

(No Model.)

3 Sheets—Sheet 1.

A. BAILEY.  
COAL MINING MACHINE.

No. 473,604.

Patented Apr. 26, 1892.

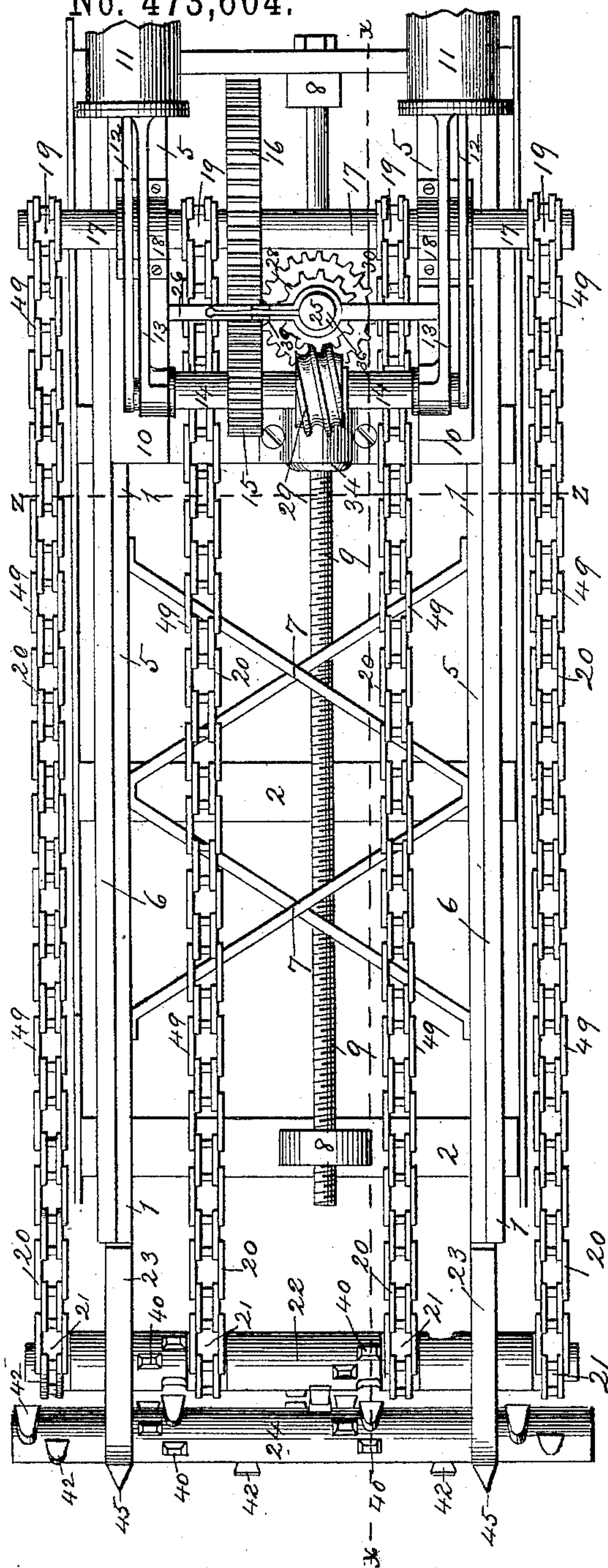


Fig. 1.

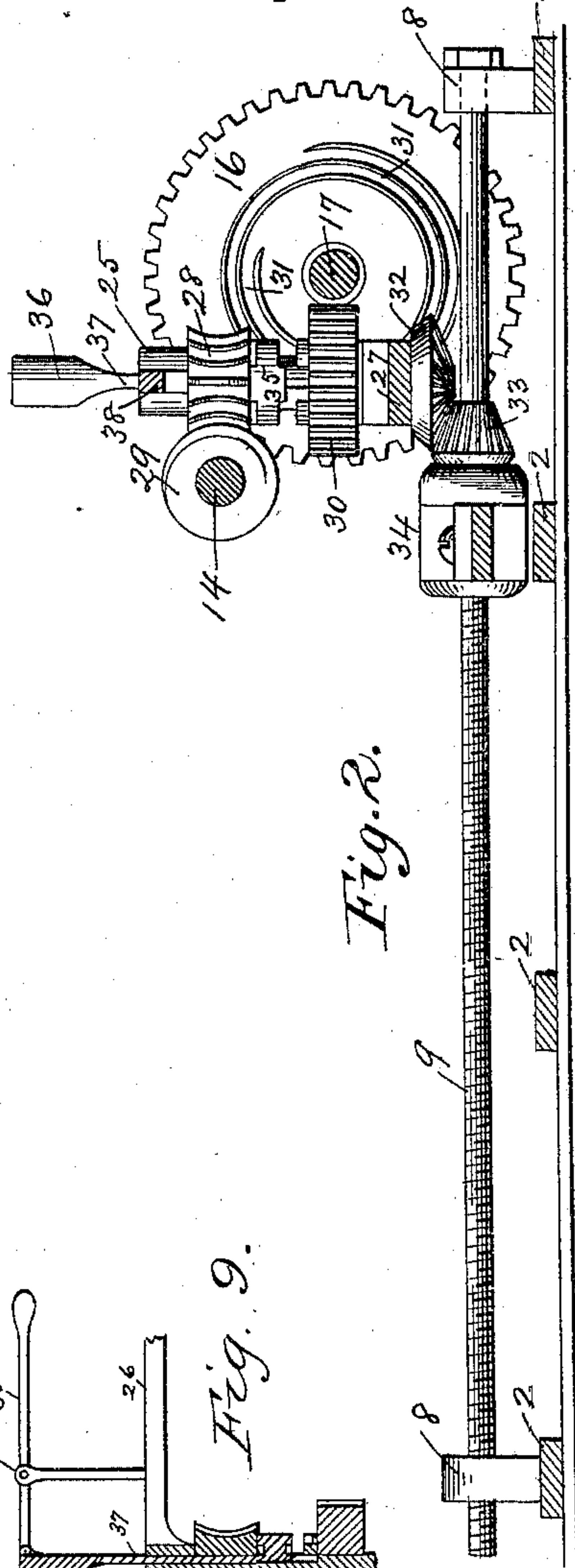


Fig. 2.

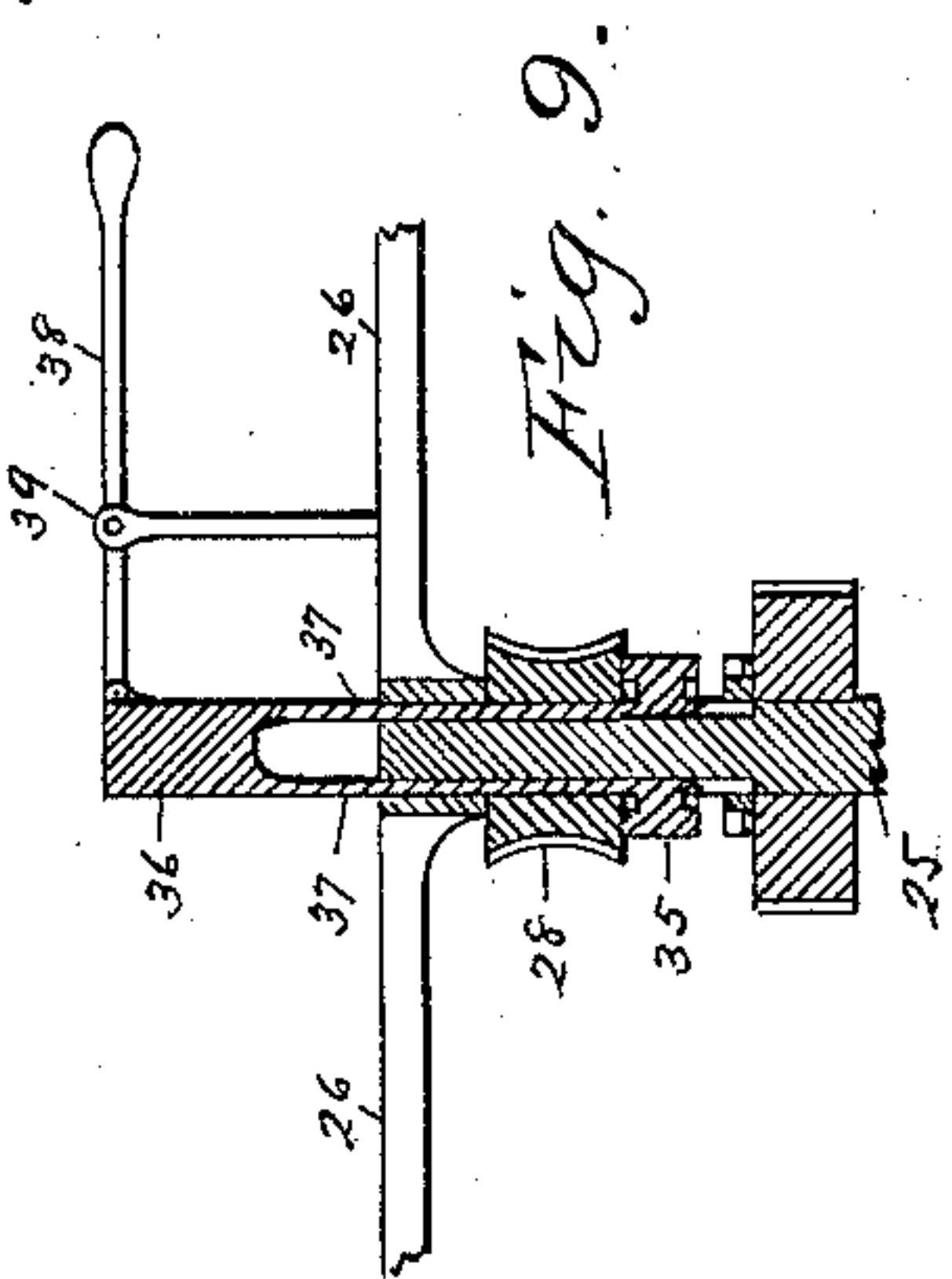


Fig. 3.

Witnesses:  
T. R. Stuart  
Alex. Britton.

Inventor.  
A. Bailey  
By  
Marble, Mason & Confield,  
Attorneys.

(No Model.)

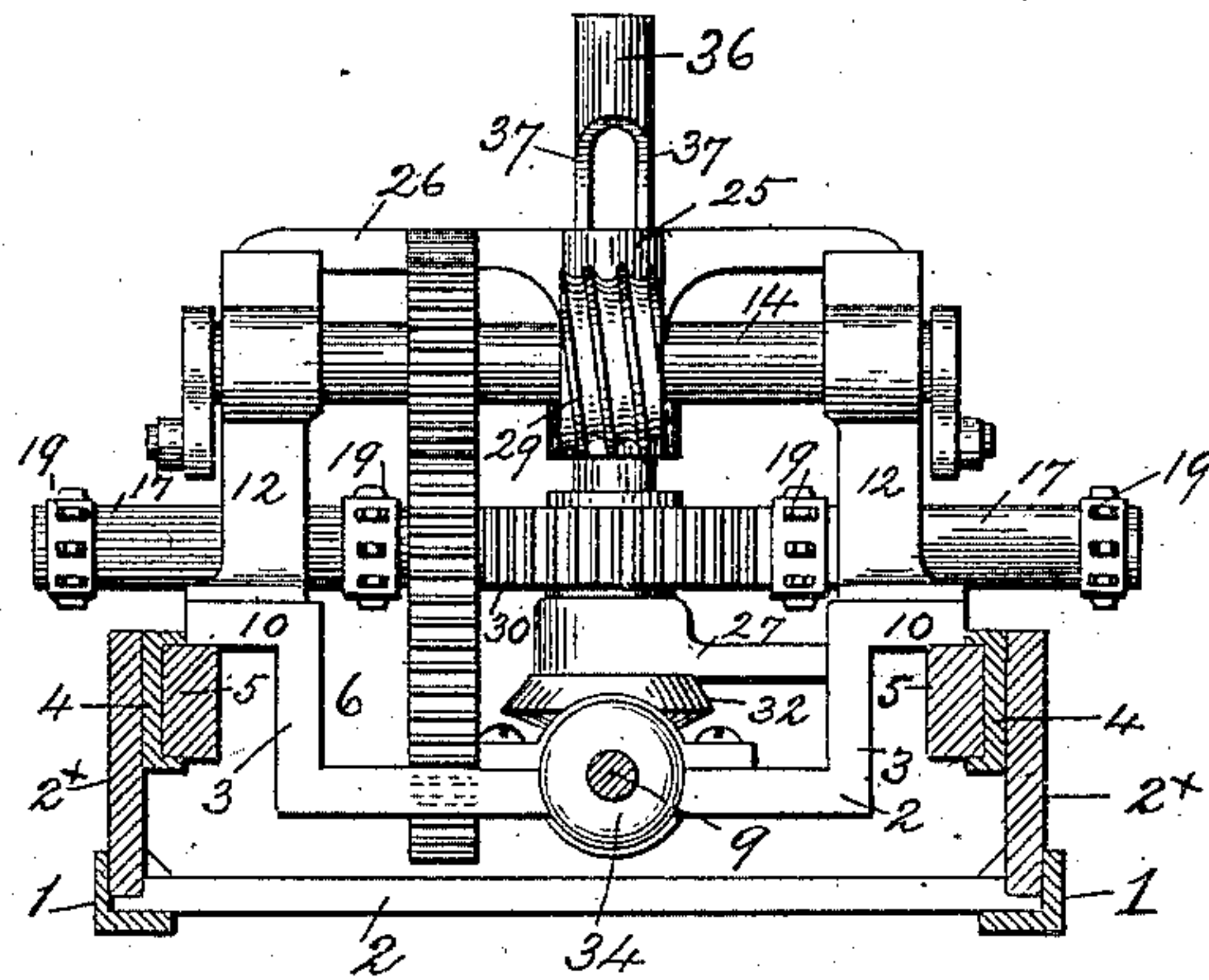
3 Sheets—Sheet 2.

A. BAILEY.  
COAL MINING MACHINE.

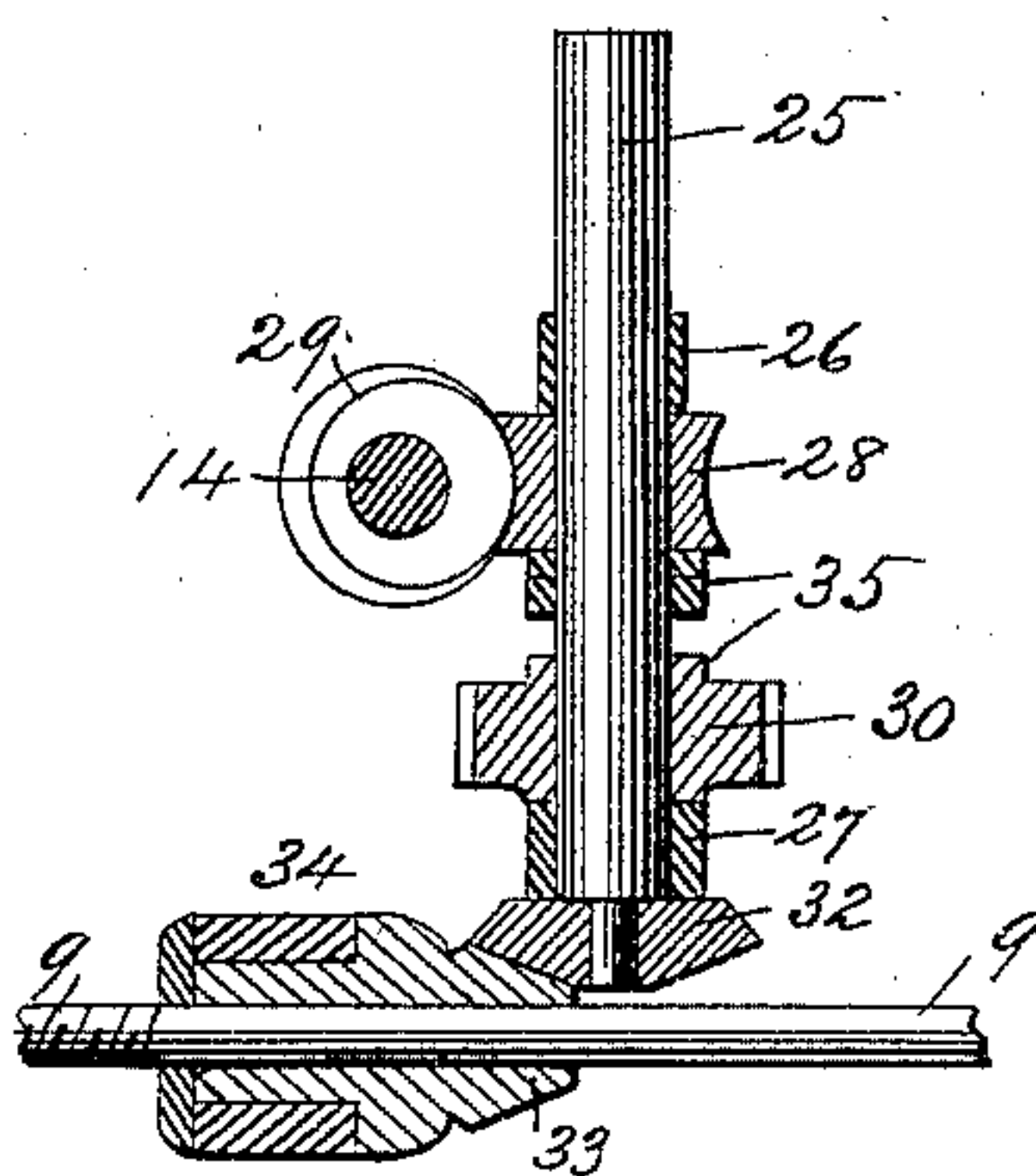
No. 473,604.

Patented Apr. 26, 1892.

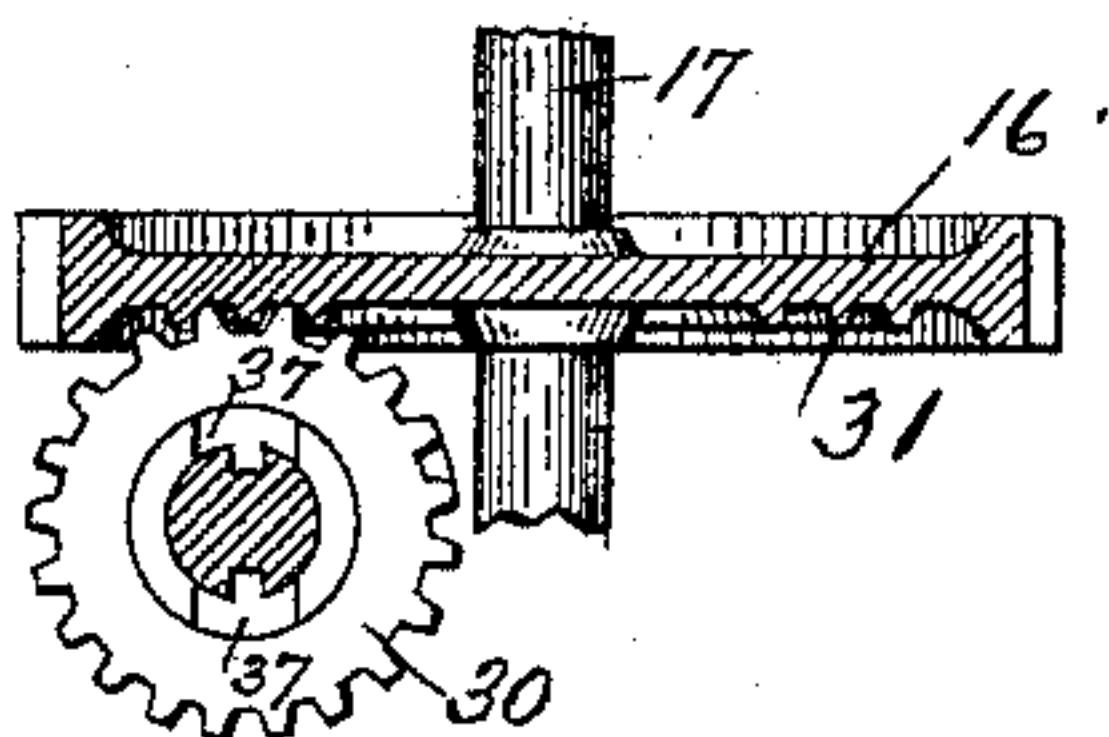
*Fig. 3.*



*Fig. 4.*



*Fig. 5.*



Witnesses:

T. R. Stuart.

Alex. Brutton

Inventor

A. Bailey

By Morse, Mason & Canfield,  
Attorneys.



3 Sheets—Sheet 3.

No. 473,604.

Patented Apr. 26, 1892.

*Fig. 6.*

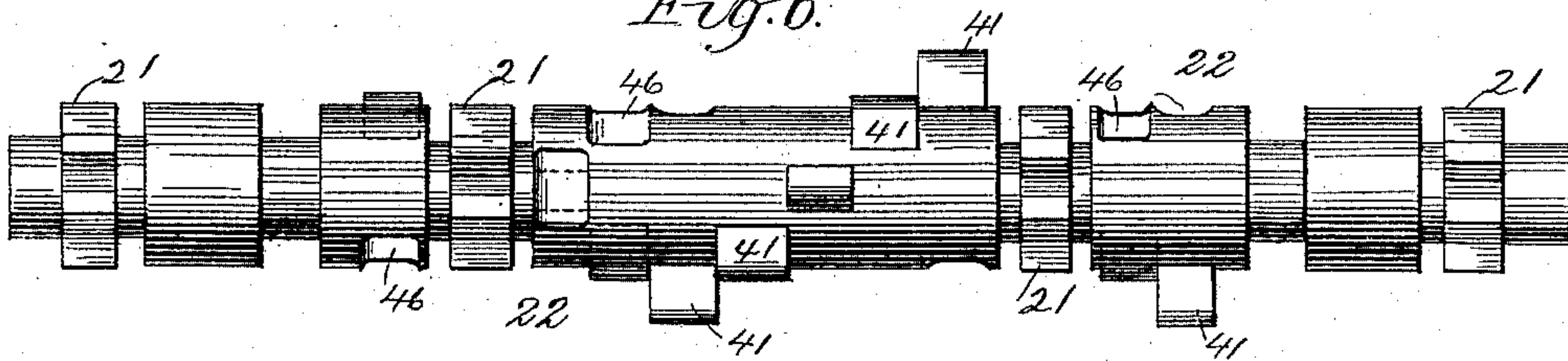
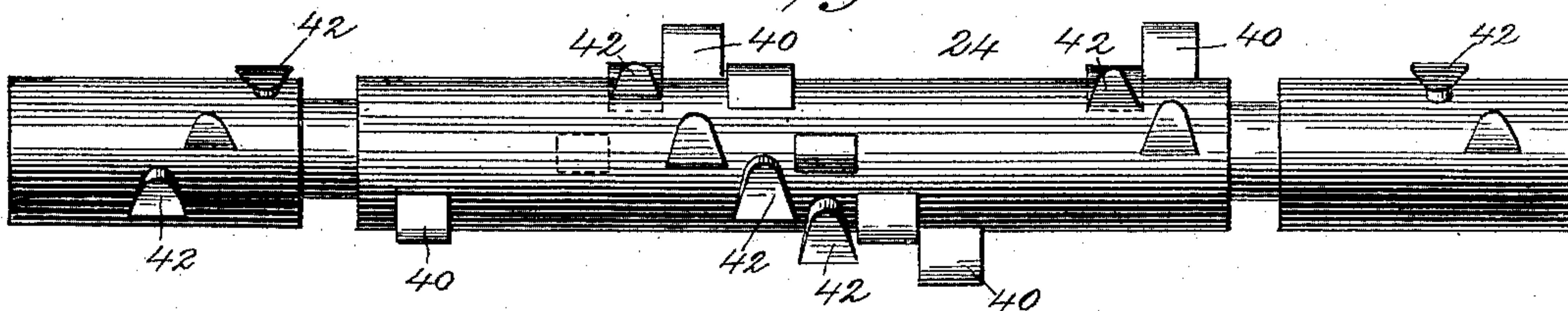
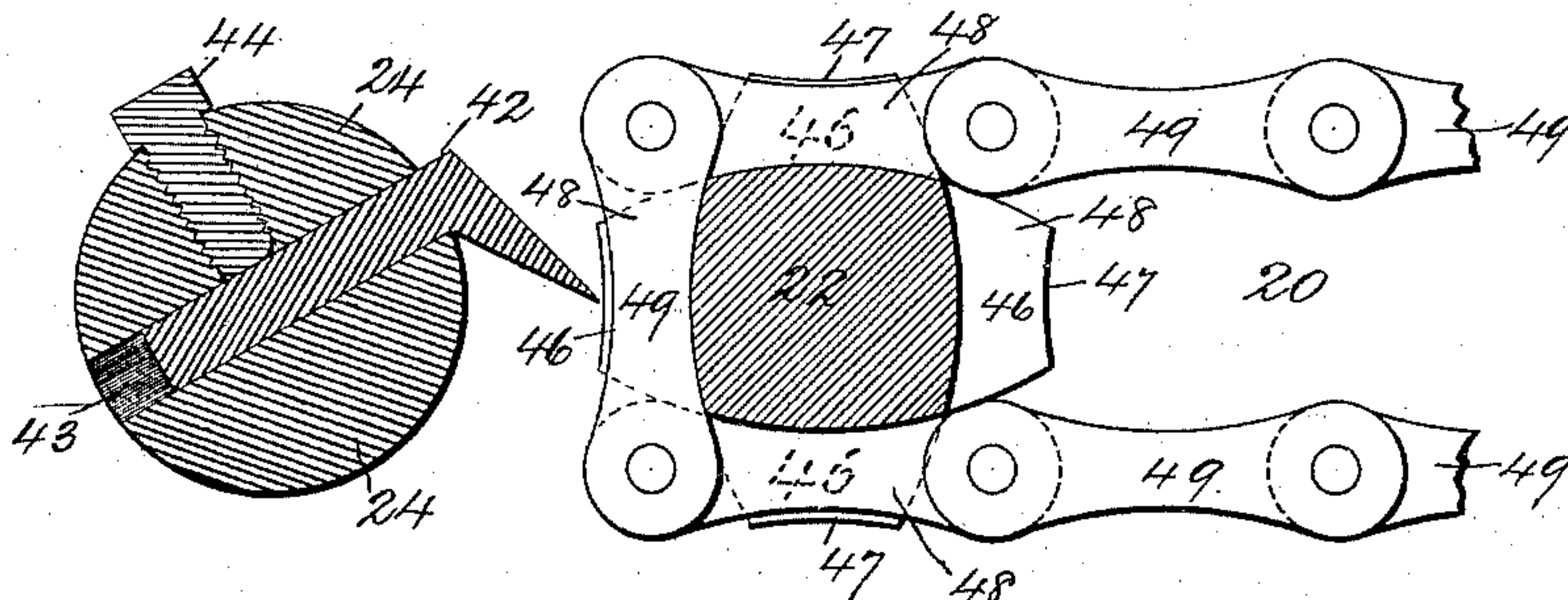


Fig. 7.



*Fig. 8.*



Witnesses:

T. R. Stuart.

Alex. Button

A. Bailey.

By Marble, Mason + Confield,

Attorneys.



# UNITED STATES PATENT OFFICE.

ARCHIBALD BAILEY, OF PHILIPSBURG, ASSIGNOR OF SEVENTEEN TWENTY-FOURTHS TO BIGLER, REED & CO. AND GLASGOW A. READ, OF CLEAR-FIELD, AND CHESTER E. GLENN, OF BUTLER, PENNSYLVANIA.

## COAL-MINING MACHINE.

SPECIFICATION forming part of Letters Patent No. 473,604, dated April 26, 1892.

Application filed July 3, 1891. Serial No. 398,395. (No model.)

*To all whom it may concern:*

Be it known that I, ARCHIBALD BAILEY, a citizen of the United States, residing at Philipsburg, in the county of Centre and 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, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates generally to coal-mining machines, and particularly to that class thereof by which the body of the coal is undercut by means of knives or cutters secured to horizontal bars or shafts, which are journaled in suitable bearings and arranged in advance of the chain-shafts from which they are driven; and it consists in the peculiarities of construction and arrangement or combination of parts hereinafter fully disclosed in the description, drawings, and claims. In some of the former machines of this class there are defects in the construction and operation of the mechanisms for moving the carriages forward for and during the undercutting operation and for withdrawing them after the desired cut of the coal has been effected; also, in some of the machines heretofore constructed the cutter-shafts are provided with cog-gears, which mesh with corresponding cog-gears on the front chain-shafts. This cog-gearing has been found liable to become choked or clogged by the coal which is thrown between the cogs thereof by the action of the knives or cutters.

The objects of my invention are, first, to provide improved mechanisms for effecting the forward movement of the carriage for and during the operation of cutting the coal and for withdrawing the same after a proper cut of the coal has been accomplished; second, to provide novel and improved gearing for connecting the cutter-shaft with and operating the same from the front chain-shaft, whereby all tendency of said gearing to become choked or clogged by coal will be avoided, and still said shafts will be arranged as closely together as possible consistent with the length of the cutters or the distance they project from their

shaft; third, to so arrange the gear-teeth upon said shafts and construct the front chain-shaft that both shafts can be mounted at a less distance apart than the cutters project from their shaft; fourth, to so construct said chain-shaft, its sprocket-wheels, and the driving-chains that cutters of full length can be seated in the cutter-shaft directly opposite or in front of said sprocket-wheels and drive-chains, and, fifth, to provide certain other herein after-disclosed details of construction and combination of parts which are accessorial to the foregoing. These objects are accomplished by the peculiarly constructed and arranged mechanism illustrated in the accompanying drawings, forming part of this specification, in which the same reference-numerals indicate the same or corresponding parts, and in which—

Figure 1 represents a top plan view of a coal-mining machine constructed in accordance with my invention; Fig. 2, a vertical longitudinal section of the same on the line  $xx$  of Fig. 1, looking toward the right side thereof; Fig. 3, a vertical transverse section of the same on the line  $zz$ , looking toward the rear end thereof; Fig. 4, a vertical section through the upright shaft, its clutch, bearings, worm-wheels, and bevel-wheel, and the feed-screw gear and nut; Fig. 5, a horizontal section through said upright shaft just above the lower worm-wheel and through the large gear-wheel having the worm or spiral flange on its inner surface for engaging said lower worm-wheel; Fig. 6, a detail view of the front chain-shaft; Fig. 7, a similar view of the cutter-shaft; Fig. 8, a side elevation of a portion of one of the sprocket-chains and a vertical transverse section of the cutter-shaft and the front chain-shaft, showing a construction which will permit of the revolution of a full-length cutter in front of the chain and sprocket-wheel without coming in contact therewith; and Fig. 9, a partly sectional detail view showing the reversing mechanism.

Referring to the drawings, the numeral 1 indicates the longitudinally-arranged base-plates, which are L-shaped in cross-section and securely connected together by the transverse brace-bars 2, which are provided with



the uprights 2<sup>x</sup>, to the inner faces of which are bolted or otherwise firmly secured the longitudinally-extending and grooved guide-bars 4. These parts constitute the main or stationary frame. Within these grooved guide-bars are loosely mounted the side rails 5 of the movable carriage 6. These side rails are interiorly supported and firmly held apart or in place in said grooved guide-bars by the crossed brace-rods 7, as shown in Fig. 1. Upon the upper surfaces of the transverse front and rear brace-bars 2 are formed or secured the vertical supports 8, through which pass and in which are journaled the ends of the feed-screw 9.

Upon the rear portion of the carriage 6 and bolted or otherwise suitably secured to the side rails 5 thereof is mounted the bed-plate or platform 10, having vertical portions 3 and horizontal connecting portions 2, (see Fig. 3,) and upon which are supported the engine-cylinders 11, the side frames 12, and the machinery by which said carriage is advanced and withdrawn. The piston-rods 13, leading from said engine-cylinders, are suitably connected at their front ends to the crank-shaft 14, which is journaled in the front portions of said side frames 12 and provided with the pinion 15, which meshes with and imparts motion to the large gear-wheel 16 on the rear chain-shaft 17, which is journaled in the bearings 18, located upon the base-plate or platform 10. This rear chain-shaft is provided with four sprocket-wheels 19, which engage with and impart motion to the four endless sprocket-chains 20, which extend forwardly and pass over the same number of sprocket-wheels 21, formed upon the front chain-shaft 22, which is journaled in the extensions or brackets 23, secured to the front ends of the side rails 5 of the carriage. In these brackets at their front ends is also journaled the cutter-shaft 24, which is arranged in proximity to said front chain-shaft. The endless sprocket-chains are so driven that their upper surfaces are moved forwardly and their lower surfaces rearwardly, one of the results of these movements of the latter being that they draw out or pull back a portion of the coal-cuttings by their passage therethrough. It is not desired to thus remove all of said coal-cuttings, but only enough to assist in keeping the cutter-shaft and front chain-shaft from becoming choked or clogged.

An upright shaft 25 is journaled at its upper end in the cross-bar 26, which is secured between the upper portions of the side frames 12 and at its lower end in the arm or bracket 27, suitably supported near its left edge, and projects inwardly. On the upper portion of this upright shaft is loosely mounted the worm-wheel 28, which engages the spiral or worm 29 on the crank-shaft 14; also, below said worm-wheel 28 and loosely mounted upon said upright shaft another worm-wheel 30 engages the worm or spiral flange 31 on the inner surface of the large gear-wheel 16

on the rear chain-shaft 17. The lower end of this upright shaft is provided with the bevel-wheel 32, which meshes with the bevel-wheel 33 on the rear end of the internally-screw-threaded feed-nut 34, which surrounds the feed-screw 9, and which when revolved moves the carriage 6 either forwardly or backwardly, as desired. Intermediate of the worm-wheels 28 and 30 the clutch 35 is splined to the upright shaft and adapted to be raised and lowered for engagement with the correspondingly-clutched lower and upper surfaces of said worm-wheels, as shown in Fig. 4. This clutch is raised and lowered for engagement with said worm-wheels by the vertical slide 36, which is provided with the downwardly-projecting arms 37, which are movable in grooves formed along the upper portion of said shaft and are secured at their lower ends to said clutch, and by the hand-lever 38, which is connected at its inner end, to the upper end of said slide and fulcrumed upon the stud 39, rising from the cross-bar 26. The spiral or worm 29 on the crank-shaft 14 and the spiral flange 31 on the inner surface of the large gear-wheel 16 are so arranged that when engaged with the upper and lower worm-wheels 28 and 30 the crank-shaft 14 and the rear chain-shaft 17 will be revolved in opposite directions, the result being that when the clutch 35 is in engagement with the lower worm-wheel 30 and the bevel-wheel 32 the internally-screw-threaded feed-nut 34 will be revolved to the right on the feed-screw 9, and the movable carriage 6 will thus be slowly slid forward and against the coal. During this operation the said upper worm-wheel 28 will run loosely or as an idler upon the upright shaft 25. After the desired cut into the coal has been finished the clutch 35 will be raised or disconnected from the lower worm-wheel 30 by the vertical slide 36 and the hand-lever 38 and caused to engage with the upper worm-wheel 28. This will result in reversing the direction of motion of the upright shaft 25, the bevel-wheel 32, and the bevel-wheel 33, in causing the feed-nut 34 to be revolved to the left on the feed-screw 9 and in withdrawing the side rails 5 of the movable carriage 6 and the cutter-shaft 24 from the cavity formed in the coal. While these motions of the parts named are occurring the lower worm-wheel 30 runs loosely upon said upright shaft.

The cutter-shaft 24 and the front chain-shaft 22, which are journaled in proximity to each other at the front end of the carriage 6, as described, are of the same diameter and respectively provided with a series of gear-teeth 40 and 41 along their peripheries, which run in contact during the rotation of said shafts and which are wedge-shaped in form and spirally arranged around said shafts in such manner that no two teeth on the same shaft are arranged in the same longitudinal plane; also, they are so situated that no two



on the same shaft are in the same line transversely thereof; also, they are the same in number on each shaft and terminate on lines just inside of the extensions or brackets 23 at the front ends of the side rails 5 of the carriage. When the front chain-shaft is revolved by the sprocket-chains its motion is first transmitted to the cutter-shaft by the teeth next adjacent to one of said brackets, and is then carried along by the succeeding teeth until the other bearing is reached, after which this motion or operation is repeated by the same teeth which first started and then continued the revolution of said cutter-shaft. There are no teeth opposite the sprocket-chains 20; but two are arranged on each shaft between said bearings and the two inner chains, while eight are placed around said shafts at points falling between said inner chains, although, as is obvious, the numbers of teeth employed may be varied as desired. Under this construction and arrangement of the teeth, whereby a system of gearing is formed for connecting the full length of the cutter-shaft with and operating the same from and for the full length of the front chain-shaft, all possibility of said gearing becoming choked or clogged with coal will be avoided, as no coal can lodge between such an arrangement of teeth, like it does when the ordinary intermeshing gear-wheels or cog-gearing are employed for imparting upward revolution to cutter bars or shafts.

Along the cutter-shaft 24 and directly ahead or in front of its gear-teeth 40 are secured the cutters 42, which are spirally arranged around said shaft, and also adjustably secured in the openings 43, formed therein by the screws 44, an instance of this being shown in detail in Fig. 8. These cutters are made slightly longer than the gear-teeth for cutting deep grooves in the coal, and also for forming spaces through which the rear or following teeth can freely pass; also, the blade portions of these cutters are wider at their outer than at their inner ends, are wedge-shaped, and are inclined forwardly of the axis of their shaft or in the direction of its rotation; also, they extend from end to end of their shaft, excepting at the points corresponding to the front ends of the extensions or brackets 23, which are formed with the sharp flanges 45 for breaking or cutting the coal in front thereof. Thus by a single revolution of said shaft and its cutters the coal is cut and broken away for the whole length of said shaft.

For the purpose of imparting solidity and strength to the teeth 40 they should be made as short as possible, while the cutters 42 should be made as long as possible for securing an effective depth of cut into the coal. For this latter purpose the front chain-shaft 22 is formed in its periphery with the recesses 46, which permit the ends of said cutters to pass freely therethrough or without touching. These recesses have no weakening effect upon the chain-shaft, owing to their

spiral arrangement and the fact that the cutters produce no strain or pressure therein, although this shaft and the cutter-shaft are arranged very closely together.

In order to further provide for the close arrangement of the cutter and front chain-shafts and for the consequent concentration of power, the latter shaft, as more plainly shown in Figs. 6 and 8, is formed with the grooves 47 and the low intermediate square or angular teeth 48, which constitute the two inner sprocket-wheels 21, around which pass the endless sprocket-chains 20, with their side links 49 resting for about one-half of their length upon the angular bottoms of said grooves. As thus constructed and arranged, these sprocket-wheels and chains also permit the cutters to be used directly in front of them and to pass the side links of said chains at the centers thereof without contact therewith, as shown in Fig. 8. This is a very important feature of the invention, as it not only enables the cutters to be used in front of said sprocket wheels and chains, but closely together for the whole length of the cutter-shaft, with the exception of the points at which the sharp flanges 45 of the brackets 23 are arranged, the purpose thereof being above explained.

As the operation of my improved coal-mining machine has been described in connection with the construction and arrangement of its parts, further reference thereto is deemed unnecessary.

Having thus fully described the construction and arrangement or combination of the several parts of my improved coal-mining machine, its operation and advantages, what I claim as new is—

1. In a coal-mining machine, the combination, with a main or stationary frame and a movable carriage mounted thereon and provided with revoluble cutters at its front end, of a feed-screw rigidly secured at its ends to said stationary frame, a revoluble interiorly-screw-threaded feed-nut surrounding said feed-screw and attached to said carriage, and means for revolving said feed-nut in opposite directions for advancing and withdrawing said carriage and its cutters, said means comprising a bevel-wheel on the rear end of said feed-nut, an upright shaft provided with a bevel-wheel at its lower end, with two loose worm-wheels, with a clutch for engaging either of said wheels, and with a vertically-movable slide for raising and lowering said clutch, a hand-lever for raising and lowering said slide, and revoluble devices for operating said shaft and its gearing, these devices including the crank-shaft provided with the pinion and the spiral or worm, and the rear chain-shaft provided with the large gear-wheel having the worm or spiral flange on its inner surface, substantially as described.

2. In a coal-mining machine, the combination, with a main or stationary frame and a movable carriage mounted thereon and pro-



vided with gear-connected and revoluble cutter and chain-shafts at its front end, with a chain-shaft at or near its rear end, said chain-shafts having sprocket-wheels and with  
 5 endless sprocket-chains passing over said sprocket-wheels, of a feed-screw rigidly secured at its ends to said stationary frame, a revoluble interiorly-screw-threaded feed-nut  
 10 surrounding said feed-screw and attached to said carriage, and means for revolving said feed-nut in opposite directions for advancing and withdrawing said carriage, said means comprising a bevel-wheel on the rear end of  
 15 said feed-nut, an upright shaft provided with a bevel-wheel at its lower end, with two loose worm-wheels, with a clutch for engaging either of said wheels, and with a vertically-movable slide for raising and lowering said  
 20 clutch, a hand-lever for raising and lowering said slide, and revoluble devices for operating said shaft and its gearing, these devices including the crank-shaft provided with the pinion and spiral or worm and the large gear-wheel mounted upon said rear chain-shaft and  
 25 provided with the worm or spiral flange on its inner surface, substantially as described.

3. In a coal-mining machine, the combination, with a revoluble cutter-shaft, of a shaft for revolving the same, each of said shafts  
 30 being provided with a series of spirally-arranged contacting gear-teeth along their peripheries, substantially as described.

4. In a coal-mining machine, the combination, with a revoluble cutter-shaft, of a shaft  
 35 for revolving the same, each of said shafts being provided with a series of spirally-arranged wedge-shaped contacting gear-teeth along their peripheries, substantially as described.

5. In a coal-mining machine, a revoluble  
 40 cutter-shaft provided with a series of gear-teeth and a series of cutters along its periphery, which are arranged spirally, said cutters being also located directly in front of said gear-teeth, substantially as described.

45 6. In a coal-mining machine, a revoluble cutter-shaft provided with a series of gear-teeth and a series of cutters along its periphery, which are arranged spirally, said cutters being also located directly in front of said  
 50 gear-teeth and made slightly longer than the same, substantially as described.

7. In a coal-mining machine, a revoluble cutter-shaft provided with a series of gear-teeth and a series of cutters along its periph-

ery and directly in front of said gear-teeth, in  
 55 combination with a revoluble shaft journaled closely to said cutter-shaft and provided with a series of contacting gear-teeth along its periphery, substantially as described.

8. In a coal-mining machine, a revoluble  
 60 cutter-shaft provided with a series of gear-teeth and a series of cutters along its periphery and directly in front of said gear-teeth, in combination with a revoluble shaft journaled closely to said cutter-shaft and provided with  
 65 a series of contacting gear-teeth along its periphery, said cutters and gear-teeth being arranged spirally along the peripheries of said shafts, substantially as described.

9. In a coal-mining machine, a revoluble  
 70 cutter-shaft provided with a series of gear-teeth and a series of cutters along its periphery, which are longer than said teeth, in combination with a revoluble shaft journaled closely to said cutter-shaft and provided with  
 75 a series of contacting gear-teeth along its periphery and with a series of recesses opposite to said cutters, substantially as and for the purpose described.

10. In a coal-mining machine, a revoluble  
 80 cutter-shaft provided with a series of spirally-arranged gear-teeth and a series of cutters along its periphery, in combination with a chain-shaft provided with a series of contacting spirally-arranged gear-teeth and formed  
 85 with sprocket-wheels having low angular teeth and the sprocket-chains, said sprocket wheels and chains being constructed to permit full-length cutters to be revolved directly in front thereof, substantially as described. 90

11. In a coal-mining machine, a revoluble  
 cutter-shaft provided with a series of spirally-arranged gear-teeth and a series of cutters along its periphery, in combination with a  
 95 chain-shaft provided with a series of contacting spirally-arranged gear-teeth and formed with grooves having angular teeth between them, constituting the sprocket-wheels and the sprocket-chains, said sprocket wheels and chains being constructed to permit full-length  
 100 cutters to be revolved directly in front thereof, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ARCHIBALD BAILEY.

Witnesses:

F. B. REED,

WM. E. IRWIN.