(No Model.)

4 Sheets—Sheet 1.

B. A. LEGG.

MINING MACHINE.

No. 548,760. Patented Oct. 29, 1895.

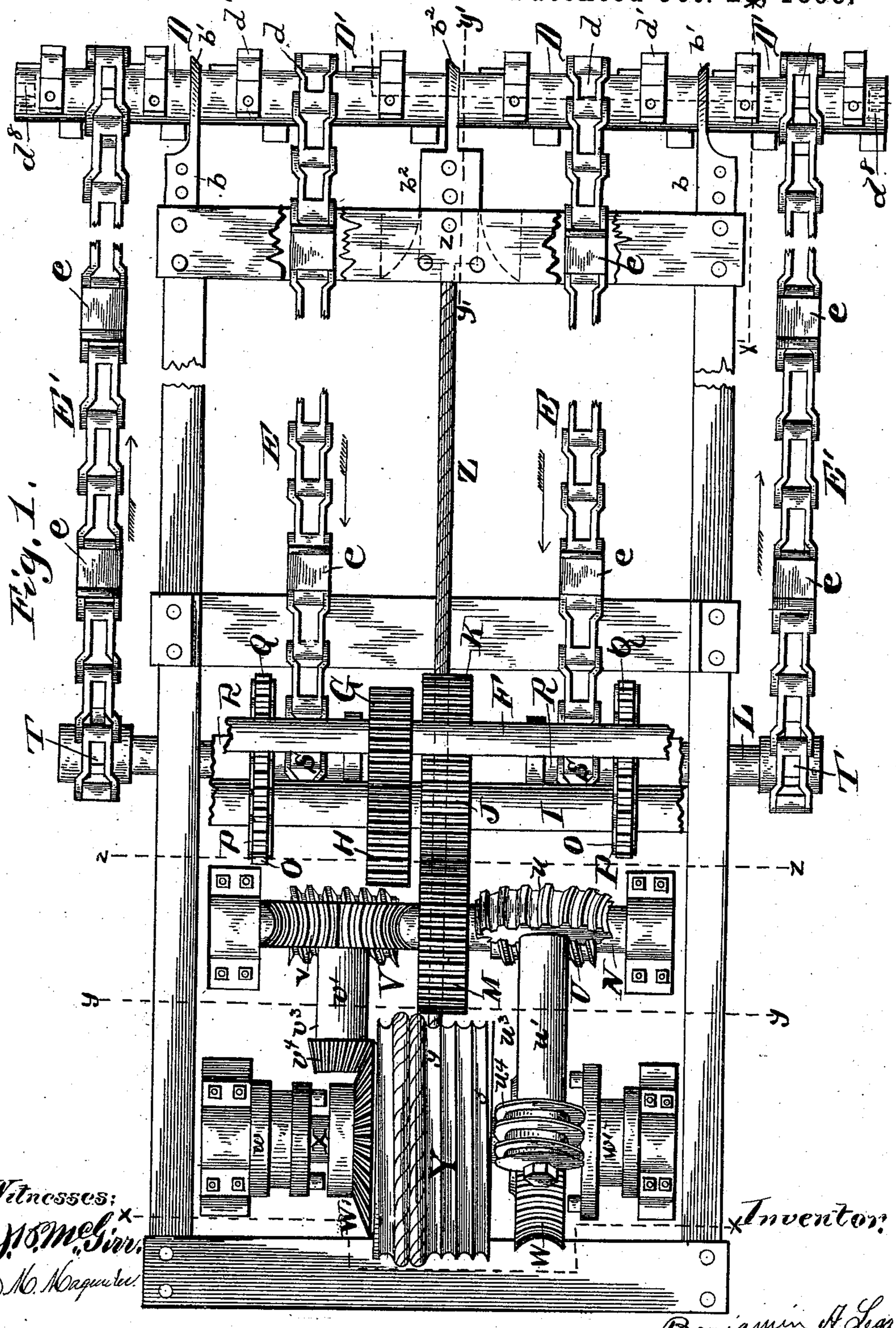

Fig. 1.

Witnesses:
J. H. McGinn.
L. M. Maguire.

Inventor:
Benjamin A. Legg
by Dodge, Bliss & Bliss
attys.

(No Model.)

4 Sheets—Sheet 2.

B. A. LEGG.

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No. 548,760. Patented Oct. 29, 1895.

Fig. 12.

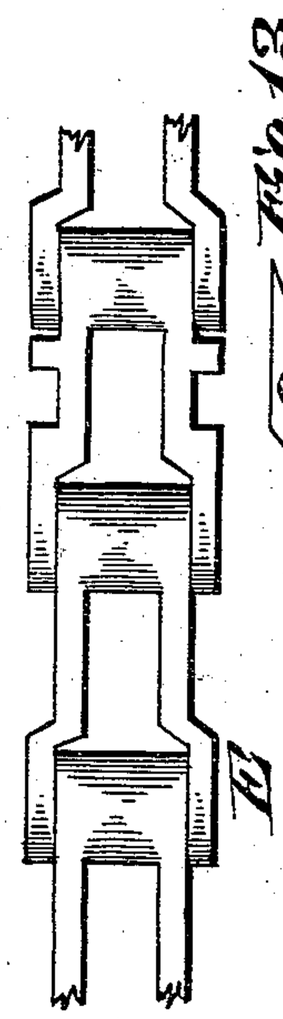


Fig. 13.

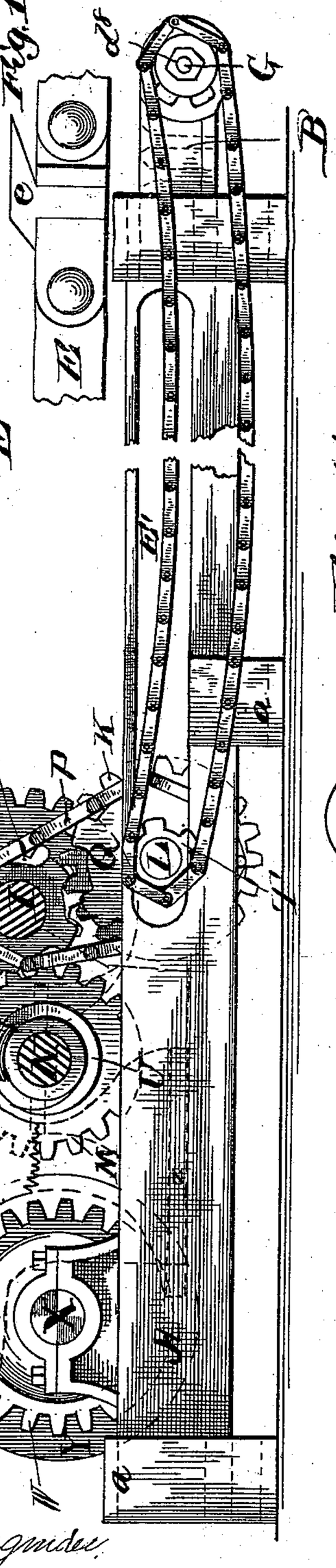


Fig. 14.

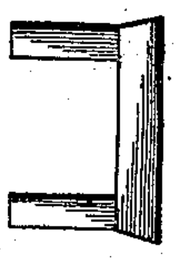


Fig. 4.

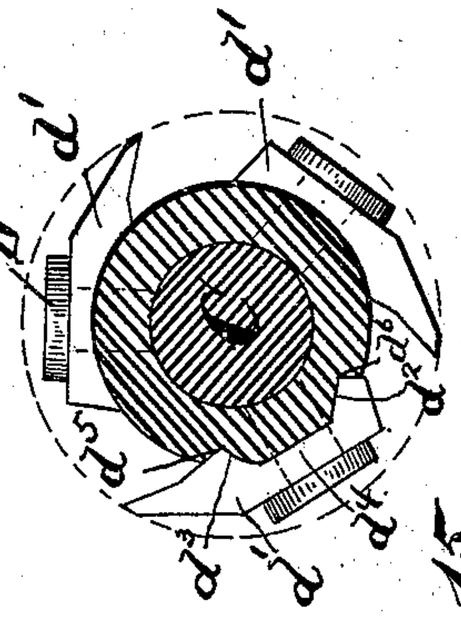


Fig. 15.

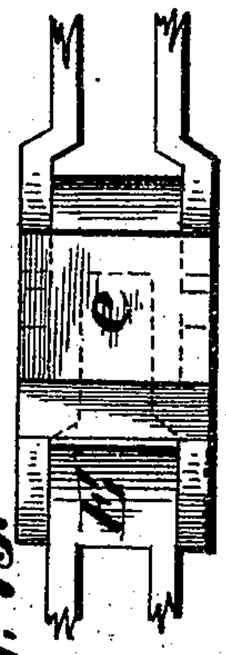
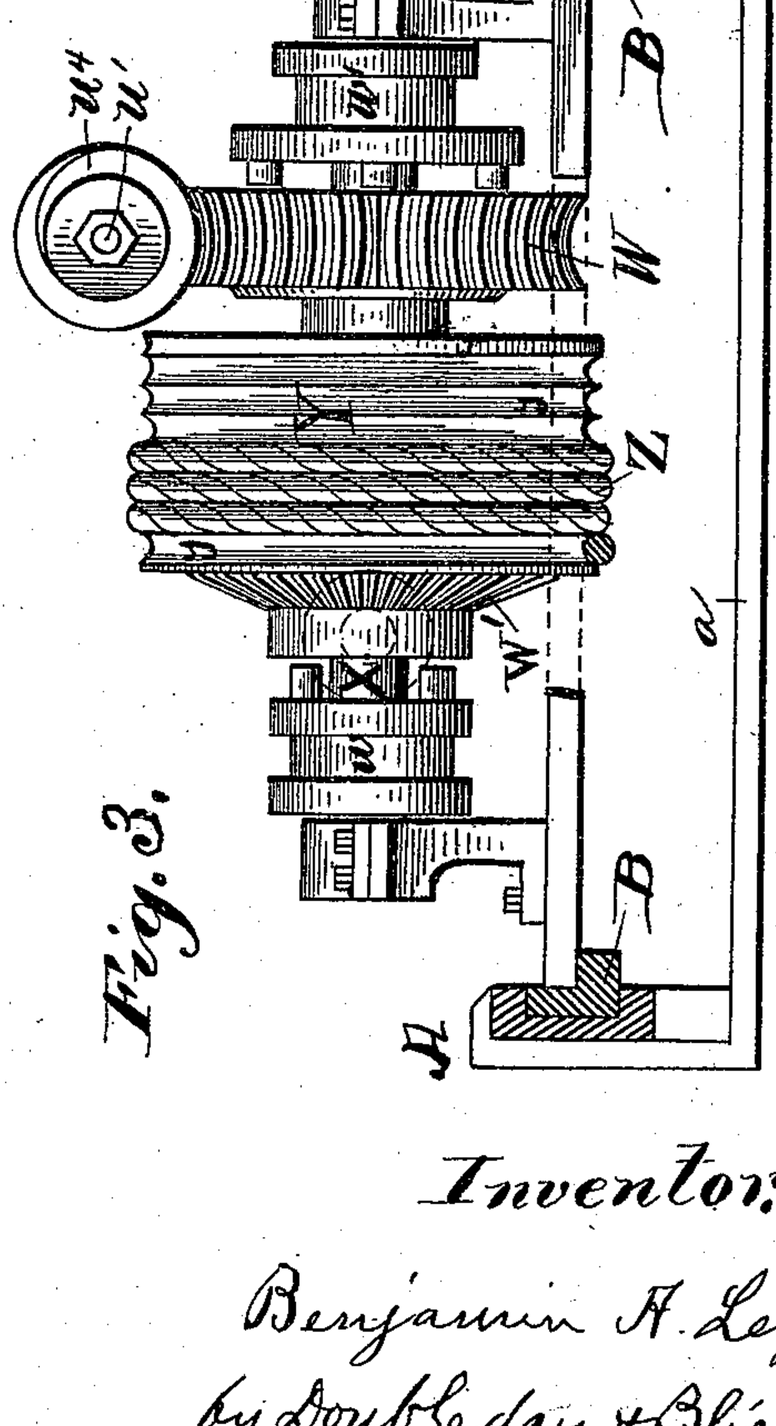


Fig. 2.

Fig. 3.



Witnesses:

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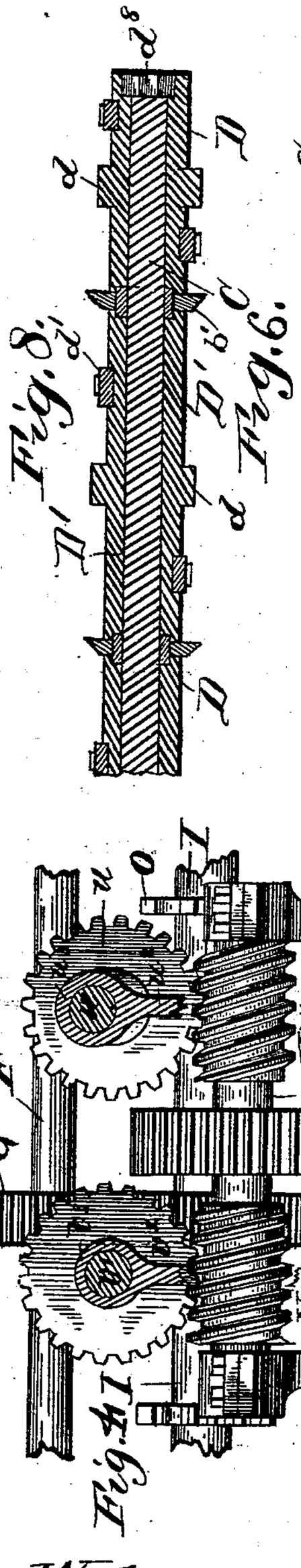
(No Model.)

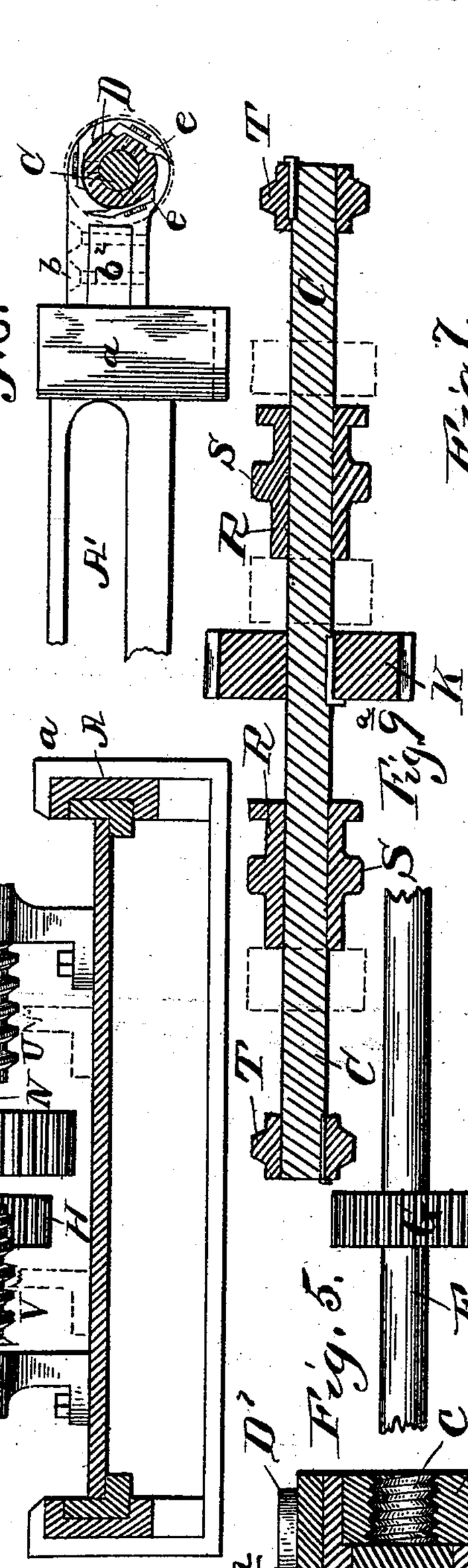
4 Sheets—Sheet 3.

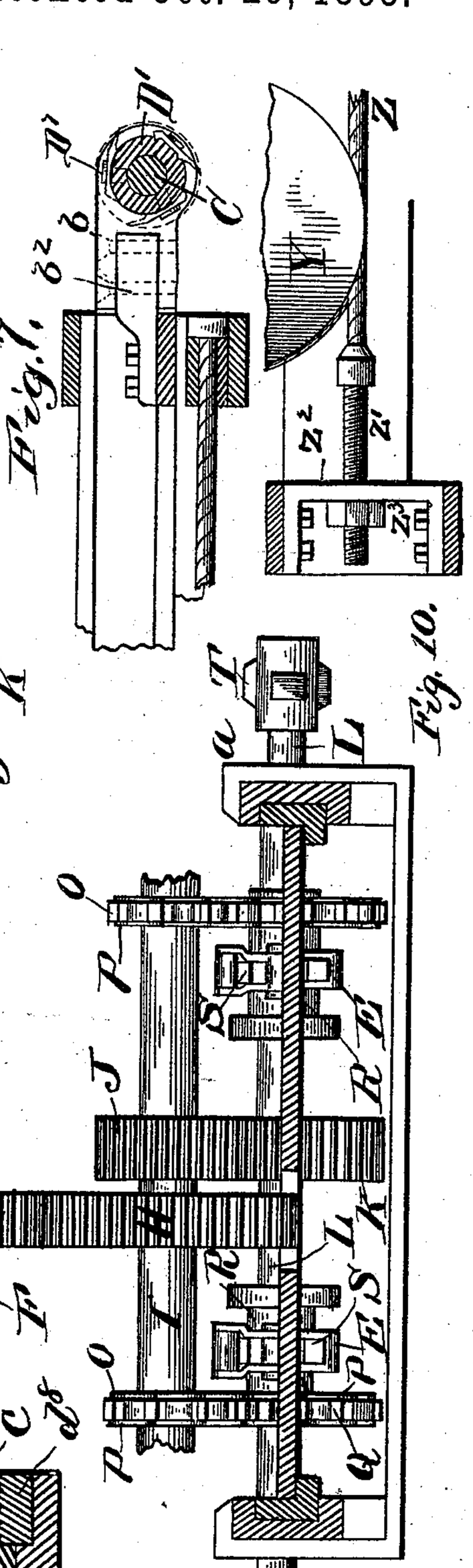
B. A. LEGG.

MINING MACHINE.

No. 548,760. Patented Oct. 29, 1895.







Witnesses:
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(No Model.)

4 Sheets—Sheet 4.

B. A. LEGG.

MINING MACHINE.

No. 548,760. Patented Oct. 29, 1895.

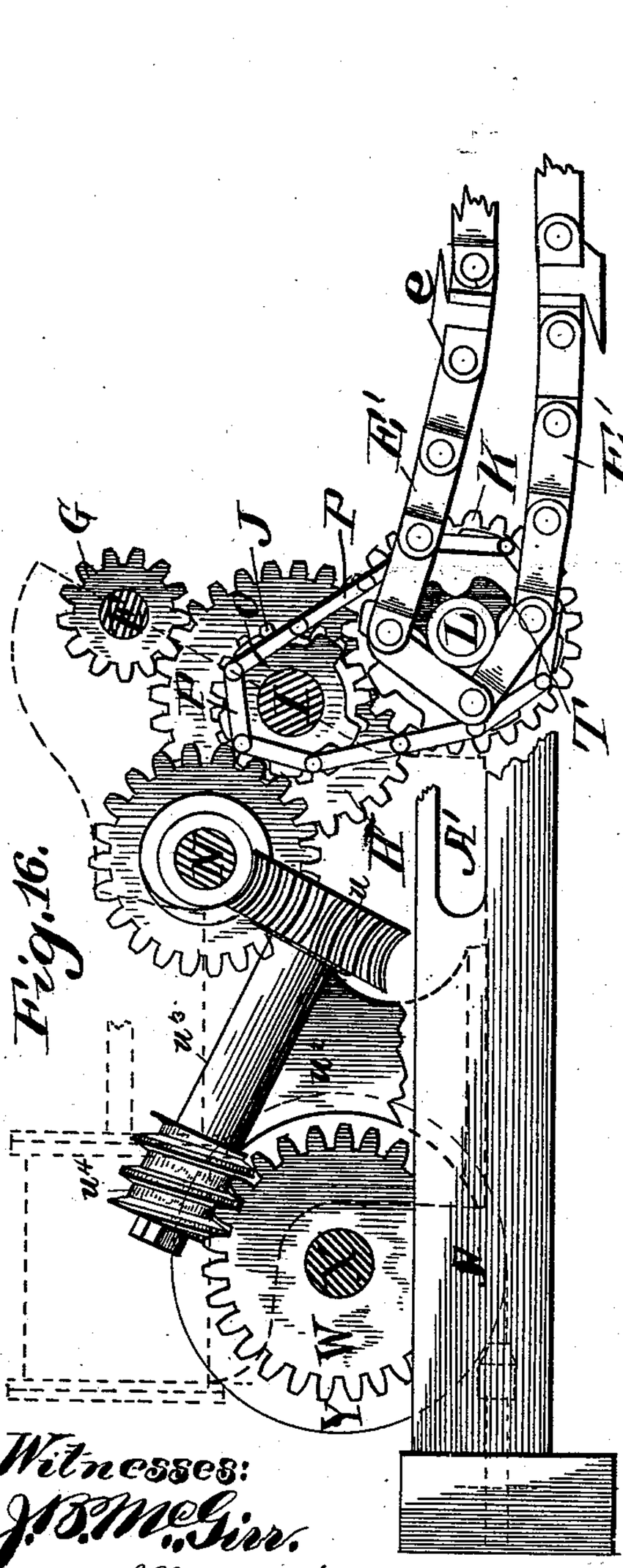

Fig. 16.

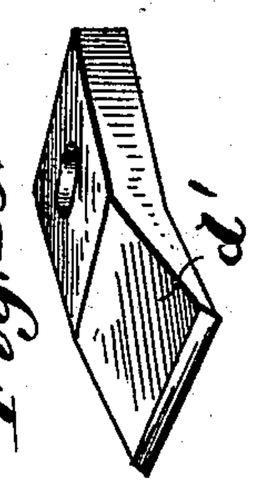

Fig. 19.

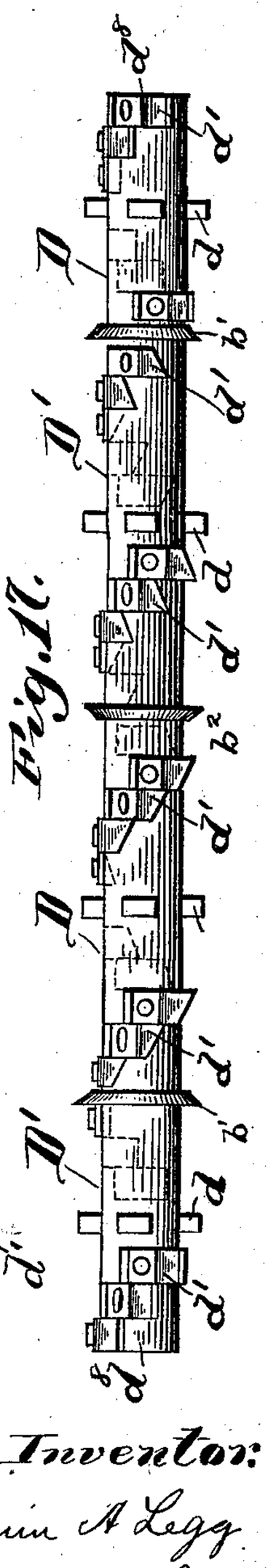

Fig. 17.

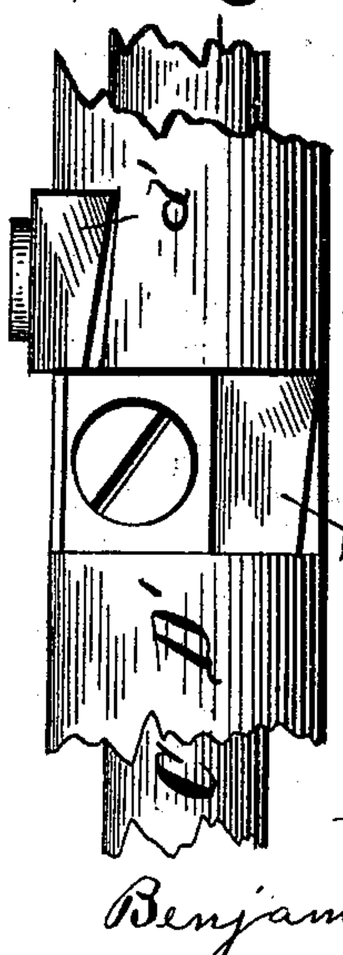

Fig. 18.

Witnesses:
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UNITED STATES PATENT OFFICE.

BENJAMIN A. LEGG, OF COLUMBUS, OHIO, ASSIGNOR TO JOSEPH A. JEFFREY, OF SAME PLACE.

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 548,760, dated October 29, 1895.

Application filed July 25, 1888. Serial No. 280,968. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN A. LEGG, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Mining-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is a top plan view of a mining-machine embodying my improvements. Fig. 2 is a side elevation. Fig. 3 is a cross section on the line *x x*, Fig. 1. Fig. 4 is a cross-section on the line *y y*, Fig. 1. Fig. 5 is a cross-section on the line *z z*, Fig. 1. Fig. 6 is a partial section on the line *x' x'*, Fig. 1. Fig. 7 is a partial section on the line *y' y'*, Fig. 1. Figs. 8 to 15 show details. Fig. 16 is a side view, partially in section, of a somewhat modified form of the machine. Figs. 17, 18, and 19 illustrate a modification of the cutters.

In the drawings a bed-frame is shown as formed of the side bars A A, bound together by the bottom cross-ties *a a*. This frame is adapted to be made stationary in any of the ways now well known or in any preferred manner by means of jacks or binding-screws. To it there is fitted a sliding carriage having side bars B B, upon the front ends of which is mounted the cutting apparatus, and upon the rear of which are mounted the engines and the devices for imparting power to the cutters and also to the mechanism that advances and withdraws the carriage upon the bed-frame. The front ends of these sliding side bars are provided with shoes *b b*, having bearings *b' b'*. To these bearings there is secured a bar C, which is stationary—that is, one which is non-rotating. Upon this bar there are mounted the sleeves or tubes D D D' D', there being four in the construction shown, though in this respect there can be variation. Each of these tubes or sleeves is provided with a sprocket-wheel *d* and with cutters *d'*. The latter are of such number and so arranged that when the tube or sleeve is revolved they will cut a clear path ahead of the sliding parts which lie in the same horizontal plane with said tubes or sleeves. The cutters are secured by forming grooves or depressions upon the faces of the tubes or sleeves, as shown at d^2 d^3. Each cutter *d'* is recessed, as shown at d^4, there being shoulders at d^5 d^6 fitting into the aforesaid recesses at d^2 d^3.

D^7 is the bolt by which the cutters are fastened tightly in place. These cutters may be regarded as being secured tangentially to their revolving carrier in contradistinction to the arrangement and manner of fastening such cutters heretofore followed. Heretofore they have been inserted radially into solid bars and secured by nuts and set-screws; but for the present purpose the manner of arranging and fastening them which I have shown is superior, as I am enabled in this way to permit the bar to remain stationary, and thus a solid firm bearing for the parts which carry the cutters is provided. The sleeves or tubes at the ends of the series are fastened in place by countersunk nuts d^8 d^8, the ends of the bar C being threaded to receive them and the outer ends of the outer tubes or sleeves being recessed for their reception. These tubes or sleeves are independently driven by means of chains E E E' E', those at E E lying inside or between the side bars of the bed and of the carriage, while those at E' E' lie on the outside thereof. The mechanism by which these chains are driven comprises the following parts:

F is a power-shaft. If ordinary reciprocating engines are used, this shaft F is the crank-shaft of said engines. The engines can be mounted upon the sliding carriage in any preferred way.

G is a pinion upon the power-shaft. It meshes with a spur-wheel H upon a second or intermediate shaft I. This shaft also carries a pinion J, which meshes with a wheel K on a shaft L nearly below it and also meshes with a wheel M on the second intermediate shaft N, preferably behind the one at I. The shaft is also provided with sprocket-wheels O, which engage with chains P, that in turn engage with sprocket-wheels Q, secured to spools or sleeves R, mounted loosely upon the aforesaid shaft L. It will be seen that the spur-wheels J and K tend to revolve the shaft in one direction, while the sprocket-wheels and chains O P Q tend to revolve the sleeves R in the opposite direction.

S S are sprocket-wheels upon the sleeves R R and they engage with the inside chains E E.

T T are sprocket-wheels rigidly secured to the shaft L and with them engage the outside chains E′ E′.

When the above-described parts are in motion, the shaft L is revolved by the spur-gear, and it imparts motion to said outside chains E′ E′ in such way as to turn the cutter-sleeves D′ D′ in one direction—to wit, downward on the cutting side—and at the same time the sleeves R R are turned by the chains P P independently of the shaft L, and they through the chains E E drive the inside cutter-sleeves D D in the direction opposite to that of the outside sleeves D′ D′—to wit, in the upward direction on the cutting side. It will be seen that I thus overcome one of the most serious objections which have been experienced in connection with mining-machines of this class—namely, the tendency of the cutting apparatus to "climb up" when the cutter-bar is driven in the ordinary way—that is to say, so that the cutters all move downward while cutting—or else to press downward with great force, as is the case in those machines in which all of the cutters travel up while working. In my case one half of the cutters are moving upward while the other half are moving downward, and therefore the front end of the sliding frame is balanced so far as upward or downward thrust is concerned. In this respect there can be numerous modifications of the machine shown without departing from the spirit of my invention, which consists in employing two or more sets of cutters thrust directly forward into the coal, of which one or more sets turn upward while cutting and one or more sets turn downward.

The movable part of the machine is advanced and withdrawn as follows: The aforesaid shaft N is provided with two worms U and V. The worm U engages with a worm-wheel u, which is secured to a shaft u', mounted in a bracket or standard u^2 with a sleeve u^3. At the rear end of the shaft u' there is a worm u^4, which meshes with the worm-wheel W on a cross-shaft X. The other worm V on shaft N engages with a worm-wheel v, secured to a shaft v', mounted in a standard v^2 with a sleeve-bearing v^3; and at the rear end of the shaft v' there is a bevel-pinion v^4, which meshes with a bevel-wheel W′, also mounted loosely on the aforesaid cross-shaft X. w w' are two clutches or two parts of one clutch, they being connected together so as to move simultaneously. They are feathered on the shaft X. The part w is adapted to engage with the loose worm-wheel u and the part w' to similarly engage with the loose bevel-wheel W′.

Y indicates a drum which is rigidly secured to the cross-shaft X. It is made of any suitable material, though preferably of a hard durable metal, and is provided with a spiral groove y.

Z is a rope or cable, preferably of wire. Several turns of this cable are made around the drum, it being fitted snugly in the spiral groove y. One end of the cable is rigidly fastened to the front end of the stationary frame, as shown at z, and the other end is adjustably fastened to the rear end of the frame, it being attached to a threaded bar z', which passes through a lug z^2 and has secured to it a nut z^3. By turning the nut in one direction or the other the tension of the rope can be regulated and the amount of friction exerted by the drum and cable upon each other can be varied.

When the clutch w' w' is so shifted as to engage with the worm-wheel W, the worm U^4 will cause said wheel W to turn the shaft X, the bevel-wheels W^4 at this time turning loosely in the opposite direction. When the shaft is thus being turned with the wheel W, the drum X is also turned, and by means of the friction between the drum and cable the sliding part of the machine will be slowly advanced. If the clutch be shifted so as to be disengaged from the wheel W and engaged with the wheel W′, the power devices through the bevel-gearing will reverse the motion of the drum, which by this engagement with the cable will cause a backward motion of the sliding parts.

All of the above-described power devices, including the two trains of gearing that drive the wheels W W′, are continuously moving; but it will be seen that the said two trains of gearing move in opposite directions and with very different speeds, the advancing mechanism moving very slowly to allow the cutting to be properly effected, while the withdrawing devices move more rapidly in order to save time in drawing out the cutters and preparing for another operation.

By examining Fig. 10 it will be seen that those portions of the cable upon which the draft is exerted are arranged in a horizontal plane, they being preferably as near as possible in the plane along which is exerted the greatest strain experienced in moving the sliding part s. To accomplish this the axis of the drum is thrown up to the proper point, so that the cable approaches it on one side and runs away from it on the other side at points below it.

By employing a cable and drum of the character of those mentioned I can provide on the one hand for feeding by a practically-positive engagement between the carriage and the bed-frame and on the other hand for feeding by a non-positive engagement—that is to say, so feeding as to allow the cable to slip on the drum when the resistance to the cutters exceeds the desired degree.

When the parts are to be adjusted for the first manner of feeding, I take several turns (generally three or four) of the rope or cable around the drum and draw the ends of the cable tight, and under such an adjustment the engagement can be made practically as rigid as when use is made of racks and pinions or

screw-threaded bars; but when, on the other hand, it is desired to provide for a non-positive feed—that is to say, such a feeding that if the resistance becomes too great the advance of the carriage shall slacken—I take a fewer number of turns of the cable on the drum, (generally one or two only,) in which case there will be a slip of these parts relatively to each other when a strong resistance is experienced by the cutters. The same end can be largely attained by varying the tension under which the cable is held in place, such variation being permitted by having fasteners for one or both ends of the cable, such as above described, and shown at z' z^2 z^3.

It is desirable to have the chain-driving shaft L situated as low as possible, so that it can be arranged in or near the horizontal plane of the cutter-bar. I form slots A′ A′ in the vertical webs of the frame-bars A A and pass this shaft L through said slots, the latter giving a free path for the shaft. It projects to points outside of the frame-bars or bed and through, as aforesaid, sprockets T T, above described.

The speeds of the power devices and of the driving parts are so related that the shaft L is driven somewhat faster than the sprocket-sleeves are, and as a consequence the outer sprockets T T and the outer cutter-sleeves D D revolve faster than the inner. There may be variation in this respect, however—that is to say, the sleeves R and the inner cutter-sleeves D′ D′ may revolve faster than the outer parts, and substantially the same end will be accomplished; or the cutter-sleeves may be all driven with similar speed, if desired.

Between the carriers b' b' there is shown a supplemental carrier b^2 for the bearing-bar C, this carrier being secured to a cross-tie or bearing at the front end of the carriage. By the use of one or more supplemental carrying-bars of this sort the bearing-bar C can be of relatively small diameter and yet have sufficient strength, as it is strongly braced by such carriers in the direction required by the strain of the chains. I do not limit myself to the exact construction shown in this respect.

In order to readily cut a path for the teeth of the sprocket-wheels d d and the chains respectively engaging with said wheels, I provide each of said chains with cutters e of a suitable number. Generally there are four to each chain. The manner of securing them in place upon the chain is clearly illustrated in Figs. 12 and 13.

The carrier-arms b' b^2 are formed with chisel-edges or suitable cutting-edges on their front sides, so as to insure that they shall clear the path.

What I claim is—

1. In a mining machine, the combination of a stationary bed, a carriage moving longitudinally thereon, a series of vertically revolving cutters all mounted on a transverse axis and extending continuously across the front end of the carriage and projecting laterally from said axis, whereby they are adapted to be advanced into the material on lines transverse to its face, means for revolving one or more of said sets of cutters in one direction, and means for rotating one or more of said sets in the opposite direction, substantially as set forth.

2. In a mining machine, a series of vertically revolving cutters arranged along a common axis in two or more sets, the sets at the ends of the series being arranged to revolve together in one direction and one or more sets intermediate of the ends arranged to revolve in the opposite direction, substantially as set forth.

3. In a mining machine, a series of vertically revolving cutters arranged in sets along a common axis, of which sets, one or more revolve with one speed, and one or more with a different speed, substantially as set forth.

4. In a mining machine, a series of cutters arranged in sets, of which sets, one or more revolve in one direction with a relatively lower speed, and one or more revolve in the opposite direction with a relatively higher speed, substantially as set forth.

5. In a mining machine, a series of vertically revolving cutters arranged in sets along a common axis, of which sets, one or more revolve in one direction with a relatively slow speed and one or more revolve in the opposite direction with a relatively high speed, substantially as set forth.

6. In a mining machine, the combination with the bed, the carriage, the carriage moving devices, and the engine, of a series of tubular cutter carriers mounted on a common axis and actuated independently of each other, cutters on said carriers projecting transversely thereof and adapted to cut a kerf of dimensions adequate to receive the front part of the carriage, and supports on the front end of the carriage situated transversely of the axes of the cutter carriers, and lying between the adjacent ends of the carriers, substantially as set forth.

7. The combination with the sliding support or carriage, of the bearing bar secured to the said carriage, the revolving tubular cutter carriers situated outside of the said carriage and the tubular cutter carriers situated intermediately of those aforesaid, and on substantially the same axis as set forth.

8. The combination with the sliding support or carriage and the stationary bearing bar secured thereto, of the tubular cutter carriers mounted upon said support outside of the carriage and revolving with a relatively high speed in one direction, and the tubular cutter carriers mounted between the said parts of the carriage and on substantially the same axis as the aforesaid cutter carriers and revolving with a relatively slower speed, substantially as set forth.

9. The combination with the bed, the carriage sliding on said bed, and the longitudi-

nally stationary fixed bearing bar mounted transversely across the front end of the carriage, of the longitudinally stationary tubular cutter carriers mounted on said transversely arranged bar, the two carrier arms rigidly secured to the bearing bar, at points adjacent its ends whereby said bar is uniformly supported at both ends, and cutters on said tubular cutter carriers rotating continuously in the same vertical planes, and cutting a path for said carrier arms, substantially as set forth.

10. The combination with the bed, the sliding support or carriage, and the cutter carrying bar at the front end thereof stationary in lines longitudinal of its axis, of the carrier arms b' for said bar, one or more intermediate carrier arms b^2 between those at b, and cutters mounted on said bar between arms b' and arms b^2, and adapted to cut a kerf adequate to receive said arms b', and b^2, substantially as set forth.

11. In a mining machine the combination with the bed, a carriage sliding thereon, a prime power shaft on the carriage, a series of two or more independent cutter carriers, rotating on a common horizontal axis and extending across the front end of the carriage, and cutters projecting laterally therefrom, of two or more driving chains independent of each other for operating said cutter carriers and both receiving power from said prime power shaft, substantially as set forth.

12. In a mining machine, the combination with the bed, the carriage sliding on said bed, the series of two or more independent cutter carriers mounted, on a common axis, transversely across the front of the carriage, and the cutters projecting laterally therefrom and cutting a continuous kerf of dimensions adequate to receive the front end of the carriage, of two or more oppositely moving driving chains, independent of each other, for operating said cutter carriage, substantially as set forth.

13. The combination of the stationary bed, the carriage moving thereon, two or more vertically revolving independent cutter-carriers mounted on a common axis transversely of the carriage at its front end, the driving shaft L mounted horizontally across the carriage, the wheels T, T, the chains E, E, connecting said wheels with two of the aforesaid cutter carriers, the wheels S, S, loose on said shaft L, and intermediate of the wheels T, T, the chains E′ E′, connecting said wheels S, S, with one or more of the aforesaid cutter-carriers, the shaft I, the toothed gearing as at J, K, connecting said shafts I and L, and chains as at P also connecting the shafts I and L, substantially as set forth.

14. The combination of the stationary bed, the longitudinally moving carriage, the vertically rotating cutters on an axis transverse to the carriage at the front end, the chain driving shaft L, the oppositely moving wheels on said shaft, the chains E E′, the shaft I parallel to shaft L, the gearing connecting shaft I with one or more of the chain driving wheels on shaft L, and the chains or gearing connecting shaft I with the oppositely moving wheels on shaft L, substantially as set forth.

15. The combination with the series of tubular cutter carriers, the non rotating supporting bar for all of said carriers, and the shoes or bearers b, b', each secured to said bar between two adjacent cutter carriers, of the nuts which engage with both ends of the said bar and retain the series of carriers in place, the cutter carrier on each end of the bar being countersunk at its outer end to receive said nut, substantially as set forth.

16. The combination with a series of driving chains and the sprocket wheels which operate them, of the toothed gearing which rotates one or more of the said sprocket wheels in one direction and the chain gearing which rotates one or more of the other sprocket wheels in the opposite direction, and the shaft I parallel to the axis of the said sprocket wheels, and supporting said toothed gearing, and chain gearing, substantially as set forth.

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

BENJAMIN A. LEGG.

Witnesses:
JOHN J. BROPHY,
G. A. FAIRBANKS.