the lifting of the machine for that pur-



pose. The picks or cutters D D D are bifurcated, having each two cutting edges,  $d d$ , the slot or opening  $d'$  between the same having a double flare—*i. e.*, toward the front or cutting edge, and also downwardly, the latter being to prevent the slack or cuttings from packing in said slot or opening. The sides are also cut away or made open, as shown at  $d^2 d^2$ , to allow the slack or cutting to escape at the rear.

The operation is substantially as follows: The machine being duly located in position, steam is admitted to the valve chest or box, and thence to the cylinder, producing a reciprocation of the piston, the movement of the latter being differential or faster on the forward or out stroke than on the return-stroke. The movement of the piston is transmitted to the pick-bar and picks, the latter making their cut or stroke on their forward motion and directly from the pressure of the steam in the cylinder. While this is occurring the cylinder, piston, pick-bar, picks, chain-rods, and chains are also caused to move laterally with the frame E, so that the picks will traverse the face of the coal-vein and make a complete cut all the way across the same. It should here be noted that the traversing motion of the frame is intermittent, and that the rotation of its driving-screws takes place while the picks are making their return-stroke. The feeding forward of the picks as the cut deepens is accomplished by hand through the medium of the lever provided for that purpose, and will be controlled by the miner's judgment. The extent of each intermittent traversing impulse of the carriage or frame E will depend upon the adjustment of the rod-connection in the arm K, and may be varied according to the exigency of the case, depending upon particular qualities of coal, &c. When the cylinder is advanced, by moving the lever M the rod I should be lengthened or extended correspondingly by adjustment of its sections  $i' i^2$  and set-screw  $i^3$ , and when it is desired to suspend the lateral motion of the carriage or frame E said rod is detached from the slotted arm K. The machine while operating is steadily supported on its base, which is very firmly held by the bow Q and standard Q'. By lengthening the pick-rods the cut may be made to any desired depth, and by adjusting the machine to different inclinations the cut may be varied from a horizontal plane if needed.

The transportation of the machine may be readily effected without arduous exertion on the part of the miner by duly inserting the screw-casters, and said machine then moved either backward or forward, as required. I have spoken of the cylinder as a steam-cylinder, and such it is, as illustrated; but my invention is not confined to the use of steam, and I may use compressed air or gas without other alteration of the machine than will relate to the cylinder and valve-box. I have also spoken of the pick-rods and picks in the plural, and a multiple number of such will in practice generally or invariably be used.

Still, as my invention would be practicable and useful with only a single pick or cutter, I do not limit my claims to a plurality of picks or cutters, and the term "pick-bar" will therefore be understood as including any equivalent means whereby even a single pick or cutter may be connected to the piston-rod. Still further, I have illustrated and described chains as the media for clearing out slack or the cutting of the picks, but I reserve the right to substitute therefor any equivalent mechanism for accomplishing the same purpose.

What I claim as my invention is—

1. In a coal-mining machine having a flat horizontal frame, a carriage laterally movable thereon, a motor-cylinder mounted on said carriage and movable forwardly as the work proceeds, and a screw which communicates such lateral motion to said carriage, said screw being located in the rear of said cylinder, or on that end of the machine from which the cylinder moves in its progression, the combination of said cylinder, its piston, and a pick-bar connected thereto, with said screw and an extensible connecting-rod, I, between said pick-bar and screw, substantially as described.

2. The combination, in a mining-machine, of a bed-piece or base, a horizontal carriage or frame laterally movable thereon, and a cylinder mounted on said carriage and movable laterally with said carriage and longitudinally thereon, said cylinder being connected to a horizontal pick-bar, and both said cylinder and pick-bar resting on horizontal guides or ways consisting of the side bars of said carriage or frame, substantially as shown and described.

3. The combination, in a coal-mining machine, of a bed-piece or base, a supporting frame or carriage, a cylinder mounted thereon, a pick-bar connected to the piston of said cylinder, a double-threaded screw mounted on the frame which supports the cylinder, a follower or fork attached to the bed of the machine and engaging with said screw, and a rod or pitman connecting said bar with a rock-arm on the shaft of said screw, whereby the movement of the piston will communicate an intermittent rotation to said screw and cause said carriage, cylinder, and pick-bar to traverse the base or bed-piece of the machine, substantially as shown and described.

4. In a coal-mining machine, the combination, with a frame or carriage having a rack, of a cylinder whose piston is connected with a pick-bar, a pinion gearing with said rack, a lever for moving said pinion, and a pawl which also engages with said rack, said pawl operating to prevent the recoil of the cylinder on the carriage or frame when the picks make a stroke, substantially as shown and described.

5. The combination, in a coal-mining machine, of a laterally-reciprocating frame forming a support for a cylinder and pick-bar, a double-threaded intermittently-rotating screw and follower at one end of the machine, and



another double-threaded screw and follower at the other end of the machine, said screws having sprocket-wheels connected by a drive-chain, one of said screws being connected with  
5 and moved from said pick-bar, whereby the reciprocating movement of said pick-bar imparts an intermittent rotation to said screws, and the latter cause said frame to reciprocate laterally by intermittent impulses, substan-  
10 tially as shown and described.

6. In a coal-mining machine having scraper-chains, the combination, with a shaft supported on arms attached to the motor-cylinder, and carrying sprocket-wheels for moving  
15 the chains, and a loose pinion, V, and clutch v, of a rack secured to the pick-bar and with which said pinion gears, whereby the return-stroke of said pick-bar communicates an intermittent rotation to said shaft and a corre-  
20 sponding forward movement to said chains, substantially as set forth.

7. In a mining-machine, telescopic rods for the picks or cutters to permit the extension of said rods and the projection of the picks or cutters, substantially as set forth. 25

8. The combination, in a mining-machine, of a bed-piece or base, a carriage or frame laterally movable thereon, and a cylinder mounted on and movable laterally with said carriage and longitudinally thereon, said cyl-  
30 inder being connected to a pick-bar, and both said cylinder and pick-bar resting on guides or ways consisting of the side bars of said carriage or frame, substantially as shown and described. 35

In testimony that I claim the foregoing I have hereunto set my hand this 1st day of December, 1884.

BENJAMIN F. ASPER.

Witnesses:

LISLE STOKES,

M. D. CONNOLLY.