(No Model.)

6 Sheets—Sheet 1.

J. KANGLEY.

MINING MACHINE.

No. 435,426. Patented Sept. 2, 1890.

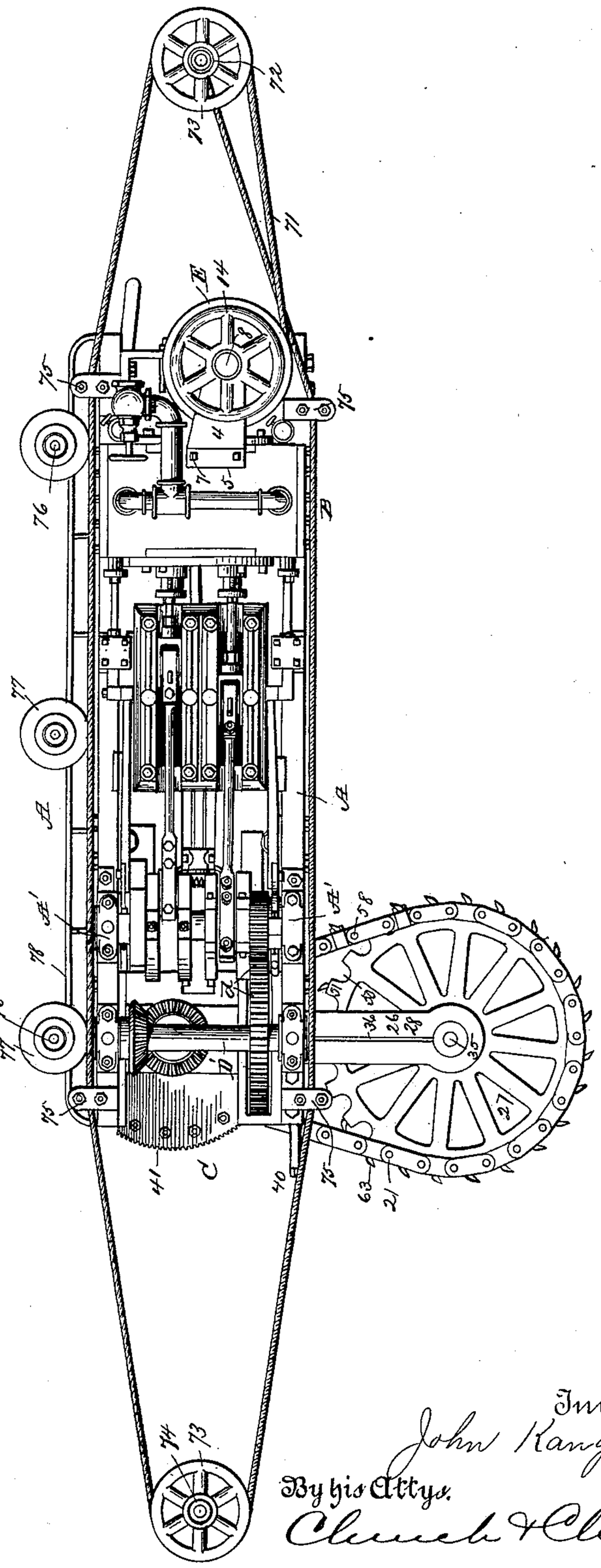

Fig. 1.

Witnesses
E. W. Smith
Thomas Durant

Inventor
John Kangley,
By his Attys.
Church & Church

(No Model.) 6 Sheets—Sheet 2.

J. KANGLEY.

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Witnesses
E. L. Smith
Thos. Durant.

Inventor
John Kangley,
By his Attys.
Church & Church

(No Model.)

6 Sheets—Sheet 3.

J. KANGLEY.

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Fig. 6.

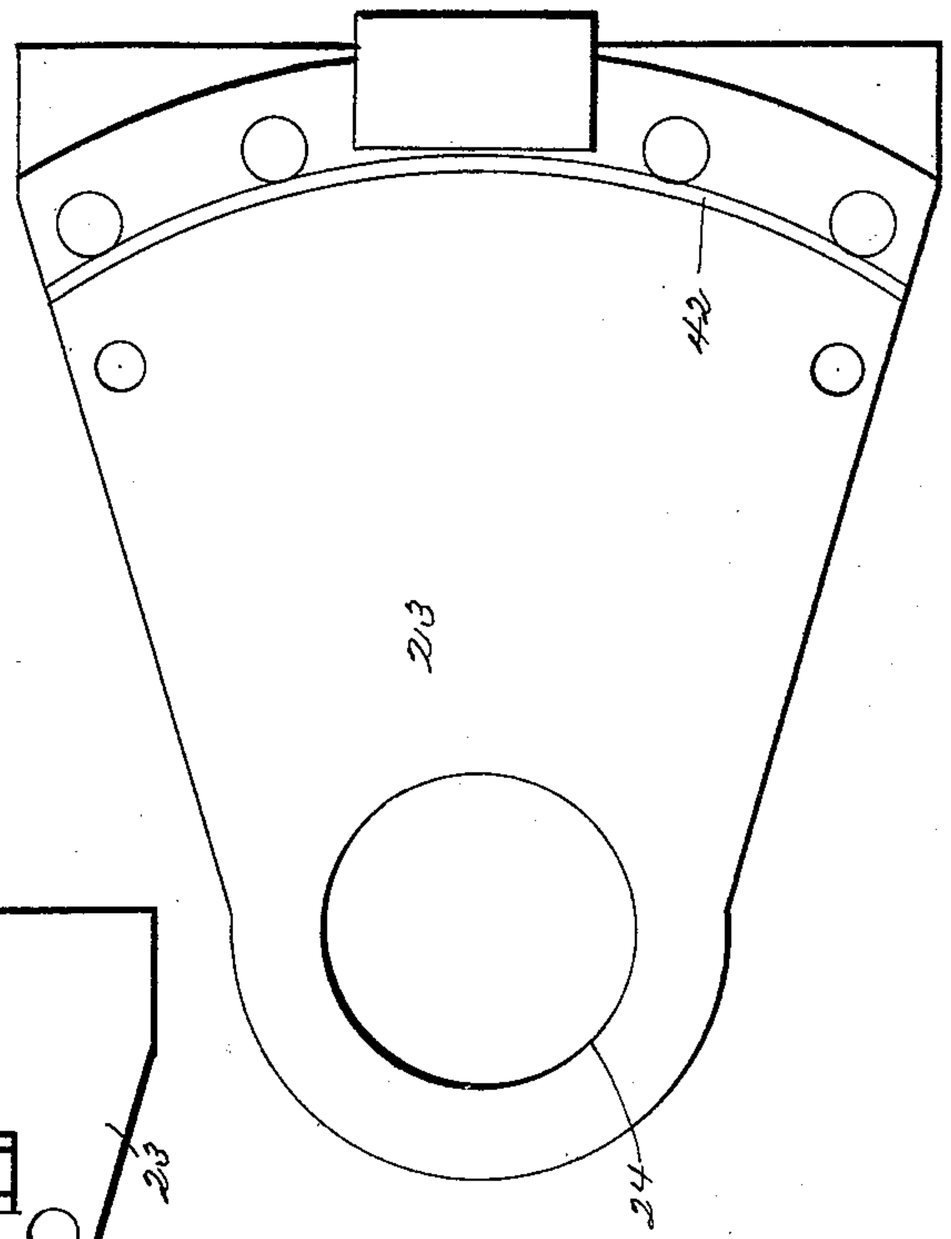


Fig. 5.

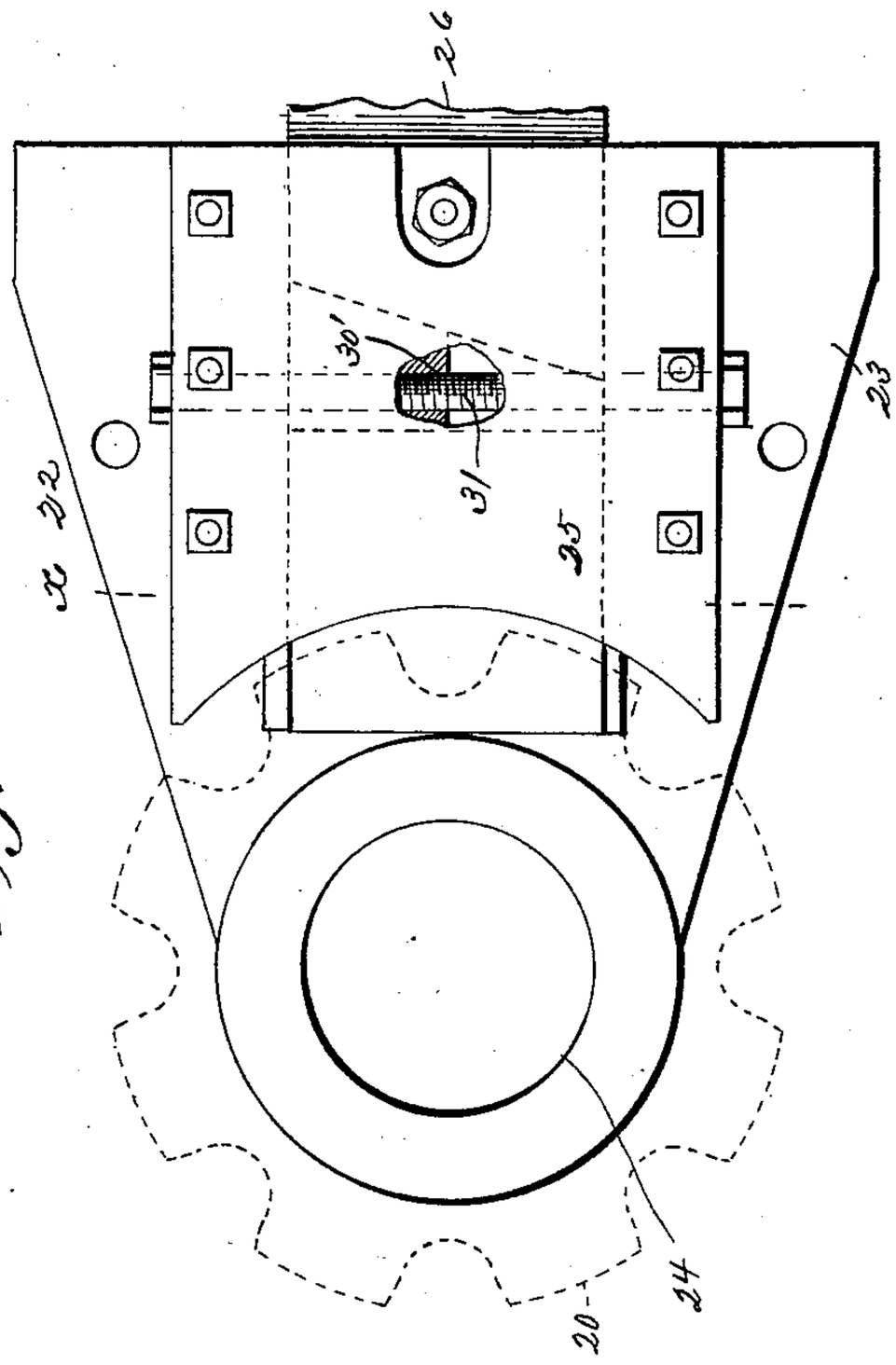
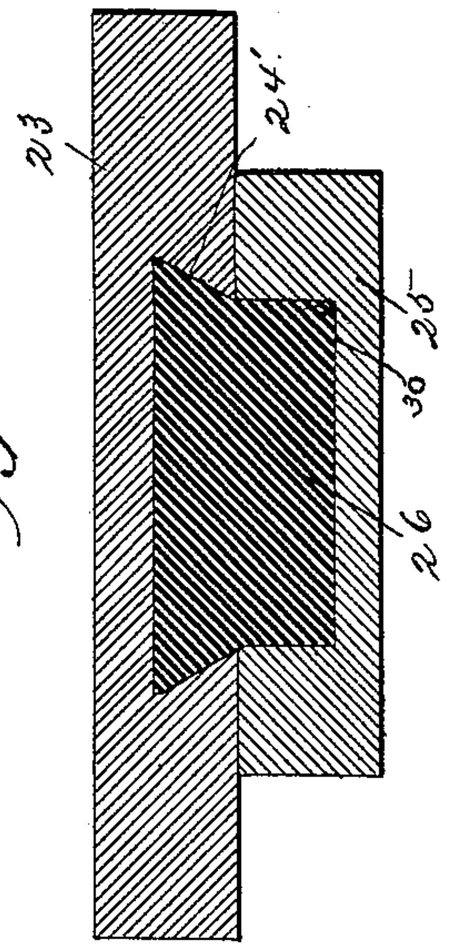


Fig. 7.



Witnesses
E. D. Smith
Thomas Durant.

Inventor
John Kangley.
By his Attorneys
Church & Church

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J. KANGLEY.

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Fig. 9.

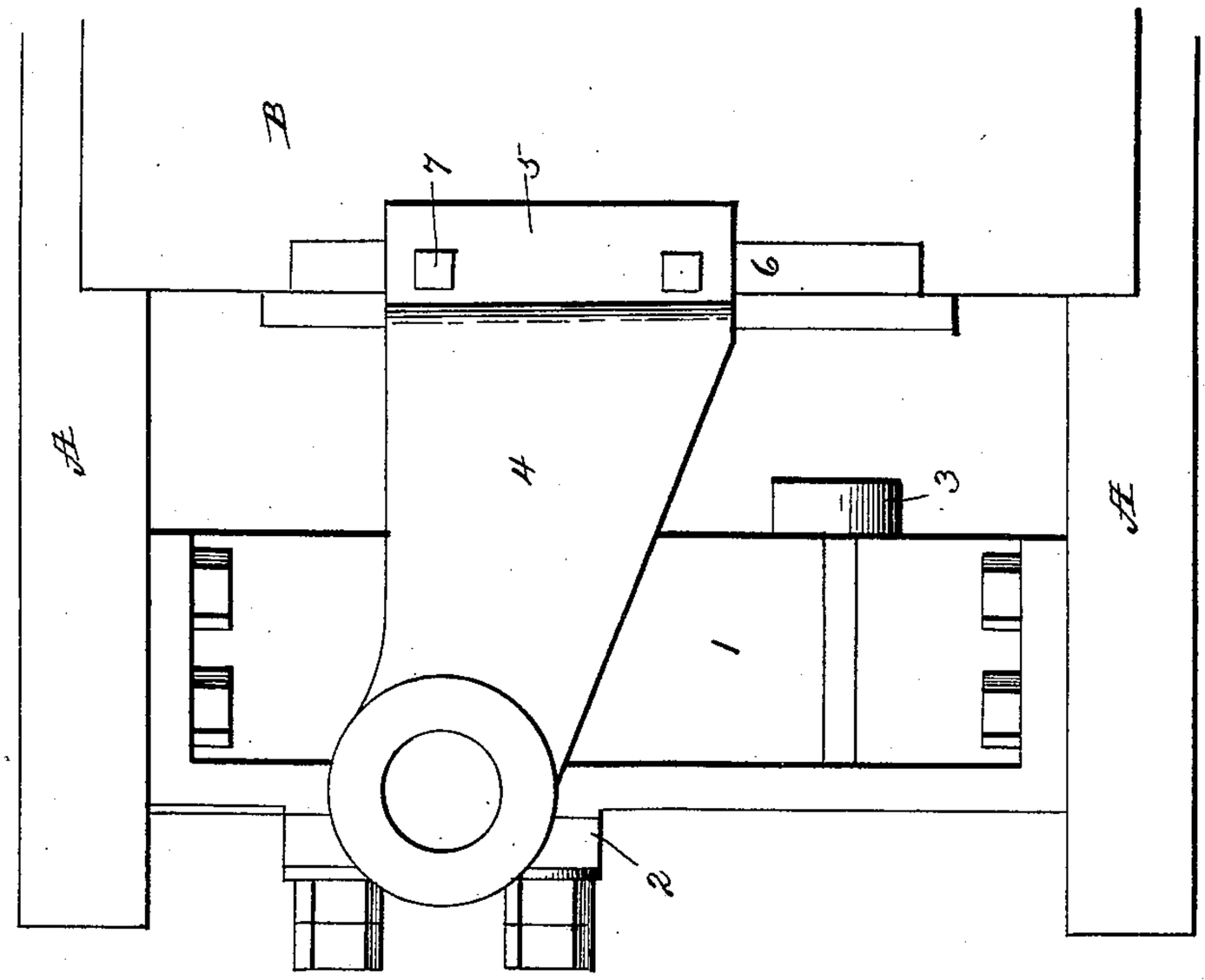
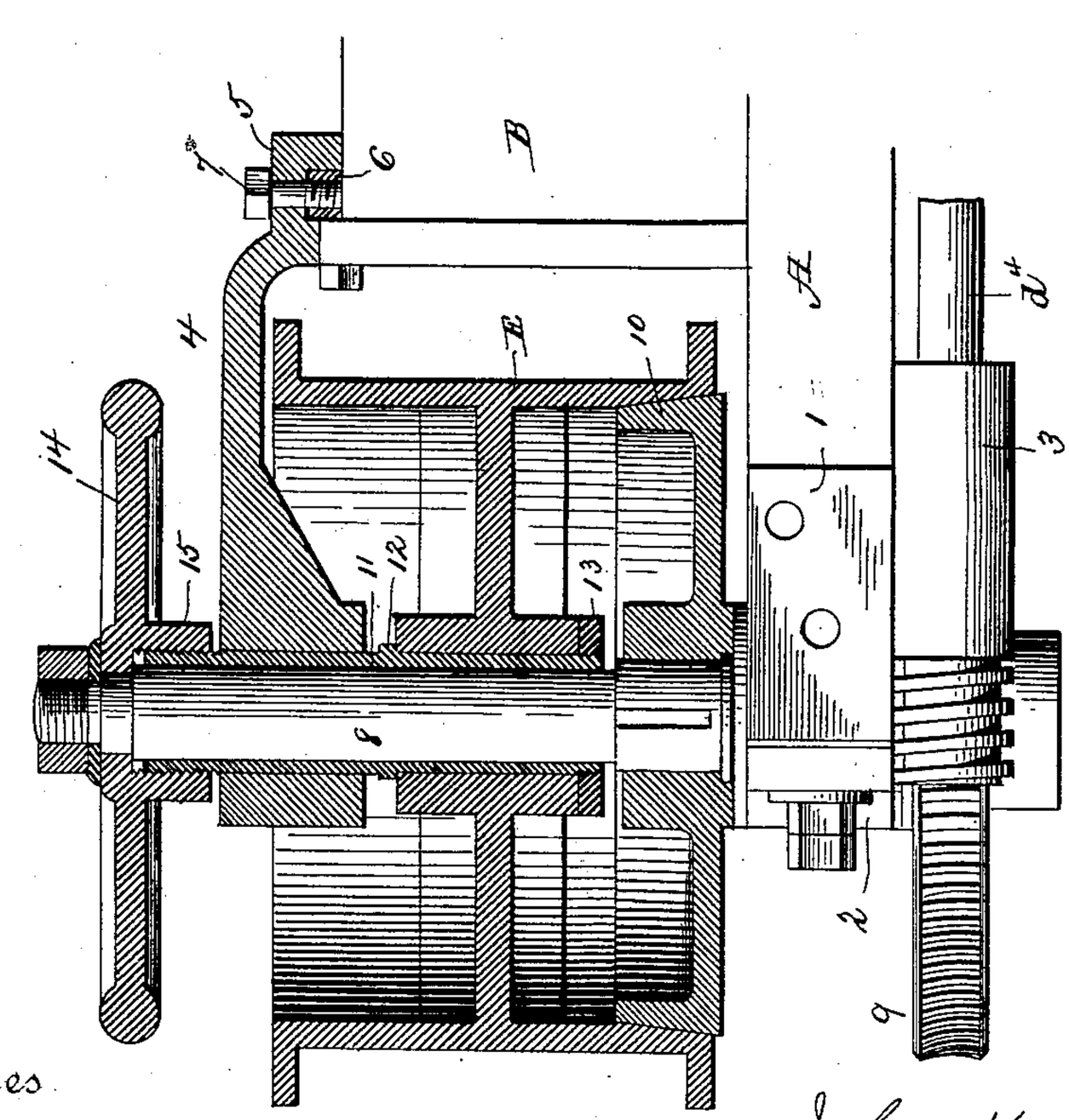


Fig. 8.



Witnesses
E. B. Smith.
Thomas Durant.

Inventor.
John Kangley,
By his Attorneys
Church & Church

(No Model.)

6 Sheets—Sheet 5.

J. KANGLEY.

MINING MACHINE.

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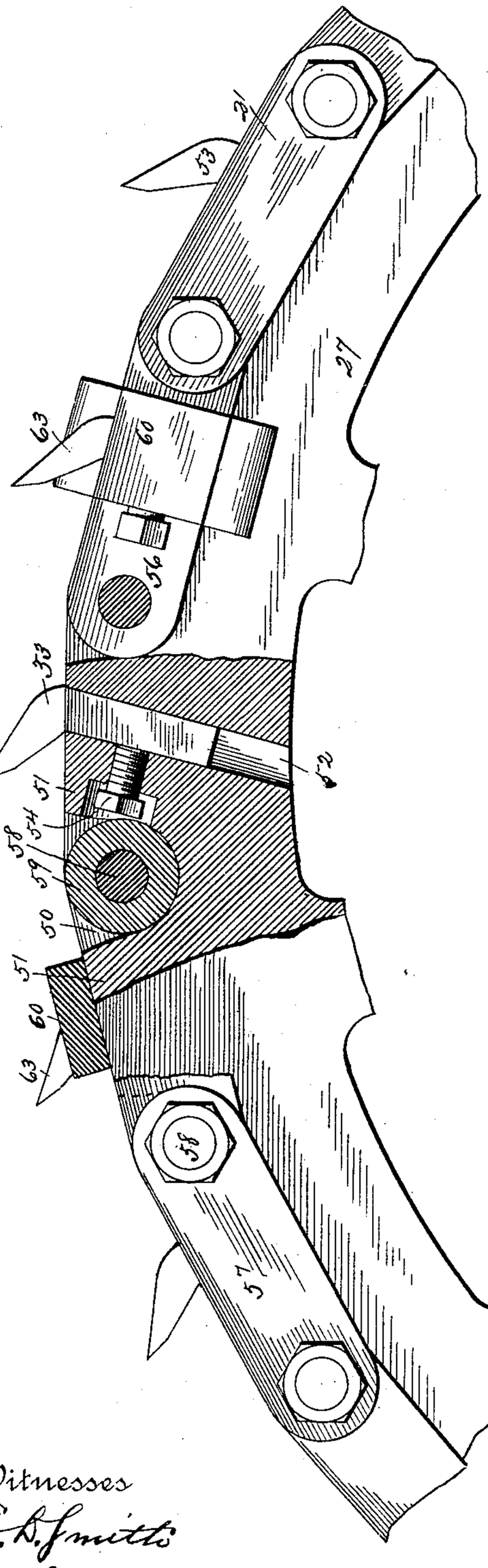

Fig. 10.

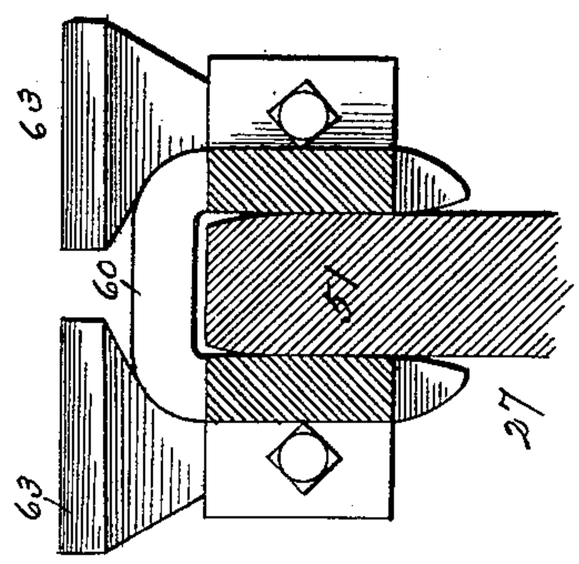

Fig. 12.

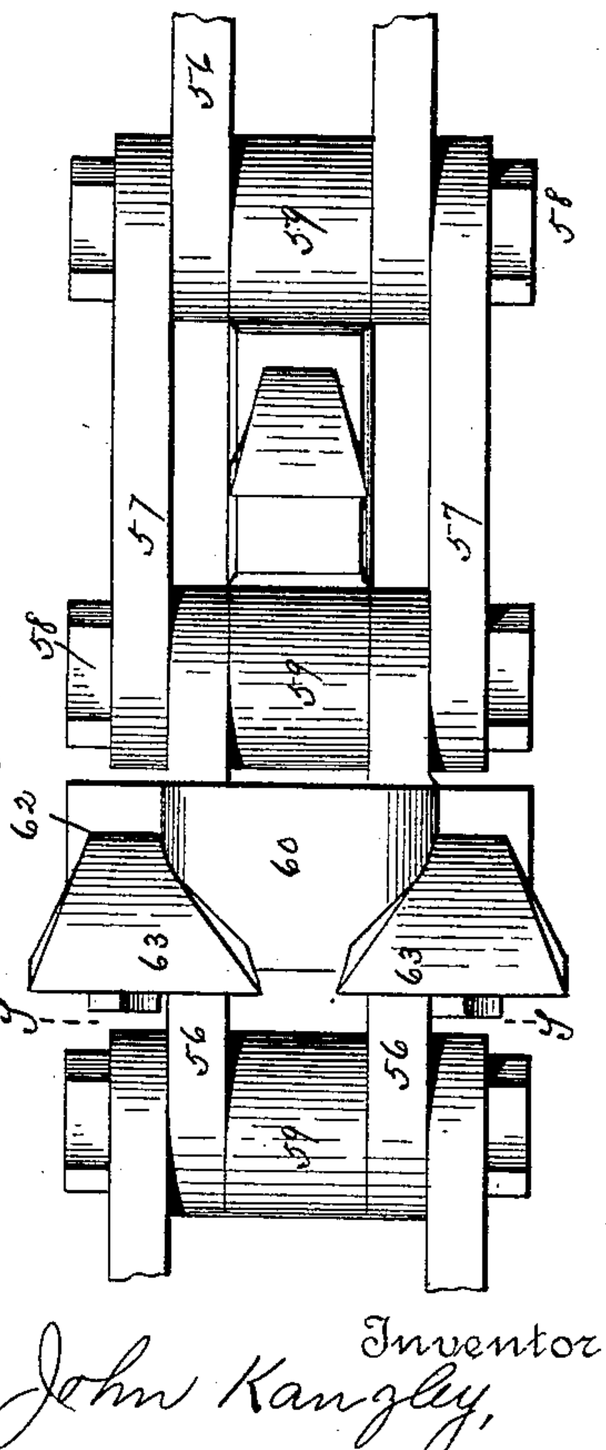

Fig. 11.

Witnesses
C. L. Smith
Thomas Durant.

Inventor
John Kangley,
By his Attorneys:
Church & Church

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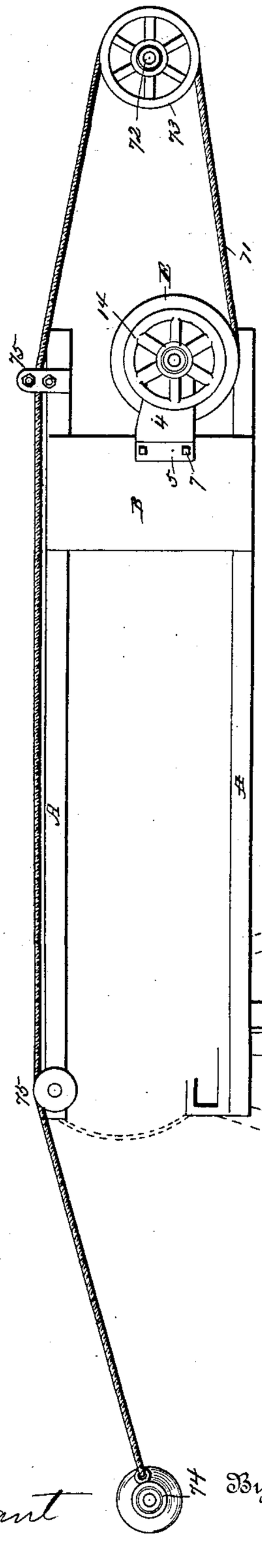

Fig. 13.

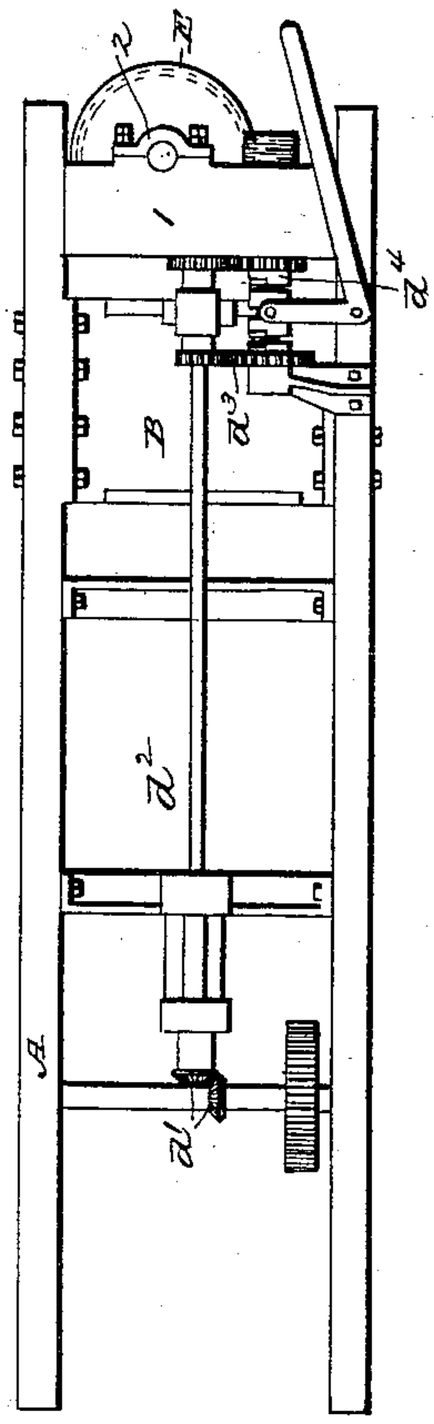

Fig. 14.

Witnesses
E. W. Smith
Thomas Durant

Inventor
John Kangley.
By His Attorneys
Church & Church

UNITED STATES PATENT OFFICE.

JOHN KANGLEY, OF STREATOR, ILLINOIS.

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 435,426, dated September 2, 1890.

Application filed May 15, 1890. Serial No. 351,973. (No model.)

To all whom it may concern:

Be it known that I, JOHN KANGLEY, of Streator, in the county of La Salle and State of Illinois, have invented certain new and useful Improvements in Mining-Machines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

This invention relates to improvements in or upon the class of coal cutting or mining machines described in Letters Patent No. 412,262, granted to me October 8, 1889; and it consists in the novel and improved combination and arrangement of parts hereinafter fully described, and pointed out in the claims.

In the accompanying drawings Figure 1 is a top plan view, and Fig. 2 a side elevation, of my improved machine and attachments for effecting the advance movements of the same. Fig. 3 is a transverse vertical section through the devices for supporting and adjusting the cutting mechanism. Fig. 4 is a detail sectional view of the bearing and support for the cutting wheel or carrier. Fig. 5 is a bottom view, and Fig. 6 a top view, of the supports for inner end of cutter-frame. Fig. 7 is a transverse sectional view on line *x x*, Fig. 5. Fig. 8 is a vertical sectional view of the winding-drum and attachments. Fig. 9 is a top plan view showing manner of supporting winding-drum. Fig. 10 is a side elevation, partly in section, of a portion of the cutting apparatus. Fig. 11 is an edge view of a section of cutter. Fig. 12 is a sectional view on line *y y*, Fig. 11. Fig. 13 illustrates in plan a modification of the feeding mechanism. Fig. 14 is a bottom view illustrating the gearing for transmitting motion from the main or crank shaft to the winding-drum.

Similar letters and numerals of reference in the several figures indicate the same parts.

The frame of the machine is composed, principally, of two side pieces or sills A, the frame or casing B, containing the cylinders, &c., of the motor, and a frame C, supporting the cutting mechanism.

The motor is located at or near one end of the frame and the cutting mechanism at or near the opposite end, the frame C of the cutting mechanism being formed or provided with seats *c*, properly shaped to receive the sills A, the latter being clamped and firmly held in position by bolts or equivalent fastenings.

Upon the sills A are bolted castings A′, containing bearings for the main crank-shaft D and a counter-shaft D′. The shaft D is driven by the motor and connected to counter-shaft D′ through gears *d*. A second counter-shaft D^2, supported in bearings *a* beneath sills A, is driven from a pinion on shaft D and transmits motion through bevel-gears *d′* to shaft d^2, the latter communicating through a system of change-gears d^3 with worm-shaft d^4 for driving the drum E. These connections are substantially the same as in my prior patent.

In my prior machine the winding-drum was horizontally disposed, and in operation, as the rope or cable was wound upon it to effect an advance movement of the machine, the line of draft shifted from one side to the other, thereby producing a lateral deflection or twisting of the machine. To overcome this defect, the winding-drum of my present machine is vertically disposed, so that as the rope or cable is wound spirally upon the surface of the drum it will always draw in the same vertical plane, and the deflection, if any is produced, will be constant instead of shifting laterally.

The means for supporting and actuating the winding-drum form a part of my present invention.

At the front end of the machine and between the sills A is fitted a cross-piece or casting 1, provided with a vertical box or bearing 2 and a sleeve or box 3 for the accommodation of the worm-shaft.

A bracket or overhanging arm 4, provided with a bearing coincident with bearing 2 and a grooved or recessed flange 5, is fitted to embrace and rest upon a flange or projection 6 on the front end of casing B, and is held thereon by bolts 7. This overhanging arm is thus securely and firmly fastened in position directly upon the casing B, thereby dispensing with extra frame-work or braces and permitting said arm to be readily applied and removed when occasion requires.

An upright shaft 8 is fitted to the bearing 2 in cross-piece 1, with the worm-wheel 9

keyed or otherwise secured to it below said bearing and a wheel or clutch section 10 above said bearing.

Upon the upper portion of the shaft 8 is fitted a sleeve 11, provided with collars 12 and 13, (one of which is made removable,) and between the latter and surrounding the sleeve 11 is mounted the winding-drum E. The drum is free to turn upon the sleeve and the latter upon the shaft, and the lower inner surface of the drum is slightly coned, inclined, or otherwise formed or constructed to co-operate with the opposite clutch-section 10 on shaft 8. In the present instance a friction-clutch is formed by the exterior surface of section 10 and the inner surface of the drum, so that when they are brought together the drum will rotate in unison with the shaft, and when separated the drum will be released from the control of the driving-shaft.

To effect the engagement and disengagement of the drum from its driving-shaft, a hand-wheel 14, or equivalent device, is swiveled upon the upper end of the shaft 8, so that it is free to rotate thereon, but is permitted little if any motion longitudinally of the shaft. Such a connection may be made by reducing the end of the shaft fitting the hand-wheel to said reduced portion and confining it by a nut or equivalent device applied to the shaft above the wheel, so that the latter will be supported between the nut and the shoulder on the shaft. The wheel or lever 14 is provided with a screw-threaded socket or collar 15, engaging the threaded end of the sleeve 11, whereby as the wheel is moved in one direction it will operate upon and through the sleeve to lift the drum, and thereby open the clutch and release the drum from the shaft, and when rotated in the opposite direction it will move the drum down toward the other section of the clutch, the action of the screw in this instance coinciding in direction with that of gravity to close the clutch, and thus secure the drum to its driving-shaft.

The next feature of improvement relates to the form, construction, and manner of supporting and operating the cutting mechanism.

The frame C is formed or provided with a bearing 16, within which turns a shaft 17, carrying a sprocket-wheel 20 at its lower end and provided with a bevel-gear 18 at its upper end meshing with a gear 19 on shaft D′.

The cutting mechanism, in the form of a chain 21, is driven from wheel 20 and supported to one side and beyond the main frame in a frame 22, pivotally mounted upon an axis coincident with shaft 17, so that the cutting mechanism can be swung as a whole about said shaft without interfering with the driving mechanism. To provide for this lateral movement of the cutting mechanism and the adjustment of the cutters, a plate 23 is provided with a socket or bearing 24, adapted to fit and move upon the lower end of bearing 16, through which the shaft 17 extends.

In the lower face of plate 23 is formed a groove or way 24′, the sides being undercut, as indicated in Fig. 7, and a cap or plate 25 is bolted to said plate 23 to confine and support the arm 26, carrying the sprocket-wheel 27.

The arm 26 is preferably constructed in two sections 28 and 29, of which the upper one 28 is longer, and its inner end is fitted to slide in the groove or way in plate 23, while the inner end of the shorter or lower section 29 is received in a groove or way 30 in the outer end of plate 25, the two sections 28 and 29 being bolted or otherwise secured together at or near the inner end of the arm 26 and through the hub of wheel 27 near the outer end of said arm, thus forming a rigid frame for carrying and supporting the cutting apparatus beyond the main frame of the machine.

To provide for taking up slack in the chain and for adjusting the position of the wheel 27, a wedge 30′ is interposed between a shoulder on the arm or frame 26, such as is formed by the inner end of the lower section 29, said wedge being actuated by an adjusting-screw 31 and arranged to traverse between said shoulder or inner end of section 29 and the wall at the inner end of groove in plate 25, as represented in Figs. 3 and 5. By moving the wedge the arm 26 can be forced outward to increase the distance between the driving-wheel 20 and the carrying-wheel 27, and the slack in the chain can thus be taken up, and when it is desired to remove or replace the chain the wedge can be retracted and the arm drawn inward. The groove or way in which the arm or frame 26 is mounted for radial adjustment is formed on a line radial to the axis about which the said arm or frame is pivoted to bring the inward thrust in line with said pivot.

The outer ends of the two sections 28 and 29 (or the bifurcated end of the frame 26) are connected through the medium of a hollow plug or journal 33, closed at one end by a head 34 and at the opposite end or top by a removable cap 35, the whole forming a clamp for uniting the two sections to prevent their separation or spreading and a receptacle for oil or other lubricant. A pipe or duct 36, extending along one of the arms or sections and open at its inner end, while its outer end communicates with the interior of the hollow journal 33, serves to convey the lubricant to the said journal.

The opposite sides or ends of the hub of wheel 27 take bearing against the inner faces of the two sections of arm or frame 26, and a sleeve 37, preferably formed or provided with beveled ends, is fitted snugly within the hub and takes its bearing upon the journal 33, while the beveled ends of said sleeve are seated and take bearing in grooves formed in sections 28 29, as indicated in Figs. 3 and 4.

The walls of the hollow journal are perforated or provided with ducts, through which the lubricant is conducted to the inner surface of the sleeve. As thus arranged a strong and durable bearing is formed for the wheel 27—one capable of withstanding wear and of resisting the strains put upon it. Moreover, the wearing-surfaces are inclosed and protected from dust and grit. Provision is made whereby the lubrication of the surfaces can be at all times effected, even when the machine is in operation and when the wheel is within the cut and not accessible. Moreover, the lubricant is supplied by hydrostatic pressure being conducted from an elevated point, so that the flow is from within the journal outward between the surfaces in contact, thereby preventing the entrance of dust, &c., from without through any space or spaces that may exist between the surfaces of the bearing. This feature is of prime importance in machines of this kind, as the cutting mechanism when in action is projected and operated within a narrow groove or cut in the coal or other material operated upon, and is more or less covered by fine particles, which, if they are permitted to enter between the surfaces, will quickly cut out and destroy the bearings.

One of the principal objects in mounting the arm or frame carrying the cutting mechanism so as to swing about a vertical center is to provide for the convenient transportation of the machine. In this class of machines the cutting mechanism is arranged to project laterally beyond the side of the main frame, so that as the machine is advanced the cutters will form a narrow cut in the face of the wall or vein and extending the full length of the gallery. The cutting mechanism is necessarily constructed to stand out some considerable distance beyond the main frame, which renders it difficult of transportation, particularly through narrow galleries or other passages without first removing the cutting mechanism and necessitating its replacement and adjustment before beginning operations. By mounting the cutting mechanism in the manner described upon a vertical axis coincident with the driving-shaft 17 the whole cutting apparatus can be swung in rear of the main frame or turned in different angular relations thereto, so that the machine can readily be transported not only through narrow but through crooked galleries and passages, and when starting the cut in a narrow gallery the cutters can be entered from a position in rear of the frame and then swung around into position at right angles thereto.

Provision is made for quickly and easily effecting the lateral movement or adjustment of the cutting mechanism about its pivotal point of attachment to the main frame by the application of worm or equivalent gearing. Thus in the present instance a worm-wheel and shaft 40 are mounted in bearings on plate 22 (the worm being protected by an inclosing-casing) and arranged to engage a toothed segment 41, formed upon or preferably secured to the frame C, as indicated in Fig. 3. The plate 22 may also be provided with a guide or flange 42, overlapping and resting upon a support or guide, such as is formed by the upper face of this toothed segment, forming an additional support for the arm carrying the cutting mechanism to resist twisting and vertical deflection of the said arm. The shaft 40 is preferably made of such length that a crank can be applied to the end and operated without interfering with the chain for swinging the cutting mechanism.

As will be seen by reference to Fig. 1, the toothed segment with which the worm engages extends in rear of the main frame a sufficient distance to permit the arm-carrying wheel 27 of the cutting mechanism to be swung around in line with the frame. It will be noted that in effecting this adjustment of the cutting mechanism its driving-gearing is not interfered with or disconnected in any way, but is at all times preserved in working condition.

The cutting apparatus constitutes another novel feature of this machine. The wheel 27 is provided with a series of grooves or spaces 50, the portion of the periphery lying between said grooves forming what may be termed "sprocket-teeth" 51. Some of the teeth 51 are provided with sockets 52 for the reception of the shanks of cutters 53, the latter being secured in position with their cutting-edges projected beyond the periphery of the wheel by set-screws 54. These set-screws are entered through the sides of grooves 50, and are covered and protected by the cross-bars or pintles of the chain when lying in said grooves, as shown in Fig. 10.

In addition to the cutters 53, carried by the wheel 27, the chain 21, by which said wheel is driven from wheel 20, is also provided with cutters.

The chain 55 may be of any ordinary or approved form adapted for the purpose, and in the present instance it is composed of a series of pairs of links 56 57, connected by cross-bolts 58, with a sleeve or collar 59, surrounding the bolts between the links of each pair, said sleeves entering the grooves or spaces between the teeth in wheel 27.

The links 56, which are arranged in line between two of the ordinary pair of links 57, are connected together or provided with a yoke or saddle 60, adapted to rest upon the teeth of the sprocket-wheel 27 and to overlap and embrace the latter, the edges of said wheel being slightly beveled, as indicated in Fig. 12, so as to facilitate its entrance between the legs of the saddle, which latter is preferably prolonged and extended somewhat below the inner or lower margin of the link. This saddle or yoke 60 is preferably made integral with the links 56, which it connects, and is provided with sockets or other holders 62 for the reception of cutters 63.

When the chain is applied to the wheel 27, it is so arranged and adapted with reference to the number and arrangement of the cutters on said wheel that each cutter 53 will be projected through the open spaces in the chain formed by links 57, while the yokes 60 will engage and rest upon teeth not provided with cutters 53.

In the illustration given the links 56 alternate with links 57. Hence every other tooth of the wheel 27 may be provided with a cutter 53; but it is obvious that a less number of cutters 53 may be employed and a larger number of yokes 60 and cutters 63 should it be deemed necessary or desirable. The yokes 60 engage the sides as well as the periphery of the wheel 27, and are thus held firmly against lateral movement and prevented from tilting, so that their cutting-edges are maintained and supported in proper position when in action.

The operating edges or faces of the cutters 63 project laterally beyond the sides of the wheel and chain, so as to form a cut of sufficient width to admit the cutting mechanism, and they project inward into the path traversed by the cutting or operating face of cutters 53, so as to effect the removal of the material lying in the plane of the chain and wheel.

As hereinbefore stated, the progressive movement of the cutting mechanism through the material is effected by advancing the machine. Consequently the cutter and its supporting-arm are hung low on the main frame, and instead of mounting the machine so as to traverse upon guiding-rails for holding it up to its work it is furnished with supporting-wheels 70, resting directly upon the floor, and the machine is guided, advanced, and held properly to its work by a novel application of the cable.

Heretofore the cable 71, one end of which is connected to and wound upon drum E, has been attached at its opposite end to a support or anchor in advance of the machine. The cutting mechanism being located in rear and to one side of the drum, the winding of the cable upon the drum has the effect of forcing the rear end of the machine to one side or away from the wall, thereby withdrawing the cutter.

By my present improvements I utilize the tension of the cable in the act of drawing the machine forward to hold it up to its work, and to this end, instead of securing the cable to the strut or anchor 72, located in front of the machine, I pass it around a pulley 73, (supported upon said strut so as to be permitted limited vertical motion thereon,) and conduct it back along the outside of the machine, and either attach the end to a strut 74 in rear of the machine (see Fig. 13) or pass it around a pulley 73 on said strut, and, carrying it again longitudinally of the machine, secure the end to a strut or anchor in advance of the machine. When the cable is thus passed longitudinally of the machine, it is caused to engage pulleys or other supports 75 at opposite ends of the frame. Thus, as shown in Fig. 1, where the cable extends longitudinally of the machine on opposite sides thereof, it takes a bearing on the frame at or near the four corners, the machine traversing between the two equal lines, both of which are under tension and serve as flexible guides for directing and holding the machine in the plane of a line connecting the two struts or anchors, and in the modified form shown in Fig. 13 the lateral pressure or deflection of the forward end of the frame, occasioned by winding the cable upon the drum, is neutralized by the pressure of the cable upon the opposite corner, while the pressure on the rear corner is sufficient to hold and maintain the cutters up to working position. The tension placed upon the cable is directly proportional to the resistance encountered in effecting the advance movement of the machine. Hence the harder the material and more difficult the cut the greater the pressure of the cable upon the sides of the frame and the resistance to lateral displacement. These guiding and holding operations may be, and preferably are, supplemented by the application along the outer side of the machine of a series of removable struts 76, provided with flanged wheels 77, against which a guide-rail 78 on the frame of the machine bears. The guide-rail 78 is secured to the frame at a point or points below the plane of its bearing-surface, which latter is rounded, and the flanged wheels 77, co-operating with said rail, are provided with hubs or sleeves and laterally-projecting flanges, and are free to move vertically upon their supports. The flanges of the wheels 77 rest upon the guide-rail, with the latter against the hubs or collars of the wheels, and, owing to the angular disposition of the guide-rail, it serves to resist the upward tilting motion of the cutting mechanism, at the same time permitting vertical motion of the frame parallel with the axis of the wheel. A collar 79 or equivalent stop is applied to the support or strut carrying the flanged wheel to sustain the latter at the proper elevation for the initial engagement of the guide-rail when the strut is placed in advance of the frame in position to be engaged as the machine is drawn forward.

Having thus described my invention, what I claim as new is—

1. In a machine such as described, the combination, with the main frame and the plate pivoted thereto and carrying the arm supporting the wheel of the cutting mechanism, of the gear-segment on the frame, the worm on the plate, and guide engaging the upper face of the segment, substantially as described.

2. In a machine such as described, the combination, with plate 22, pivotally connected to the main frame and provided with an undercut groove or way, and a cap-plate 25, of

the arm 26, formed in two sections, and the wedge 30′, engaging the inner end of one of said sections, substantially as described.

3. In a machine such as described, the combination, with the pivoted furcated arm bearing the cutting apparatus, of the wheel interposed between the members of said arm and held in position by a hollow journal connecting said members, substantially as described.

4. In a machine such as described, the combination, with the wheel of the cutting mechanism and the arm supporting said wheel, connected to and projecting beyond the main frame, of the closed hollow journal upon which said wheel is supported, provided with an oil-duct extending longitudinally of the supporting-arm, substantially as described.

5. In a machine such as described, the combination, with the main frame, the laterally-projecting arm, and the wheel mounted upon said arm, of the closed hollow journal, the oil-duct leading from said journal longitudinally of the supporting-arm and provided with an elevated receiving end, and the duct or ducts leading from within the journal to the wearing-surfaces, substantially as described.

6. In a machine such as described, the combination, with the main frame, a laterally-projecting arm or frame carrying the cutting mechanism, and the wheel mounted in the furcated end of said arm, of the sleeve provided with beveled ends engaging seats in the opposite members of the arm, and a journal extending through said sleeve and clamped upon the outside of said members of the arm, substantially as described.

7. In a machine such as described, the combination, with the furcated arm carrying the cutting mechanism, of the wheel mounted in said arm, the hollow journal, and the beveled bearings on opposite faces of the wheel, substantially as described.

8. In a machine such as described, the combination, with the main frame, of the grooved bracket engaging a web or flange on the cylinder-casing, the cross-piece inserted between the sills, the vertical shaft supported in bearings in said cross-piece and bracket, and the winding-drum mounted upon said shaft, substantially as described.

9. In a machine such as described, the combination, with the vertical shaft supported on the main frame and provided with a clutch-section, of the drum supported above said clutch-section on a sleeve on said shaft, with devices for moving said sleeve and drum to engage or release the clutch, substantially as described.

10. In a machine such as described, the combination, with the main frame, of the vertical shaft carrying one section of the friction-clutch, a sleeve movable longitudinally of said shaft, the winding-drum supported upon said sleeve and provided with the other section of the clutch, and a nut swiveled upon the shaft and engaging the sleeve thereon to move the drum and thereby connect or disconnect it from the shaft, substantially as described.

11. In a machine such as described, the combination, with the main frame, of the vertical shaft carrying the tapering friction-wheel, the winding-drum supported on a sleeve movable longitudinally upon said shaft, said drum being provided with a tapering end to co-operate with the friction-wheel, and the hand-wheel swiveled upon the shaft and provided with a threaded portion engaging the sleeve to move the latter, substantially as described.

12. In a machine such as described, the combination, with the supporting arm or frame of the cutting mechanism, of the sprocket-wheel provided with cutters on its periphery and the chain engaging said wheel and also provided with cutters, substantially as described.

13. In a machine such as described, the combination, with the supporting frame or arm of the cutting mechanism, of the wheel provided with transverse grooves forming sprocket-teeth for engaging the chain and having radial sockets for the cutters and set-screws inserted through recesses or openings in the walls of said grooves and engaging the shank of the cutter, substantially as described.

14. In a machine such as described, the combination, with the wheel of the cutting mechanism, provided with transverse grooves or sprocket-teeth and radial cutters, of the driving chain carrying cutters on opposite sides, substantially as described.

15. In a machine such as described, the combination, with the sprocket-wheel and its radial cutters, of the driving-chains composed of open links and yoked links carrying cutters, substantially as described.

16. In a machine such as described, the combination, with the carrying sprocket-wheel provided with radial cutters inserted at intervals in the teeth, of a driving-chain composed of a series of pairs of links connected by cross pieces or bars, some of said links being connected by yokes and carrying cutters beyond the edges of the wheel, substantially as described.

17. In a machine such as described, the combination, with the carrying sprocket-wheel beveled at the edges, of the drive-chain, the links whereof overlap the parallel sides of the wheel and are connected together at intervals in the length of the chain by yokes in which cutters are mounted, said yokes being extended inward toward the center of the wheel beyond the inner edges of the links to provide a longer bearing on the wheel and prevent lateral displacement of the cutters, substantially as described.

18. In a machine such as described, the combination, with the main frame, a cutting mechanism mounted thereon, and devices for effecting the advance movement of the frame, of a series of struts bearing guide-rollers and a guide-rail extending longitudinally of the frame and attached to the latter in a plane

below the bearing-surface of the rail, substantially as described.

19. In a machine such as described, the combination, with the main frame, cutting mechanism, and feeding devices, of a portable strut carrying a flanged roller movable longitudinally of the strut and engaging a guide-rail on the frame, substantially as described.

20. In a machine such as described, the combination, with the frame and its cutting and feeding devices, of the struts, the flanged rollers, the supports for limiting the movement of the rollers on the struts, and a guide-rail secured to the frame and engaging the roller, substantially as described.

21. In a machine such as described, the combination, with the portable frame carrying the cutting mechanism and provided with a winding-drum, of struts or anchors arranged in front and in rear of the frame, and a cable or rope extending from the anchor in rear of the frame, passing around the anchor in front of the frame, and connected to the winding-drum, with pulleys or supports in the frame engaging the cable at points intermediate of the anchors, substantially as described.

22. The combination, with a portable mining-machine, such as described, provided with cutting mechanism and a winding-drum, of a cable connected to the winding-drum and extending forward to a fixed support or anchor and thence rearwardly to a second support or anchor, with bearings on the frame engaging the cable between the two supports or anchors, substantially as described.

23. The combination, with a portable mining-machine provided with cutting apparatus, of a cable extending longitudinally of the machine from a point in rear to a point in advance of the machine and connected at one end to the latter, with a pulley or bearing on the frame engaging and traversing upon the cable between the supports therefor, substantially as described.

24. The combination, with a portable mining-machine, of a cable extending longitudinally of the machine and engaging the latter to guide and hold it to its work, said cable being connected to the feeding mechanism for advancing the machine and maintained under tension thereby, substantially as described.

25. The combination, with a portable mining-machine carrying winding mechanism, of a traction-cable engaged by the winding mechanism, said cable being supported in rear and in advance of the machine and engaging the frame on the side opposite the cutting mechanism, substantially as described.

26. The combination, with a portable mining-machine, of two supports or anchors located the one in rear and the other in advance of the machine and a traction-cable connected to the machine and extending longitudinally thereof on opposite sides and engaging both anchors, substantially as described.

27. The combination, with a portable mining-machine and two portable anchors or struts, the one located in advance and the other in rear of the machine, of a traction-cable extending longitudinally of the machine from the front to the rear anchor and on the opposite side from the rear anchor to the front anchor and thence to the machine, with bearings or pulleys on the frame running between the parallel portions of the cable, substantially as described.

28. The combination, with a portable mining-machine, of the traction-cable extending longitudinally of the machine and connected to the machine and at the opposite end to an anchor in advance thereof and to a winding-drum and a series of struts ranged in the line of movement of the machine and engaging a guide-rail on the frame, substantially as described.

29. The combination, with the main frame provided with vertical bearing 16 for shaft 17, of the frame carrying the cutting mechanism, pivoted directly upon the lower extension of bearing 16, the sprocket-wheel 20, applied to shaft 17 below the cutter-frame, and a chain engaging said sprocket-wheel, substantially as described.

JOHN KANGLEY.

Witnesses:
C. H. RATHBUN,
FRANK O'MEARA.