No. 684,356. Patented Oct. 8, 1901.

H. B. DIERDORFF.

MINING MACHINE.

(Application filed Feb. 26, 1894.)

(No Model.) 4 Sheets—Sheet 1.

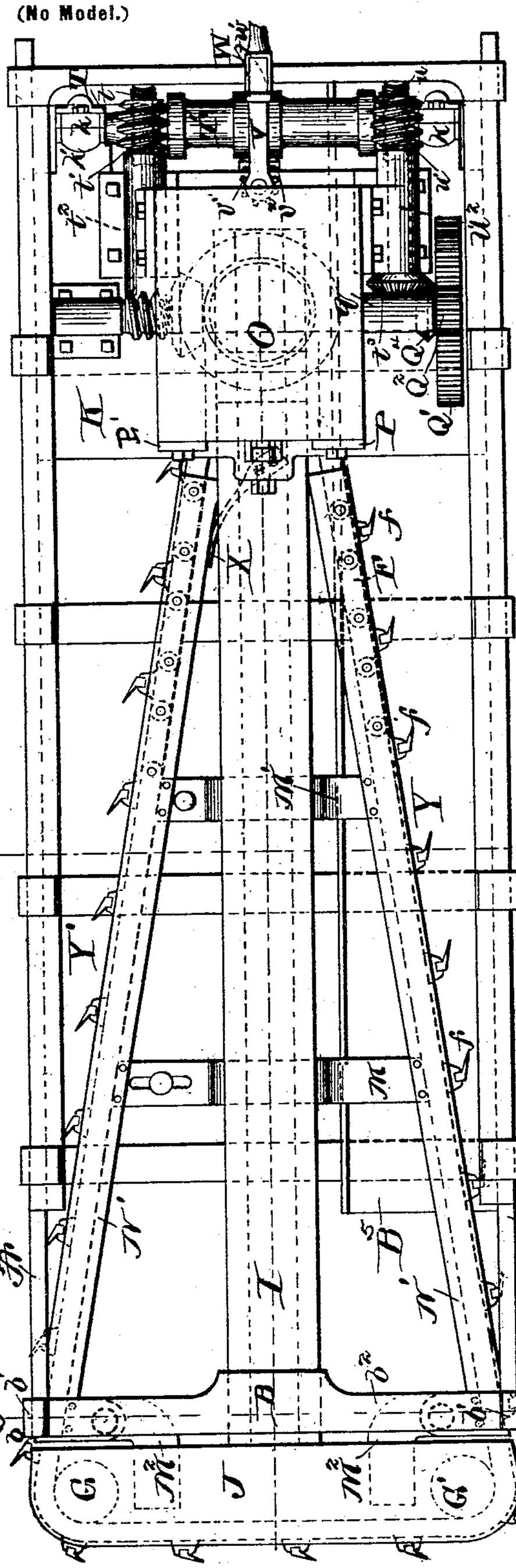

Fig. 1.

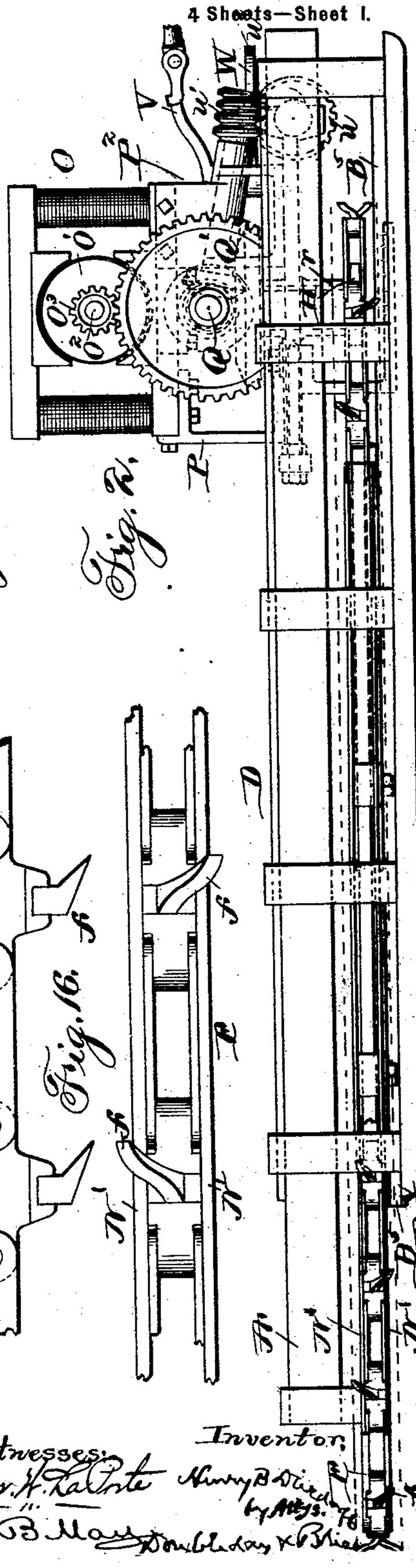

Fig. 2.

Fig. 16.

Witnesses:
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M. B. Mayo

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Henry B. Dierdorff
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No. 684,356. Patented Oct. 8, 1901.

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(No Model.) 4 Sheets—Sheet 2.

Fig. 3.

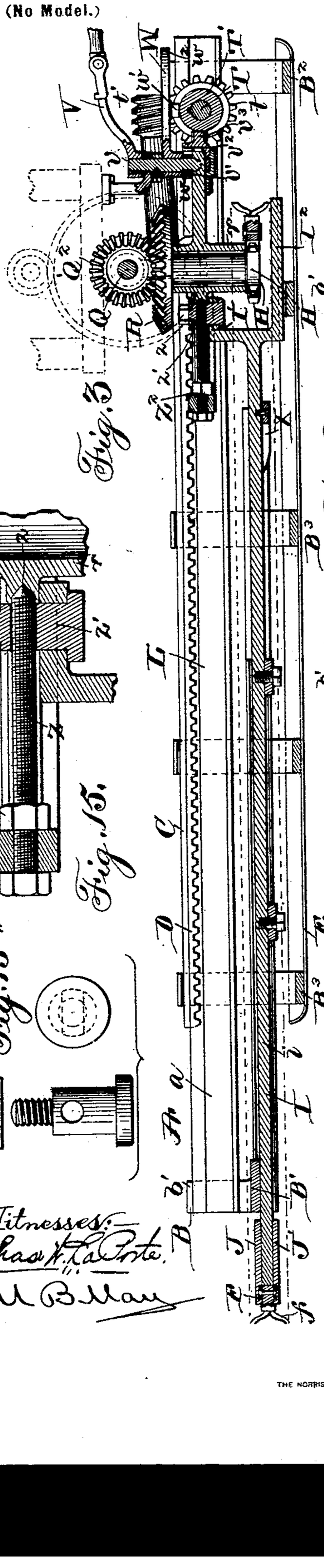

Fig. 4.

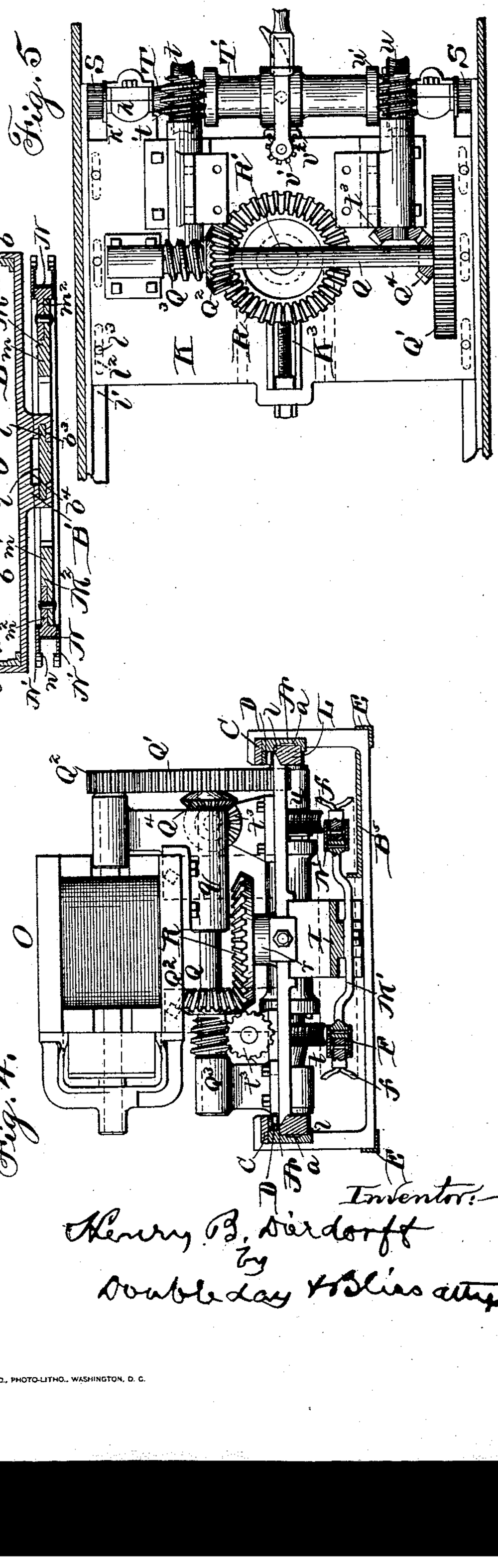

Fig. 5.

Fig. 6.

Fig. 15.

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No. 684,356. Patented Oct. 8, 1901.

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MINING MACHINE.

(Application filed Feb. 26, 1894.)

(No Model.) 4 Sheets—Sheet 3.

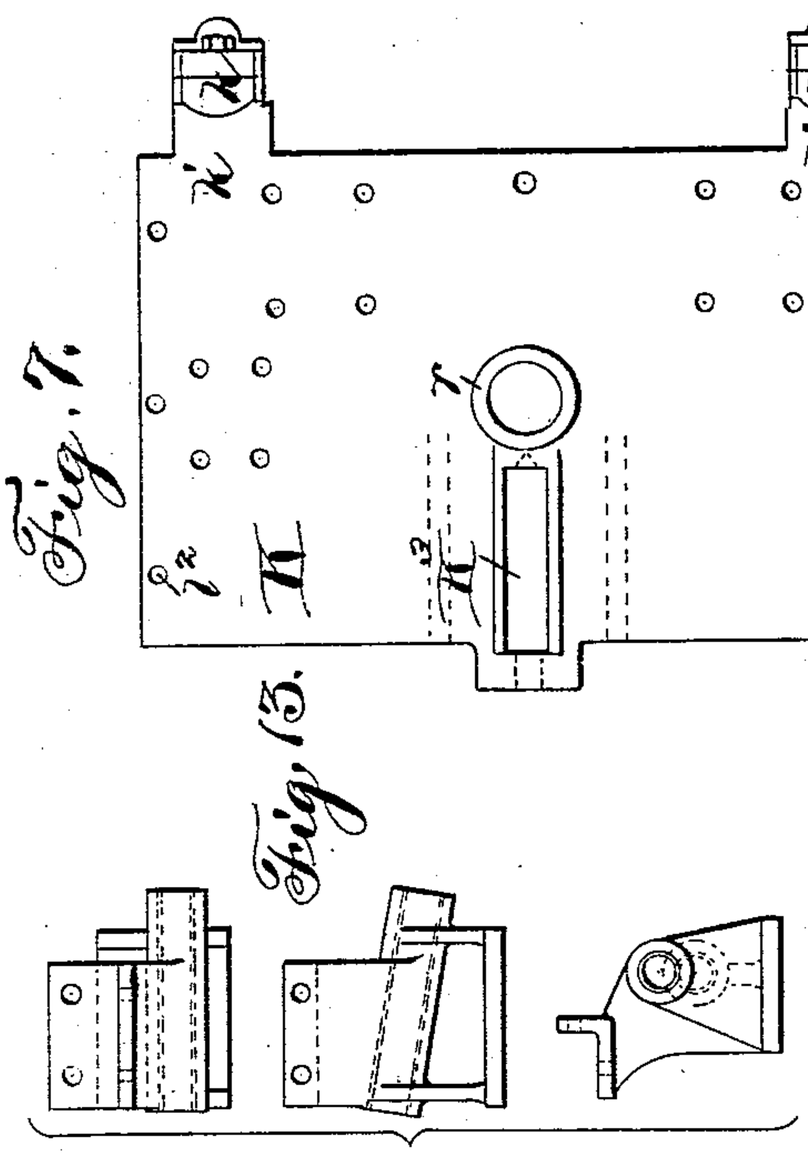

Fig. 7.

Fig. 13.

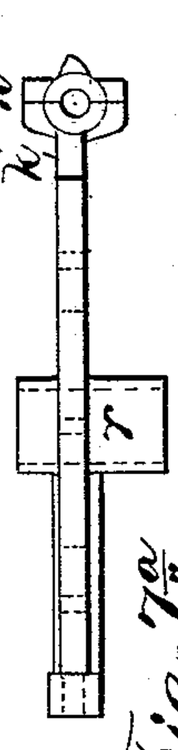

Fig. 14.

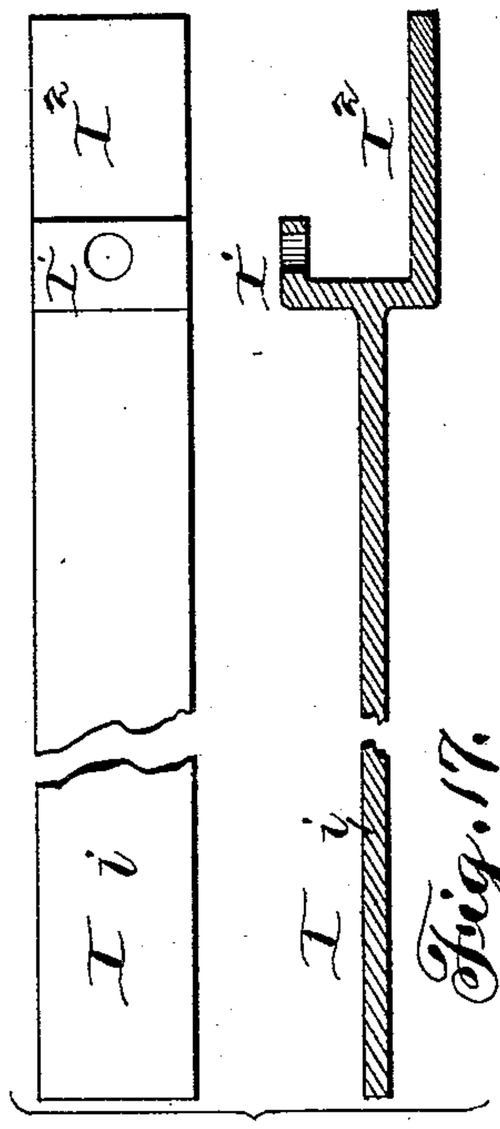

Fig. 17.

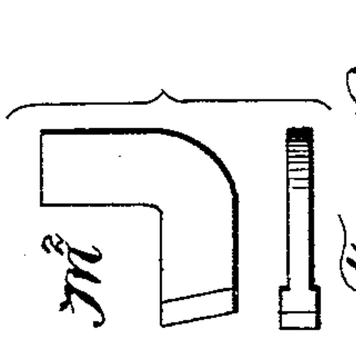

Fig. 18.

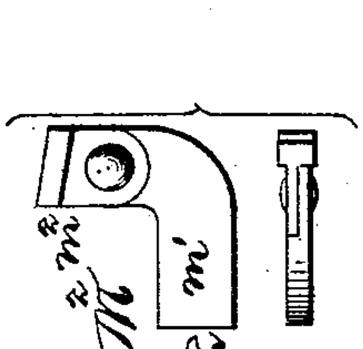

Fig. 12.

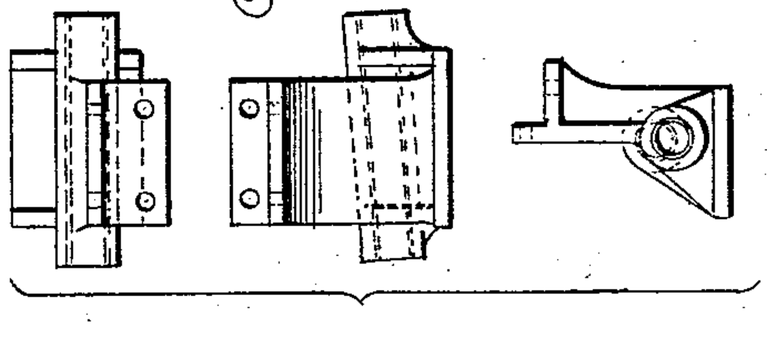

Fig. 15.

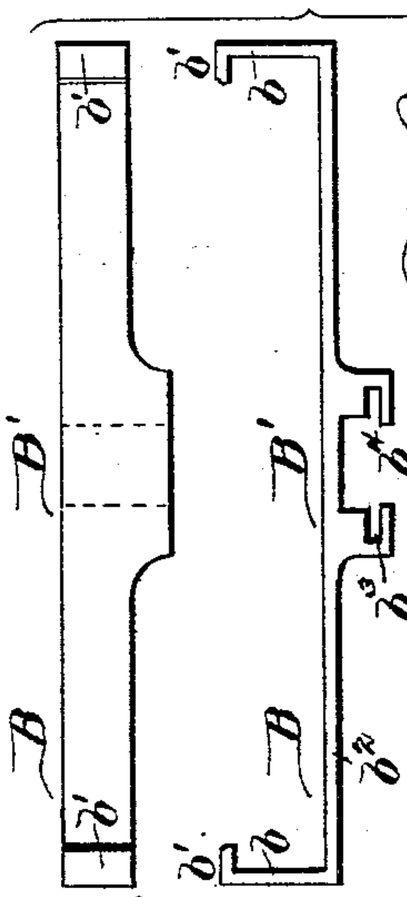

Fig. 8.

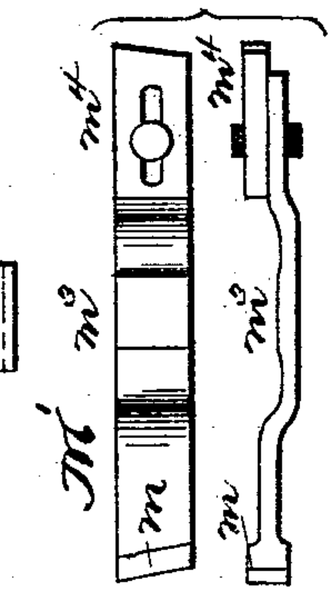

Fig. 11.

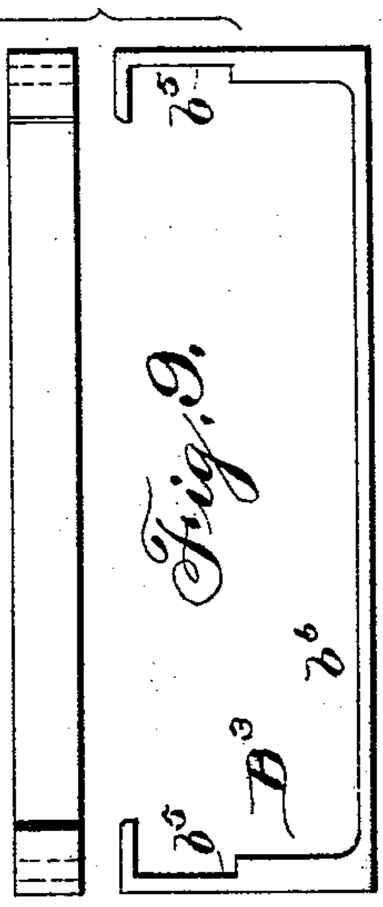

Fig. 9.

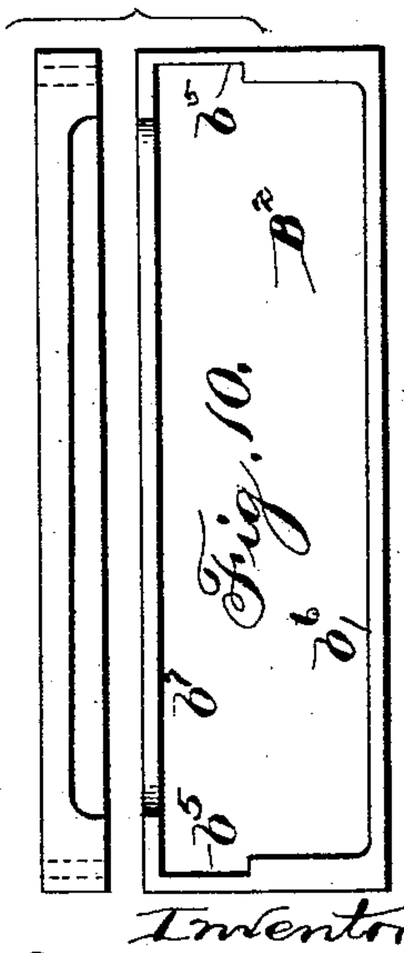

Fig. 10.

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No. 684,356. Patented Oct. 8, 1901.

H. B. DIERDORFF.

MINING MACHINE.

(Application filed Feb. 26, 1894.)

(No Model.) 4 Sheets—Sheet 4.

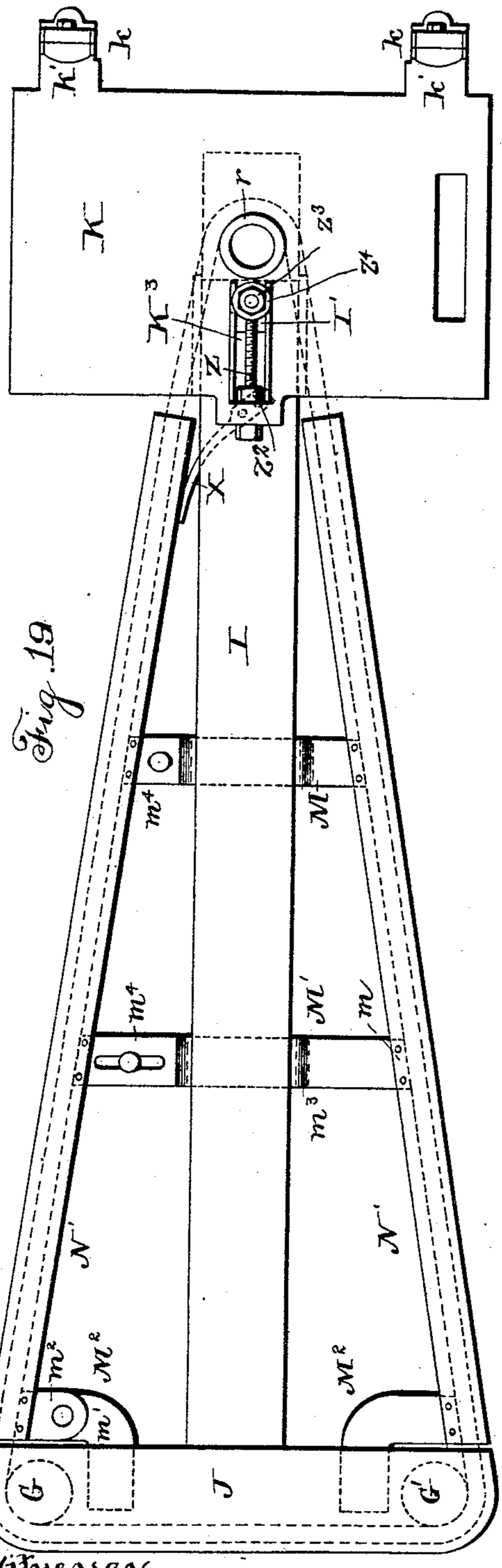

Fig. 19

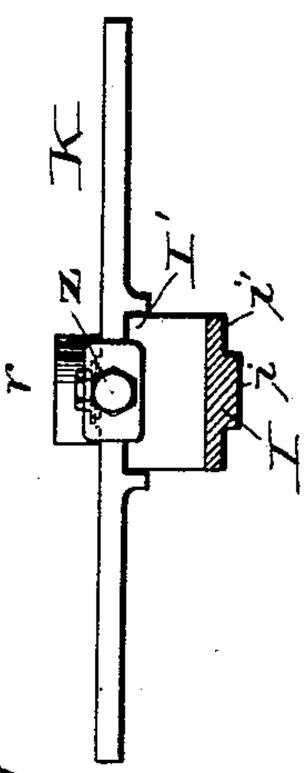

Fig. 21.

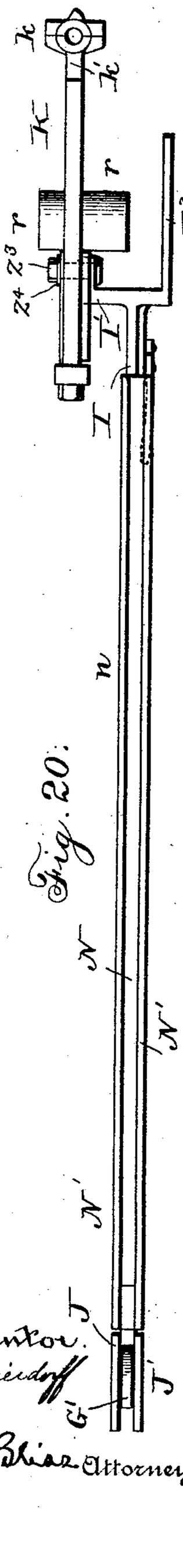

Fig. 20.

Witnesses
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UNITED STATES PATENT OFFICE.

HENRY B. DIERDORFF, OF COLUMBUS, OHIO, ASSIGNOR TO JOSEPH A. JEFFREY, OF SAME PLACE.

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 684,356, dated October 8, 1901.

Application filed February 26, 1894. Serial No. 501,584. (No model.)

To all whom it may concern:

Be it known that I, HENRY B. DIERDORFF, 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, (for which were granted by the Government of France Letters Patent No. 243,644, dated December 14, 1894, and British Letters Patent, No. 23,935 of 1894;) and I do 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, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

Figure 1 is a plan view of a machine embodying my improvements. Fig. 2 is a side elevation. Fig. 3 is a central longitudinal section. Fig. 4 is a cross-section on the line *x x*, Fig. 1. Fig. 5 is a plan of the carriage plate and shafting, the motor being removed. Fig. 6 is a cross-section of the bed-frame and carriage on line *y y*, Fig. 1. Fig. 7 is a top plan view, and Fig. 7ª is a side or edge view, of the carriage-plate. Fig. 8 shows in plan, in elevation, and in side view the front cross-piece of the bed-frame. Fig. 9 shows in plan and in elevation one of the intermediate cross parts or braces. Fig. 10 shows in plan and in elevation the rear cross-brace. Fig. 11 shows in plan and in elevation one of the cross-bars of the carriage-frame. Fig. 12 shows in plan and in edge view one of the parts of the carriage-frame at the front end. Fig. 13 shows in plan, in side view, and in end view the stand for the carriage-feed shaft. Fig. 14 gives similar views of the stand for the carriage pull-back shaft. Fig. 15 is a sectional view, on a larger scale, showing the devices for adjusting the rear carriage-plate, the driving-wheel, &c., relating to the front parts of the carriage. Fig. 15ª shows the bolt in detail. Fig. 16 shows one of the several forms of chain which may be used. Fig. 17 shows the longitudinal carriage-bar. Fig. 18 shows a modification in respect to the parts shown in Fig. 12. Fig. 19 is a plan of the motor-support and the chain-frame detached. Fig. 20 is a side view of the same. Fig. 21 is a cross-section on the line *v v* of Fig. 20.

In the drawings a bed-frame or main frame is shown which is adapted to be made temporarily stationary while the cutters are at work, but which can be moved every few minutes, if desired. This bed is made of side bars A A, which are flat and are arranged with their widest dimensions in vertical planes and are formed with grooves or channels *a a* on their inner faces. At the front ends these bars are joined together by a cross-brace or connecting device B, which is preferably forged or otherwise shaped to have the vertical parts *b* on the outside of bars A, the arms b' above them, and the inwardly-extending arms b^2. (See Figs. 6 and 8.) At the center of this cross-brace B there is a guideway and support B′ for the carriage, preferably consisting of a thick plate having grooves b^3 and a passage-way or slot b^4. At the rear end these bars are also rigidly braced or connected together by means of a housing or brace B^2, which is formed so as to receive the side bars A in chambers b^5 and has a bottom cross-connecting bar b^6 and a top cross-bar b^7.

At a suitable number of places between the front cross-brace B and the rear one at B^2 there are intermediate girths or braces B^3. Each of these has also recesses at b^5 to receive the side bars A of the bed and a bottom cross-bar b^6; but the upper parts are not joined together. It will be seen that the upwardly-projecting parts of the front cross-braces B and the intermediate ones B^3 are not joined together, as are those of the rear cross-bar B^2, openings being left for the passage of the carriage along the bed.

To the upper edges of the bars A there are secured plates C, which extend inward and support rack-bars D, which constitute one of the elements of the carriage-moving mechanism.

In order to slide the bed easily over the ground, (and this must be done every few minutes,) shoes E are provided, which are secured to the braces B′ B^2 and have rounded ends. (See Figs. 2, 3, and 4.)

To the bed-frame above described are fitted the parts which move forward and back thereon during the cutting operation.

The cutting is effected by means of an endless chain F, whose links of a suitable number are provided with cutters *f*. The chain

with respect to the details of its parts and of the cutters secured thereto may be of any suitable form. One is shown merely for the purpose of conventionally illustrating a complete machine. It passes around two main guide-wheels G G′, with or without others intermediate thereof, and around the driving-wheel H.

In many "chain-cutter" machines as heretofore constructed use has been made of four or more wheels for supporting or driving the chain, this in many cases being due to the fact that the frames (the carriage and the bed) were so constructed and arranged that this larger number of wheels was necessary in order to give the chain the proper direction. Another reason has been that when the parts were arranged as in the earlier machines it was necessary to have the backward-moving part of the chain travel on a line comparatively near a parallel line to the carriage-path in order to bring the slack and cuttings back along the outside of the bed. I have overcome the necessity of this larger number of wheels by so reorganizing the machine and so changing the relation of the bed and the carriage that the chain can move directly from a center drive-wheel forward to the wheel G and directly back from the wheel G′ in a simple triangular path, whereby power is economized, the chain-space is reduced, and the danger from the cutters on the rear part of the chain is obviated.

A high-speed and therefore light engine and a relatively high-speed gearing can be employed, and the power can be transmitted with great efficiency and economy, inasmuch as by the arrangement of the chain which I employ a small rapidly-rotating driving-wheel can be used, and nevertheless the chain can travel directly from it on straight lines to the guide-wheels on the front cross-head which are arranged so as to provide a cutting-line whose length is much greater than the diameter of the driving-sprocket at the apex of the triangle.

The carriage which supports the chain and the parts that drive it comprises a longitudinal bar or bars I, a cross bar or bars, as at J J′, and a rear plate or platform K. The cross-bars or plates J J′ may be of any suitable sort. As shown, there is one at the top and one at the bottom, with the wheels G G′ mounted between them and with the longitudinal bar I rigidly secured between them at their centers. This bar is shaped to have a thicker central part *i* and tongues or flanges *i′*, which are fitted to the aforesaid guide or guides B′ on the bed-frame. I have found that a single guide B′ is sufficient, the frames being so related to each other that the strains or thrusts shall be properly received and distributed. The carriage-plate K at the rear is adapted to slide on the bed-bars A, it being fitted to the grooves *a* or secured to wearing or bushing bars L, which are fitted therein. When such wearing strips or bars are employed, they are of about the same length as the carriage-plate or motor-platform and are secured thereto by bolts at l^3 in apertures l^2, adjustably or otherwise. The bars may be thicker or thinner, as occasion requires, and formed with seats at *l′*, though with respect to them there can be variation, and, as above said, the carriage-plate itself can be fitted directly to the grooves *a* in the bed. The main longitudinal bar I is secured to the plate K, it having at the rear a plate or extension I′, which lies against the under side of the plate K, and also having below the extension I′ a plate or extension I^2, for a purpose to be described. The plate K supports the engine or motor and the shafting and gearing which take power therefrom for driving the cutters and for moving the carriage forward and back.

In addition to the parts above mentioned as constituting the more essential elements of the carriage-frame—viz., those indicated by I, J, J′, K, and L—I prefer to employ also laterally-arranged bracing and strengthening devices, as follows: M M′ are transverse bars bolted to the main bar I and preferably of the form or shape shown in Fig. 11, each terminating in T-heads or flanges *m*. N N are inclined bars, which are bolted to the T's *m*, they lying parallel to and just inside of the chain and extending from near the front wheels G G′ to or nearly to the rear end of the bar I and the drive-wheel. At their front ends these inclined bars N are secured to carrier-bars M^2, which are fastened to the cross-plate J J′ and at their outer ends have T's or flanges for fastening to the bars N.

The parts just described, the cross-bars M M′ M^2, and the inclined bars N constitute a strong bracing-frame for the carriage and also provide an advantageous support and guide for the cutter-chains, as will be described more fully.

The motor is indicated by O, its armature O′ having a pinion O^3 on its shaft O^2.

The motor is supported upon brackets P P′ P^2. The field is raised somewhat from the carriage-plate K, so as to place operative parts below it.

Q is a shaft below and preferably parallel to the armature-shaft. It carries a large wheel Q′, driven by the armature, a bevel Q^2 for actuating the cutter-chain, a worm Q^3 for driving the carriage-feed mechanism, and a smaller bevel Q^4 for driving the pull-back or carriage-recede mechanism. It is mounted in a tubular bracket-bearing *q*, bolted to the under side of the motor, and in a stand *q′*, bolted to the plate K. The bevel-wheel Q^2 engages with a bevel-wheel R on a vertical shaft R′. This shaft is mounted in a tubular bearing *r*, extending partly above and partly below the plate K. To its lower end the main driving sprocket-wheel H is secured. When the armature is revolving, this wheel, through the parts above described, is rotated, and the cutter-chain will be driven through the path

provided by its guides. At the same time the cutting apparatus can be advanced into the coal, as the carriage can be moved forward by means of the aforesaid racks D and the pinions S, which engage with them. These are mounted on the cross-shaft T, which is mounted in bearings at k, held by rearward-extending arms k' of the carriage-plate K. The shaft T is provided with a clutch T', which is adapted to engage with a worm-wheel t, mounted loosely on the shaft. The wheel is rotated by a worm t' on the rear end of a short shaft t^2. This is driven by the aforesaid worm Q^3, which engages with a worm-wheel t^3 on shaft t^2. The parts indicated by Q^3, t^3, t^2, t', and t are rotating continuously, the wheel t having a relatively slow motion, which, with the clutch T', is in engagement when it is imparted to the pinions S, resulting in a slow forward movement of the carriage and the cutting apparatus. The part I' serves not only as a connecting device between the chain-frame and the motor carriage or platform and as a means to permit the longitudinal adjustment of said two parts, but also acts as a spacing device between them—that is to say, it holds the chain-frame at such a distance below the motor-support and the gearing and at such a distance above the parts below it that there shall be a free space above and below the chain-frame and the driving sprocket-wheel, whereby the chain can have long upwardly-projecting and downward-projecting cutters which will revolve free without striking any of the relatively stationary parts. The guide for the chain-frame is thus placed below the upper guide for the motor, platform, and the heavily-strained parts are thus brought near to the ground, so that the jars and vibrations are reduced to the minimum and are received by the strongest part of the bed. In this respect the machine differs radically from the earlier ones, such as are illustrated in Patents No. 428,920, dated May 27, 1890, and No. 340,791, dated April 27, 1886, and others, in which the thrust-bars of the chain-frame had to be deflected at points near their rear ends—that is to say, had to be turned downward—the effect being that the cutter-chain was thrown relatively higher and not lower, as in the present case, so that it could be brought near the ground plane. As is well known, it is desirable to cut the coal as close as possible to the bottom, so that there will be but little "bench" left to require hand-digging subsequently. Another important advantage arising from placing the chain-frame relatively lower than the motor frame or platform is that I can drop, relatively, the carriage-feeding mechanism—in fact, can utilize what I prefer as carriage-moving devices—namely, the downwardly-turned tracks on the bed and pinions on the carriage—and can bring them relatively near the horizontal planes of the thrust of the chain-frame in contradistinction from the relatively-elevated screw shafts and nuts which have been generally used in machines of this class heretofore.

By moving the clutch over into engagement with a wheel u the carriage can be drawn back. This wheel u revolves oppositely to the wheel t and with a faster speed. It is rotated by a worm u', secured to a shaft u^2, which at its front end carries a bevel-wheel u^3, which engages with the aforesaid bevel Q^4 on the shaft Q. The last said parts—viz., those indicated by u^3, u^2, u', and u—are also in continuous motion and are therefore ready at any instant to actuate the carriage mechanism to recede the cutters. The clutch has a position intermediate between the wheels t and u, where it is out of engagement with either and is therefore inactive, and when it is in such position the carriage is at rest. The wheel u is rotated much more rapidly than the wheel t, and therefore the carriage is brought back at a much higher speed than that by which it is advanced. The clutch is moved by means of a lever V, which is secured to a shaft v, the latter at its lower end having a pinion v', which engages with a rack-plate v^2, and the latter carries a pin v^3, which rides in the groove of the clutch, so that when the lever is moved in one direction or the other the power imparted to it is multiple and is transmitted from the part v^3 to the clutch. The clutch can also be automatically moved away from wheel u by means of a loose lever-arm W, pivoted at w and having a pin w', which fits in the clutch-groove. The rear end w^2 is cam-shaped and is adapted to impinge on a stationary cam on bed-bar, which is so related that it swings the lever W just far enough to throw the clutch away from wheel u and away from its inactive position, after which the carriage will remain at rest.

It will be seen that I have so arranged the parts that the cutters travel in a path parallel to the lines of the advance of the carriage as a whole, it differing in this respect from those machines heretofore formed in which the chain rotated in a plane inclined to the plane of the carriage-path. Many advantages are incident to such an arrangement, as is well known.

I am not aware of any earlier machine having in combination a cutter-chain horizontal throughout its entire length, a chain-supporting frame having a thrust-bar, whose central horizontal plane is coincident with that of the chain, together with a bed-frame for guiding the chain-frame which surrounds the chain on its outer side and underneath or together with a guide for the chain-frame of the character of that herein. In any earlier machine within my knowledge either the chain traveled in a path partly in one horizontal plane and partly in another or required four or more guide-wheels or required an undesirably large driving sprocket-wheel or the thrusting-bars of the carriage were so arranged as not to be coincident horizontally

with the chain itself. I apply the advancing or thrusting force on the central horizontal planes of the chain at the front, and therefore apply it uniformly, as the thrusting-bars are coincident with the chain. By having the chain horizontal throughout its length I insure that the cutters shall enter the kerf on lines parallel to its top and bottom walls and avoid the dragging of the cutters upon said walls, which results if there is the least inclination of the chain at any point. One of the matters which conduce to this arrangement of a chain which has upwardly and downwardly projecting cutters is that I have two independent guideways on the bed—one for the chain-frame part of the carriage and the other for the motor-support, the former being relatively low and the latter being relatively high, with a considerable space vertically between them, so that although the bed-frame encircles or houses the cutter-chain and although the latter moves into and out from the bed at the rate of three hundred feet a minute, there is ample room for the diverging cutters not only vertically but horizontally. The carriage-feed devices are in the planes of and engage with that part of the bed which carries or supports the upper guideway, and therefore apply their force near the horizontal plane of the power-platform and prevent cramping.

It will also be seen that when the carriage is in its rear position that part of the chain which is behind the front end of the bed lies between the outside lines of the bed. There is no danger of accident to the operators, such as is incident to those machines in which the chains lie more or less outside of the side lines of the bed.

In the present machine the ground-support or bed-frame is arranged to encircle and inclose the chain, (not to be encircled by the chain,) the vertical parts b^8 of this bed being outside of the path of the chain at all times and extending downward across the horizontal planes of the chain. Thus the cutters are housed or surrounded by a rigid protection and are thrust forward and supported on lines at the longitudinal center of the machine. The center support of the chain-frame lies between the stationary guide plates or lugs on the bed, in contradistinction from those earlier constructions in which the guiding-bars of the carriage were on the outside of or straddled a standard on the bed. The guide plates or lugs in the present construction are relatively thin on transverse lines, but can be elongated to provide a powerful support without consuming space laterally. Consequently the rear or contracted portion of the chain-triangle can be brought up close to the front end of the bed, so that its full length can be economized—a matter of the utmost importance in these machines.

I believe the present machine to be the first one having the parts so related that cross-braces could be employed on the chain-frame extending from the path of the chain on one side to its path on the other side or across the central longitudinal plane of the machine. In the earlier machines employing longitudinal carriage-bars considerably remote from each other and straddling a central standard at the front of the bed it was impossible to use such cross-braces, inasmuch as they would have impinged upon the said stationary standard. In the present case cross-bars can be used at points in front of the power-platform and yet not impinge upon the front guide-lugs on the bed, the braces moving in such horizontal planes as to pass freely across the vertical lines of the lugs. As shown, these braces pass under the guide-lugs B′, but of course there can be variation in this respect.

It will also be seen that by arranging the chain in the way in which I have shown—that is to say, upon the three sides of a centrally-disposed triangle—I am able to provide it with a guide or holder throughout the greater part of its path, the above-described guide parts at N extending to points in rear of the midway transverse line between the wheel at H and those at G G′. To those practically acquainted with the operation of these chain machines it is well known that one of the principal difficulties and objections arises from the fact that the chains are unsupported over the greater portions of their side paths. The chain on the inward-moving side Y, Fig. 1, is exceedingly taut, this being the draft side, while on the other, Y′, Fig. 1, it is loose and slack. The slackness is not only unavoidable, because of the wear and stretch and strain and the expansion and contraction due to their becoming highly heated after being set in motion and at work, but is also largely necessary in order that the links, which are large in order to be strong, may move properly around the several curves, sprocket-teeth, &c., in their path. The length of that part of the chain along the side Y′, Fig. 1, is from seven to nine feet, and therefore the slack part of it is whipped and jerked violently through wide vibrations, as each link can be considered as traveling often three hundred lineal feet per minute. The results are disastrous to the machine. The whipping and vibrating of the chain speedily results in loosening the parts, it being well known that the chains of these chain-cutting machines are difficult to keep in working order. The chain itself is rapidly worn and prepared for breakage. A large percentage of the power is lost in these detrimental motions of the chain-links, and when they come to the front guides (in some earlier machines extending only a few inches back from the cross-plates at J J′) they do so with a jerk, being instantly stopped in their vibrations. I have succeeded in obviating these difficulties by providing, as aforesaid, a support and guide for the chain-links which extends back beyond the aforesaid midway transverse line and preferably to or nearly to the drive-

wheel H, so that the unsupported part of the chain on the slack side is so reduced that whipping and lateral jerking are prevented, and then, in order to provide for the presence of more or less slack arising from any cause, I furnish means which compensate for it without depriving the chain of its folding guide.

N′ N′ are top and bottom supporting and guiding plates secured to those at N, above described. They are turned down at their outer edges or are so shaped as to provide ribs *n*, which lie in front of the chain-links and prevent them from flying out. As concerns their being parts of the chain-frame and their bracing and strengthening said frame, it is not essential that these bars N N′ should be situated on precisely the lines illustrated; but such arrangement is preferable where they are to serve both functions as chain-guide and as parts of the chain-frame.

I believe myself to be the first to have constructed a front-thrust mining-machine with an endless cutting-chain, having the chain arranged in a triangular path, together with a substantially triangular frame, around which the chain travels and by which it is supported vertically, in combination with a guide on the bed for the traveling frame, which engages with it at points inside of the triangular space surrounded by the chain.

On that side of the machine where the chain is slack the supports for the guides N N′, which in the construction shown are the bracing-bars M M′ M^2, have some details of construction additional to those above described. The front bar M^2 is made in such way that the forward end of the chain-guide can have a pivotal connection. As shown, it is formed in two parts m' m^2, hinged or pivoted together, guide N being fastened to the movable part m^2. The bars or braces M M′ are also formed in two parts, as at m^3 m^4, which are secured together in such way that one can slide somewhat relatively to the other. The sliding part is secured to the chain-guide and can move outward with it when required. Such outward movement is caused by a spring X, which may be of any suitable character. As shown, a flat spring is placed between the rear end of the guide-bar N and the side of the longitudinal bar I. When the chain from any cause becomes slack, the spring immediately asserts itself and pushes outward the guide far enough to keep it properly taut. When the chain is again tightened, as by contraction or when an adjustment is made, the spring is compressed and the links brought more nearly in line. The rear end of the guide-passage formed by the parts N N′ N′ is preferably expanded or flared, as by bending the parts forming it, so that in whatever position it may be the links may smoothly and readily enter.

The side parts of the triangular frame are not shown as extending entirely to the rear drive-wheel, but they are of such length as to constitute, in effect, a frame of that shape and character. The cross-braces M and M′ hold the side parts of the frame firmly in their desired positions, and by having the front guide at B′ "underhung" or extending downward from the main frame, with a free and unobstructed passage-way between it and the ground, these cross-bars of the triangular frame can readily pass under the guide; but all of the features of the mechanism are not limited to having this front guide underhung or downwardly depending, as it can be otherwise disposed in lighter machines, in which the triangular frame omits the cross-bars M M′.

An adjustment of the chain-frame such as was just referred to can be made by means of the devices shown in Figs. 3, 5, and 15.

To move the carriage-plate or motor-platform relative to the chain-frame, I employ the adjusting-screw Z. It is mounted in the slotted or recessed part of the plate K, as shown at K^3. Its end is seated at *z* and bears backward against the plate, its thread engaging with a nut at *z*′, which is supported on the rear end of the main longitudinal carriage-bar I. z^2 is a jam-nut by which the screw Z can be tightly fastened after adjustment. It will be seen that if the jam-nut z^2 is loosened the plate K can be pushed back relatively to the bar I and the front wheels G G′ by turning the screw Z. Such backward moving of the plate K results in a tightening of the chain F, and an adjustment is frequently required to compensate for the wearing and lengthening of the chain, although for the reasons above set forth it is not advisable to set the plate K and the bar I in such way as to hold the chain perfectly taut, as allowance must be made for contraction and expansion. The nut *z*′ is held in the carriage-plate in such way that it can be loosened, there being an aperture in the part I′ to receive it. It is shown as being inserted into a carrier or supporting-sleeve, to which it may be secured by thread or otherwise. At the upper end it is threaded, and to it are fitted a nut z^3 and a washer z^4. At the lower end of the nut or its sleeve there is a head or flange engaging upwardly with the plate I′. After the power-platform and the chain-frame have been adjusted they can be securely clamped by these devices, as the nut z^3 and the washer z^4 are bound tightly against the platform, while the head or flange below the plate I′ is drawn as tightly upward, and thus the strain can be taken off from the adjusting-screw Z and the jam-nut z^2. The nut z^2 and the head of the screw serve to hold the screw against longitudinal displacement, and it will be seen that the nut z^2 can be dispensed with or be of the nature of a mere stop, as the important function is performed by means of the screw and the nut or threaded part *z*′, and it will also be seen that so far as concerns the performing of this function the details of the parts at *z*′ and the surrounding sleeve can be modified. They are practically unitary. Primarily the pressure is exerted by the screw bear-

ing in one direction against the motor-support and bearing in the other direction against the chain-frame, and the threads take this pressure. This under many circumstances would be sufficient; but I prefer to supplement the holding action of the screw-threads by an additional holder, so that the jars and vibrations shall not turn the screw and so that the latter shall be relieved of much of the reactionary strain, and this supplemental holding is attained by the clamp devices which fasten the nut z' independently of the screw. Again, the screw and nut can be relieved of strain by having the rear part of the chain-frame provided with guide-ribs or bracing-bars, such as shown in dotted lines in Fig. 7 and in elevation in Figs. 7^a and 15 and in front view in Fig. 21. In this respect the machine differs materially from the earlier ones employing front-thrust cutter-chains. Heretofore the parts were so arranged that two sets of adjusting devices were necessary between the chain-frame and the plate or platform which supported the power mechanism, and these two sets of adjusting devices were placed one at one side of the carriage and the other at the other side. Now the power-platform in these machines is always substantially rectangular in form—at least has a bearing on the bed at two or more points on each side. The back pressure and torsional strain on the chain-frame are constantly varying as concerns the two sides, and it is difficult to obtain or preserve an adjustment which is uniform across the carriage when two sets of adjusting devices are employed, as heretofore; but in the present machine the back thrusts and torsional strains are all transmitted to one point or small area, and that, too, preferably in the central vertical longitudinal planes of the carriage, and but one adjusting device is required, and consequently the power-platform can always remain in the guideways without torsion or cramping therein, and the draft or tension of the chain can be regulated at the point where it is transmitted to the carriage-plate by said single adjusting device. A guideway having the flanged lips above described, it will be seen, continues around the front end as well as at the sides. I do not, however, claim such lips or flanges, broadly, as of my invention, as I am aware that flights or guideways of this general character have been heretofore used, as is illustrated in British Patents No. 906 of 1869 and No. 1,890 of 1875. As above seen, in machines heretofore used having cutters of this character the slack and cuttings have been drawn backward along the outside of the side bars of the bed. A very large amount of such slack is drawn out at each cut—enough, in fact, to largely cover the operative parts of the machine unless it is properly disposed of before getting among such parts.

Having reorganized the machine in the respects above described and having reduced the chain-wheels to three, so that it moves to the center of the carriage and back therefrom, there is a consequent inward carrying of the slack on the side at Y; but I provide for the ready disposal thereof by employing the cross brace-bars b^6 of the bed and supporting thereon a continuous floor at B^5, upon which the slack is received. From this it is readily removed, either by an automatically-acting carrier or by a hand-tool, such as a scraper or shovel of the sort commonly in use for removing the slack from the machines of other type. One operative stands at the motor to control its movements, and he can readily withdraw the cuttings that are deposited on the floor B^5 before they accumulate so as to interfere or injure the machine; but I do not limit the other features of invention to this detail of the structure, as the slack can, if preferred, be removed by hand, there being under each or both of the front corners of the machine (see Figs. 2 and 3) an open space permitting an operative to remove the slack by hand.

I am aware of the fact that chain-cutting machines have been made or proposed in which the main frame rested upon ground wheels or shoes only at the rear end and at the front end, as is shown, for example, in Patent No. 482,046 to B. A. Legg, the carriage having longitudinal bars between the side of the bed-bars, which longitudinal bars slide in supports that depend from the front ends of the bed-bars and the front shoe extending down from the depending cross-bar to the ground-line, the machine having no support intermediate of the front and rear shoes or rollers. In fact, there could not be introduced such support, because of the arrangement of the cutter-chain, which, as aforesaid, is extended out from the driving-wheel at an obtuse angle to two idlers near the rear end, and then extending from said idlers in such way as to have the cutters travel from the idlers on lines entirely outside of the bed-frame to the front guide-wheels. Such outward extension of the chains to lines outside of the bed prevents the employment of side shoes or supports, as the chain-carrying parts depend downward to planes below the longitudinal parts of the bed.

In my construction I bring the cutter-chains, as aforesaid, inside of the lines of the bed-bars, and therefore am enabled to give a firm and solid support to the machine from end to end. Moreover, I can dispense with the ground-support, whether shoe or roller, below the front ends of the bed-bars.

While I herein at times refer to this machine as having a single central thrusting and guiding bar, it will of course be understood that I do not thereby merely mean a single piece of metal, as substantially the same novel features of construction and arrangement can be attained if there be modification in this respect. The essential feature to note is that with respect to the central vertical longitudinal planes of the ma-

chine there is a guide and support for the chain-frame which lies between and does not straddle the bed-guide at the front, which guide in this instance consists of the lugs or bars outside of the central part of the chain-frame. It is now well-known to mechanics that for obtaining lightness or other purposes a small bar could be duplicated or separated into two parts joined or not by cross-braces, and though I herein make no specific claim therefor I regard such a bar or frame as substantially similar to that herein as concerns the front guideway, the bringing of the chain back from the cross-head to the drive-wheel on the sides of a triangle, and the avoidance of rear chain-deflecting guides, and with respect to the other details incident to the particular machine illustrated it is to be understood that while I have described them fully and also the several advantages incident to their construction and arrangement in the illustrated machine, specifically considered, I do not limit the features of invention to exactly such details, for it will readily be seen that the novel matters of construction and arrangement can be applied otherwise than in a machine of this specific form.

What I claim is—

1. In a front-thrust undercutting mining-machine the combination of a reciprocating carriage, the cutter-chain mounted thereon to cut transversely to the path of the carriage, and the stationary bed having longitudinal side bars arranged outside of and above the backward-moving part and the forward-moving part of the chain, and having downwardly-extending guard bars or plates situated in vertical lines outside of and transversely opposite to the space included within the path of the cutter-points and secured to the said upper longitudinal side bars, substantially as and for the purposes set forth.

2. In a front-thrust undercutting mining-machine the combination with the carriage, and the cutter-chain arranged to cut at the front of the carriage on a line transverse to its path and extending back toward the rear end of the carriage, of the bed-frame having vertical bars extending downward across the horizontal plane of the chain at points in front of the rear end of the chain-support and situated in vertical lines outside of and transversely opposite to the space included within the path of the cutter-points, and longitudinal bars above the chain engaging with the carriage, and connected to the said vertical bars, substantially as set forth.

3. In a front-thrust mining-machine the combination of the carriage, the chain thereon arranged to cut across the front end of the carriage and on a line transverse to its path, and the bed having longitudinal carriage-moving side bars above the chain and vertical bars extending downward across the horizontal plane of the chain to support the bed from the ground, said vertical bars being situated between the front and the rear ends of the travel of the chain-support and on vertical lines outside of and transversely opposite to the path described by the cutter-points, substantially as set forth.

4. In a front-thrust mining-machine the combination of the carriage, the chain thereon moving across the front of the carriage and extending to a drive-wheel at the rear of the carriage, and the bed having longitudinal bars above the chain and outside of the backward-moving and forward-moving parts of the chain and vertical bars extending downward across the horizontal plane of the chain and situated in vertical lines outside of the path described by the cutter-points and on transverse lines between the front end and the rear end of the travel of the said rear chain-wheel, and cross-bars resting on the ground under the chain and secured to said outside vertical bars, as set forth.

5. In a front-thrust mining-machine the combination of the carriage, the cutter-chain mounted thereon to cut across the front on a line transverse to the path of the carriage, and extending back to a rear wheel at the rear of the carriage, and the bed having the longitudinal side bars above the chain and outside of the backward-moving and the forward-moving parts of the chain and the vertical bars extending across the plane of the chain in vertical lines outside of the path described by the cutter-points, and the shoes extending parallel to the aforesaid upper side bars and secured to the lower ends of the vertical bars, substantially as set forth.

6. In a front-thrust mining-machine the combination of the reciprocating carriage having a chain-supporting frame with a horizontally-arranged thrusting-bar, the cutting-chain supported thereon in a horizontal plane and extending back to a rear chain-wheel at the rear of the carriage, and the bed having the longitudinal side bars above the chain and outside of the rearward-moving and the forward-moving parts of the chain, and the downward-extending supporting-bars between the rear and the front ends of the travel of the rear chain-wheel and crossing the plane of the chain on vertical lines outside of the path described by the cutter-points to provide a support from the ground and a shield for said points, substantially as set forth.

7. In a front-thrust mining-machine the combination of the carriage, the cutter-chain supported thereon in a horizontal plane throughout its length and arranged to extend from the wheel G at one end of the cutter to the wheel G′ at the other end, and to extend from the said wheels on substantially straight lines to the driving-wheel H on the carriage, and the bed having its longitudinal parts situated outside of the rearward-moving and forward-moving parts of the chain and having vertically-arranged ground support-bars out-

side of and transversely opposite to the side parts of the chain whereby the distance between the wheels G and G′ can be much greater than the diameter of the driving-wheel, and the inwardly-inclined side parts of the chain can be freely advanced without impinging on the ground-supports, substantially as set forth.

8. In a mining-machine, the combination of a carriage having a chain-guiding cross-head with wheels G G′, a bed having on each side a carriage-moving bar, and a guide on the bed for the rear end of the carriage, a continuously-acting guide on the bed for the front end of the carriage situated on longitudinal lines other than those of the said rear guide, the power devices engaging with the carriage and with said bars on the bed for advancing the carriage, and a chain on the carriage arranged to move from the wheel G at one end of the guide to the wheel G′ at the other end and extending directly backward from the said wheels to the driving-wheel, whereby it follows a triangular path arranged centrally relatively to the said carriage-moving bars on the bed, substantially as set forth.

9. In a front-thrust chain-cutter mining-machine, the combination of the bed, the carriage reciprocating thereon and having the thrust-bar on the central longitudinal lines of the carriage, the rear driving sprocket-wheel, and the front cross-head provided with the wheels G G′, the cutter-chain mounted on the carriage in a horizontal plane and extending from said front wheels G G′ back to said rear driving-wheel, the support having the flanged guideway for those parts of the chain between the rear wheel and the front wheels, and cross-braces or frame-bars extending across the central vertical plane of the carriage from one side guideway to the other, substantially as set forth.

10. In a front-thrust chain-cutter mining-machine, the combination with the bed-frame having shoes or ground-supports extending along the sides, the front end of said bed-frame extending forward from said shoes and overhanging them, whereby there is provided a free space between said front end of the bed and the ground, a guide depending from said overhanging front end of the bed, the carriage having its rear end supported on the bed and being at the front supported on said depending guides at the front of the bed, and the chain mounted on the carriage in a horizontal plane parallel to the path of the carriage, substantially as set forth.

11. In a mining-machine, the combination of the endless-chain cutter arranged to cut at the front of the machine and moving in a triangular path, the bed-frame, the sliding chain-frame having a front cross-head and side bars lying on the sides of the triangle followed by the chain and inclined backward and inward, and extending continuously from the front cross-head to points near the rear apex of said triangle, a rear driving sprocket-wheel at the rear apex of said triangle, a guide for the said chain-frame having a longitudinal bar extending from said apex to said cross-head, and arranged substantially as set forth to lie between the converging side bars without interfering with the triangular path of the chain, and a stationary guide on the bed engaging with the said guide-bar on the carriage, as described.

12. In a mining-machine, the combination of the bed, the endless cutter-chain arranged to travel around the sides of a triangle, a carriage having an approximately triangular chain-supporting frame, a relatively small driving sprocket-wheel at the rear apex of the triangle, a cross cutter-head at the front elongated to points outside of the longitudinal lines of the bed-bars, guide-wheels on the cross-head outside of the bed-bars and at the front angles of the triangle, two vertically-arranged plates or projections secured to the front of the bed-frame to form a guideway and situated in the space surrounded by the chain, a guide bar or carrier for the chain-support placed in the central longitudinal vertical planes of the machine and moving between the said guide plates or projections on the bed, and a chain-guide connected to the central part of the chain-frame inclined from the front cutter-head inward toward the chain-frame, substantially as set forth.

13. In a mining-machine, the combination of the endless-chain cutter arranged to act at the front of the machine, the bed-frame, the sliding chain-frame having a front cross-head, inwardly and rearwardly inclined bars at the sides adjacent to the lines of the side parts of the chain, a longitudinal bar between the said side bars, and braces or bars connecting the rear ends of the inclined bars to the bar between them, a vertical lug or guide-bar on the bed between one of the inclined side bars and the central bar, and a supplemental vertical guide lug or bar on the bed between the other inclined side bar and the central bar, substantially as set forth.

14. In a chain-cutter mining-machine, the combination of the cross-head, the central longitudinal traveling bar or carrier for the cross-head, the cutter-chain supported on said cross-head and carrier, vertical lugs or guides on the bed, one on one outer side of the central bar or carrier, and the other on the other outer side thereof, inwardly and rearwardly inclined bars, one outside of each of said vertical lugs or guide-bars, and means for connecting each of the inclined side bars to the central bar or carrier, substantially as set forth.

15. In a mining-machine, the combination of the bed-frame, the cutter-chain, two vertically-arranged guiding plates or projections secured to the bed at the front thereof, and a chain-frame having a cross-head, a longitudinal thrust and guiding bar or carrier on the central longitudinal lines of the machine and lying between the aforesaid guiding plates or projections, and two inclined

bars one on each side of the central bar or carrier and connected thereto at or near their rear ends and connected at their front ends to the cross-head, substantially as set forth.

16. In a mining-machine, the combination of an endless chain having cutters attached, a bed-frame, a front guide on the bed for the chain-frame, power shafting and gearing, a movable carriage having a platform or frame supporting said shafting and gearing, and having a chain-support consisting of a front cross-head, a series of inclined and longitudinally-arranged bars extending back from the cross-head, and transversely-arranged bars, said inclined longitudinal and transverse bars forming a frame which, at lines between the said front guide and the platform or frame for the shafting and gearing, extends continuously across the central vertical longitudinal planes of the machine, the aforesaid guide and the said frame being arranged substantially as set forth relatively to each other, whereby the carriage can move over its predetermined path without impingement upon the bed by the transverse parts which travel in the said central vertical planes.

17. In a mining-machine, the combination of a cutter-chain having cutters attached, the bed-frame, power shafting and gearing, a movable carriage supporting said shafting and gearing and having a chain-support consisting of a front cross-head, an approximately central longitudinal bar extending back from the cross-head, inward-inclined bars immediately inside of the chain and extending back from the cross-head, and transverse bars connecting the inclined bars to the central carrier, and the guide on the bed for the chain-carrier arranged substantially as set forth to permit the transverse bars to move across the vertical lines of the guides whereby the carriage travels the full length of its predetermined path without said guide impinging on the central carrier or the transverse bar.

18. In a front-thrust chain-cutter mining-machine, the combination of a bed-frame, the cutter-chain arranged to operate on a relatively-prolonged transverse line, the carriage sliding forward and back on the bed when the latter is stationary, having the chain-frame part and a rear frame or platform part adapted to support the power mechanism, a screw and nut for adjustably connecting the chain-frame and the power-platform and operating on lines in the central vertical longitudinal plane of the chain-frame, the said platform and chain-frame being disconnected at the sides of said central plane, substantially as set forth.

19. In a front-thrust chain-cutter mining-machine, the combination of the stationary bed, the chain, the chain-frame in a relatively low plane and holding the active part of the chain on a relatively-extended transverse line at the front, the platform for the power devices in a relatively higher plane, a screw and nut for detachably connecting together adjustably the chain-frame and platform situated in the vertical, central, longitudinal plane of the said platform, and means for positively advancing the chain-frame and platform longitudinally of the bed, substantially as set forth.

20. In a front-thrust chain-cutter mining-machine, the combination of the stationary bed, the cutter-chain, the chain-frame holding the active part of the chain on a relatively-extended transverse line across the front, the frame or platform for the power devices, adjustable connecting devices for joining the chain-frame and the platform, having the longitudinally-arranged adjusting-screw for moving the said connecting devices situated in the vertical, central, longitudinal planes of the platform, and means for positively advancing the chain-frame and platform longitudinally of the bed, substantially as set forth.

21. In a mining-machine, the combination of the horizontally-mounted cutter-chain, a sliding carriage having a relatively low chain-supporting frame and a relatively higher frame or support for the motor and gearing, a connecting and spacing bar or plate extending from said motor-platform downward to the chain-frame to provide a free or open space horizontally between them, and a bed-frame having longitudinally-arranged carriage-feeding devices and having independent of the feeding devices longitudinal bars providing a relatively high longitudinal guideway for the motor-support, a second relatively low guideway for the chain-frame, and stationary transverse cross-bars below the chain-frame rigidly connected with the upper horizontal guide-bars, substantially as set forth.

22. In a mining-machine, the combination of the horizontally-moving cutter-chain, the sliding carriage having a relatively low chain-frame, a relatively higher frame or platform for the motor and gearing, the connecting and spacing bar extending downward from the motor-platform to the chain-frame, the stationary bed having longitudinal bars above the chain and a series of vertical bars on each side of the machine extending to points below the chain and situated outside of the space surrounded by the chain, said longitudinal bed-bars extending forward from and beyond the front vertical bars of said series and being provided with an underhung guide for the chain-frame, said guide having a free space between it and the ground to permit the passage of the transverse parts of the carriage, substantially as set forth.

23. In a mining-machine, the combination of the horizontally-moving cutter-chain, the sliding carriage having a relatively low chain-frame, a relatively higher frame or support for the motor and gearing, the relatively higher guide for the motor-support, the rela-

tively lower guide at the front of the bed for the chain-frame, the chain-frame holding the cutter-chain substantially as described to travel around said frame in planes parallel to the planes of the guides, the connecting and spacing device extending downward from the motor-platform to the chain-frame, to hold the latter below the former and permit upwardly-projecting cutters to freely travel, and the bed-frame supporting said higher guide and lower guide and having cross-bars below the chain-frame, vertical bars outside the space surrounded by the chain and secured to said cross-bars, and longitudinal bars above the bottom cross-bars and secured to the vertical bars, substantially as set forth.

24. In a mining-machine, the combination of the sliding carriage, having a cross-head or support at the front, and a longitudinal thrusting bar or carrier on substantially the central longitudinal lines of the machine, a horizontally-mounted cutter-chain having its central horizontal planes substantially coincident with those of the said thrusting-bar, a guide for the chain-frame at the front end, a frame or platform for the motor and gearing, a connecting and spacing bar or plate extending down from the said motor-platform to the chain-frame, and a bed-frame having longitudinal bars above the chain, vertical bars outside the space surrounded by the chain, cross-bars below the chain, and longitudinal bars below the chain connected to the said vertical bars, said bed having a relatively high guideway for the motor-platform, all arranged substantially as set forth, whereby the chain-frame can be underhung relatively to the motor-frame and the top of the bed-frame, and can be surrounded and protected by the bed-frame.

25. In a mining-machine, the combination of the cutter-chain arranged to operate on a relatively extended transverse straight line at the front of the machine, the chain-frame, having a central thrusting bar or carrier, a cross-head or chain-support secured at its center, transversely, to the said carrier, and guiding the chain across the front on the said transverse straight line, two guide-wheels at the ends of the said cross-head and in the horizontal planes of the thrust-bars, a relatively small driving sprocket-wheel for said chain at the rear of the said central bar, and a cross-brace connected to the central bar and to the chain-guide, said parts being arranged, as set forth, to guide the chain in a substantially triangular path having its sides diverging outward from the said driving sprocket-wheel directly toward the front guide-wheels, substantially as set forth.

26. In a mining-machine, the combination with the stationary bed having an upper elevated longitudinally-arranged part and having at the front a guide projecting downward from said elevated part, of an endless cutter-chain arranged in a triangular path, the sliding carriage having a central thrust-bar held in the said guide, a transverse chain-support at the front of the said bar, and bracing devices for the said bar extending laterally therefrom and adapted to pass across the vertical lines of the said guide on the bed, substantially as set forth.

27. In a mining-machine, the combination of the following elements, namely, relatively elevated longitudinal bed-bars, carrying longitudinal racks and adapted to provide a carriage-guide, an engine or motor and gearing, a platform or carrier for the said motor and gearing arranged to hold them as described, whereby they are partly supported above and partly below the horizontal plane of the aforesaid guides and racks, a relatively lower guideway at the front end of the bed, a chain-support in the horizontal planes of the front guideway and having two or more longitudinal bars connected to transverse braces which cross the central longitudinal vertical planes of the machine, and arranged to move forward and back without impinging on the said front guide, a cutter-chain held by said support, a rear driving sprocket-wheel forming part of the said gearing, and two front wheels for said chain, the said wheels being arranged substantially as set forth, to hold the chain on one side on a line tangential substantially to the periphery of the driving-wheel and to the periphery of one of the front wheels, and to hold the chain on the other side on a line tangential substantially to the periphery of the other front wheel, and to the periphery of the driving-wheel, substantially as set forth.

28. In a mining-machine, the combination of the bed, the carriage moving forward and back thereon, an endless cutter-chain arranged to rotate in a triangular path, a chain-support secured to said carriage and having a cross-head with a chain-guideway at the front stationary on the carriage, and two diverging side chain-guideways stationary on the carriage for holding said chain in said triangular path with a straight base-line of the triangle in front of the bed, said side guideways extending directly and substantially continuously on straight lines from the ends of the cross-heads to a rear end of the triangular chain-path, a driving sprocket-wheel of reduced diameter relatively to said base-line and situated at the rear apex, means for rotating the chain and means for advancing the base-line of the triangle directly forward from the bed, and a guide on the bed for the chain-support, substantially as set forth.

29. In a front-thrust chain-cutter mining-machine, the combination of a bed, having two racks secured thereto, one on each side, and two guideways in different horizontal planes, a reciprocating carriage having a rear part substantially quadrangular in form fitted to said bed in one of said guideways and supporting a motor and a driving sprocket-wheel, and having a chain-support-

ing part fitted in the other said guideway extending forward from the quadrangular part and connected thereto at its center transversely, a chain supported upon the last said part and extending forward from said sprocket-wheel and moving transversely in front of the bed, means for positively adjusting the chain-carrying part relative to the quadrangular part, and two carriage-moving wheels on the carriage and engaging with said racks, the said parts being arranged substantially as set forth to transmit the back pressure from the chain to the center of the rear part of the carriage and distribute it from that point to the two racks, as described.

30. In a front-thrust chain-cutter mining-machine, the combination of a bed-frame, having two longitudinally-arranged carriage-feeding devices, one on each side of the central longitudinal line of the bed, and having two guideways, a reciprocating carriage having a part substantially quadrangular in form fitted to one of said guideways and supporting a motor and a driving sprocket-wheel, and having a chain-supporting part fitted in the other said guideway and extending forward from the gearing-supporting part and connected to the latter at its center transversely, a chain supported upon the said chain-carrying part and extending forward from said sprocket-wheel and moving transversely in front of the bed, means for adjusting the chain-supporting part and the quadrangular part and two carriage-moving devices on the carriage engaging with the aforesaid carriage-moving devices on the bed, all the aforesaid means being arranged substantially as set forth to transmit the back pressure from the chain to the center of the gearing-supporting part of the carriage and distribute it from that point to the two carriage-feeding mechanisms, substantially as set forth.

31. The combination of the chain having cutters and traveling horizontally laterally, a carriage having a front-thrust endwise-moving chain-frame provided with an elongated cross cutter-head adapted to hold the operative part of the chain on a relatively-elongated line of cut, a guide for the forward portion of the chain-frame adapted to hold it against horizontal sidewise swing under the action of the laterally-moving cutters, a traveling motor on the rear part of the chain-frame, a horizontal driving sprocket-wheel rotating continuously in one direction and engaging with said cutter-chain at the rear part of the chain-frame, rotary carriage-moving wheels reversible independently of the said sprocket-wheel, a bed-frame having the aforesaid guide for the front part of the chain-frame and a second guide for the rear part of the carriage and having one or more longitudinal racks with open spur-teeth engaging continuously with said reversible wheels, and means for holding said rack against both lateral torsion or bending from the lateral action of the cutters and from vertical spring of the chain-frame, said means consisting of longitudinal bars on the ground under the chain, cross-bed ground-bars, and devices for rigidly fastening the longitudinal ground-bars, and the cross ground-bars to the rack-toothed bars, substantially as set forth.

32. In a front-thrust chain-cutter mining-machine, the combination of the bed having the relatively-elevated bars arranged longitudinally and each provided with rack-teeth, the lower longitudinally-arranged ground-bars and the cross-bars rigidly connected together and to the elevated rack-bars, the carriage having a chain-frame fitted in a guide on the bed and having supporting devices for the motor and gearing, sliding in another guide on the bed, the vertical chain-driving shaft, the relatively small driving sprocket-wheel thereon, the elongated cross-head at the front of the chain-frame, the chain extending directly from said driving-wheel to the ends of the said cross-head, the transverse carriage-moving shaft having two remote pinions engaging with the said rack-bars and adapted to apply the feeding force uniformly across the motor-support and to have one feed device reinforce the other against the sidewise torsion from the lateral action of the cutters, substantially as set forth.

33. In a front-thrust chain-cutter mining-machine, the combination with a bed, a motor, gearing, a sprocket-wheel driven thereby, a support traveling on the bed for said motor and gearing, and a triangular cutter-chain, of a chain-supporting frame constructed substantially as described, it having a cross-head J, wheels G,G′, at the ends of the cross-head, chain supporting and guiding bars at the sides of the triangle, connected to the cross-head and converging backward on lines meeting at said sprocket-wheel, a guiding-bar secured centrally, vertically, to the cross-head and lying between the converging chain-guides, and means for holding the chain-guides and the intermediate guiding bar or frame in proper relative position, substantially as set forth.

34. In a front-thrust chain-cutter mining-machine, the combination of the bed having longitudinal bars on the ground between the rear end and the front end, the motor plate or platform fitted to the bed, the triangular chain, the chain-frame having the cross-head and the backwardly-extending thrust-bar occupying and moving in the central longitudinal planes, said thrust-bar being at its rear end remote from the bed ground-bars and from the motor-support to provide a free passage for the chain-cutters, and arranged to have its rear end lie in the horizontal planes of the chain-links, and longitudinally adjustable relatively to the motor-support, and detachable therefrom, substantially as set forth.

35. In a front-thrust chain-cutter mining-machine, the combination of the bed, the motor, the cutter-chain, the carriage having the quadrangular support or frame for the motor, and the substantially triangular chain-frame fitted at its apex in a longitudinal guide at the center of the motor-support, and means for positively moving the chain-frame in said central guideway to adjust it and the chain, substantially as set forth.

36. In a front-thrust chain-cutter mining-machine, the combination of the bed, the chain, the sliding quadrangular support or frame for the motor fitted to the bed in a guideway in a horizontal plane, a chain-frame having an elongated cutter-head as at J, J′, inclined side bars extending directly toward the central part of the motor-support and longitudinal bars between said side bars, means for positively adjusting both of said side bars together with the intermediate longitudinal bar in relation to the motor-support, and means for holding the chain-frame in horizontal planes other than those of the aforesaid guideway; substantially as set forth.

37. The combination in a front-thrust chain-cutter mining-machine, of the bed, the carriage sliding thereon and having a rear part for supporting the motor and gearing and a horizontally-arranged part supporting the cutter-chain, the horizontal chain-driving sprocket-wheel, the vertical shaft therefor mounted in the motor-support, the horizontal bevel-wheel on said vertical shaft, the horizontal main shaft having a bevel-gear Q^2 for driving the cutter-chain, the bevel-gear Q^4, means driven by said beveled gear Q^4 and engaging with the bed for pulling the carriage back, the worm Q^3, means driven by said worm Q^3 and engaging with the bed for feeding the carriage, and the gear Q′, and the electric motor mounted on the said support directly over the said shaft and wheels, and means driven by the said shafting and gearing for moving the carriage forward and back on the bed, substantially as set forth.

38. In a front-thrust chain-cutter mining-machine, the combination of the bed, the carriage, the cutter-chain, and the chain-support having a center bar or carrier I, a cross-head J, the inwardly-inclined bars N′ N′, cross framing or bars, as at M M′, extending continuously from one inclined side bar N′ to the other, and a stationary guideway at the front end of the bed for the carriage arranged to provide a passage-way for the said cross-framing bars, substantially as set forth.

39. The combination with the carriage having a part for supporting a motor and gearing, and a forwardly-extending cutter-chain-carrying part, of the adjusting-screw mounted on one of the said parts, and the nut supported on the other, said nut being adapted to be loosened, and means for clamping the nut rigidly in place after adjustment, substantially as set forth.

40. The combination with the sliding carriage having the part for supporting the gearing and the part for supporting the cutter-chain, of the longitudinally-arranged screw mounted on the gearing-support, the nut carried by the chain-support and detachably engaging with the gearing-support, and means for clamping the nut rigidly to both of said parts of the carriage, substantially as set forth.

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

HENRY B. DIERDORFF.

Witnesses:
CHARLES W. MILLER,
WILLIAM E. RICH.