(No Model.) 6 Sheets—Sheet 1.

J. L. MITCHELL.

TUNNELING MACHINE.

No. 565,494. Patented Aug. 11, 1896.

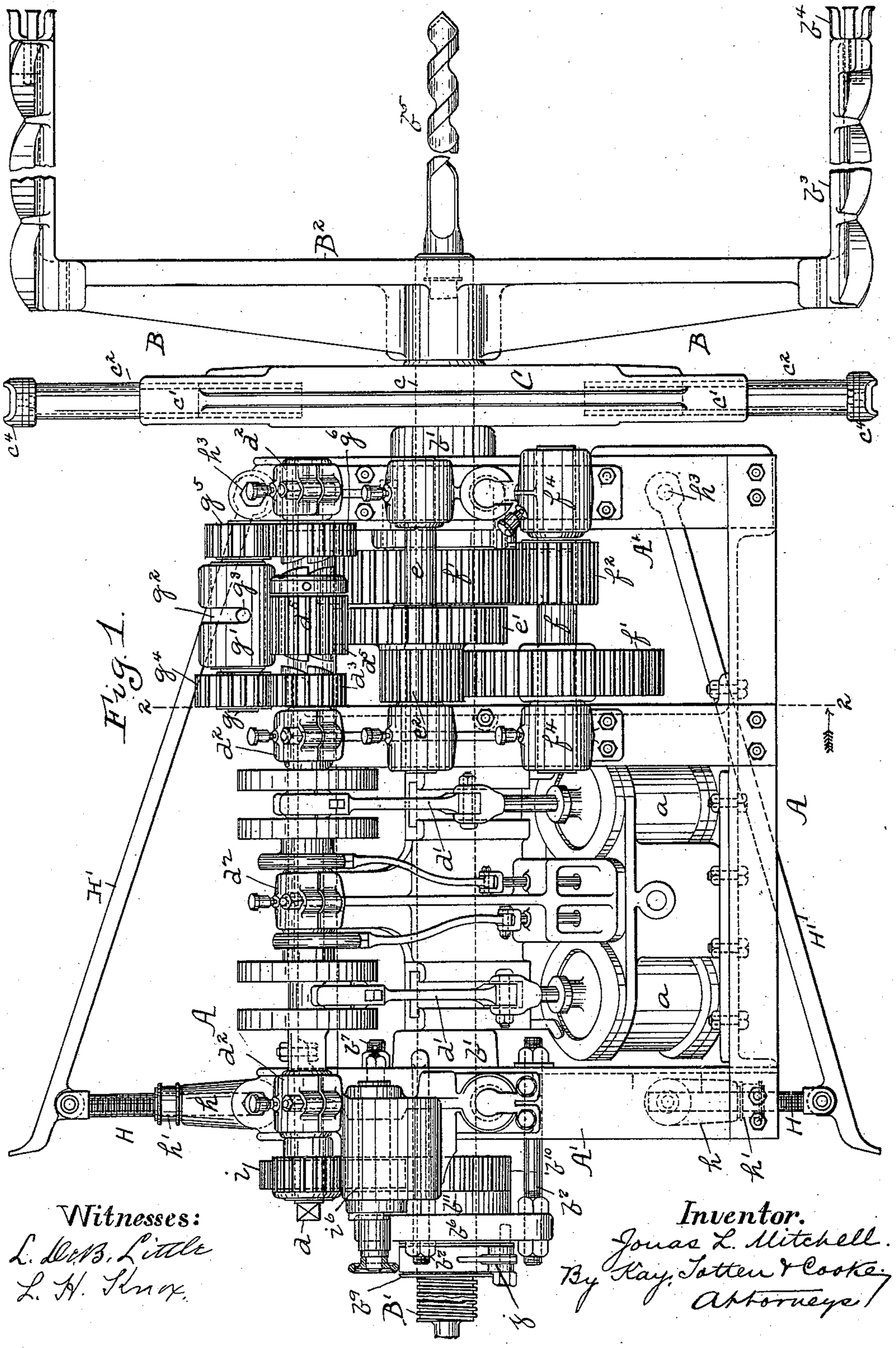

Fig. 1.

Witnesses:
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(No Model.) 6 Sheets—Sheet 2.

J. L. MITCHELL.

TUNNELING MACHINE.

No. 565,494. Patented Aug. 11, 1896.

Fig. 2.

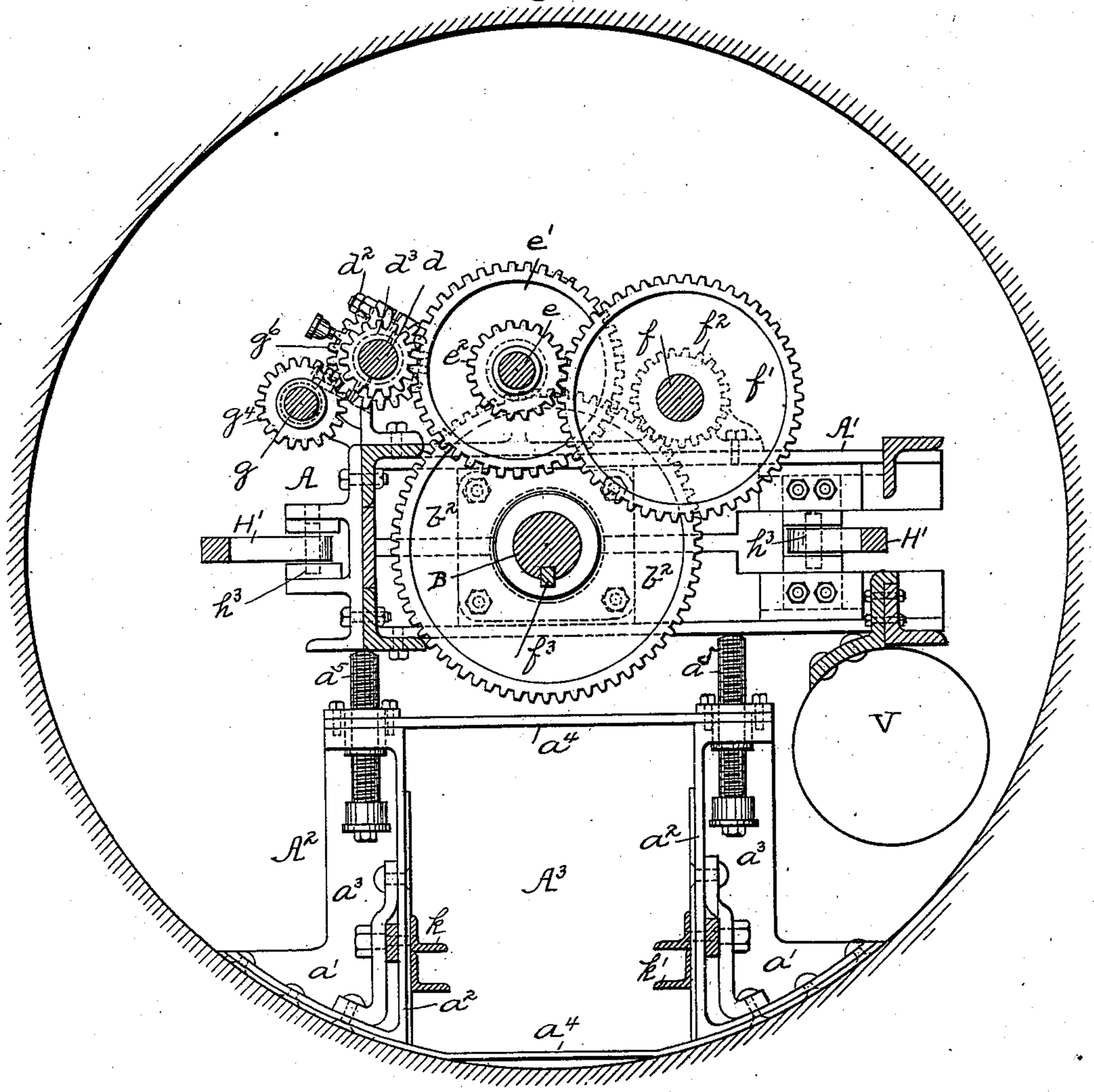
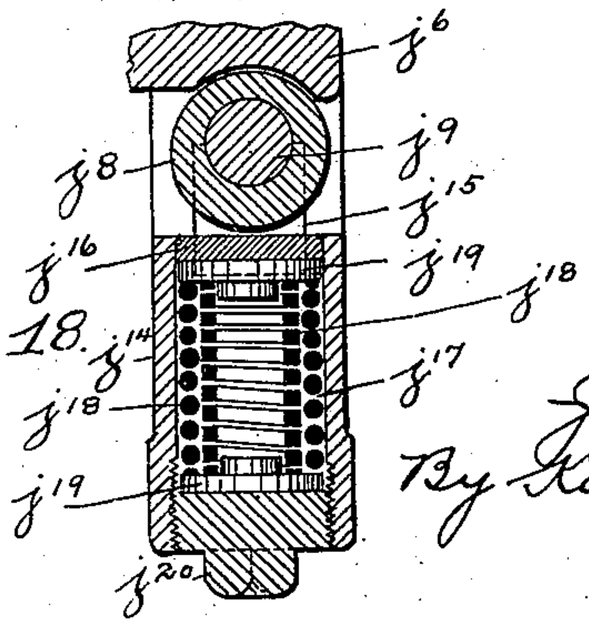


Fig. 18.



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(No Model.) 6 Sheets—Sheet 3.

J. L. MITCHELL.

TUNNELING MACHINE.

No. 565,494. Patented Aug. 11, 1896.

Fig. 3.

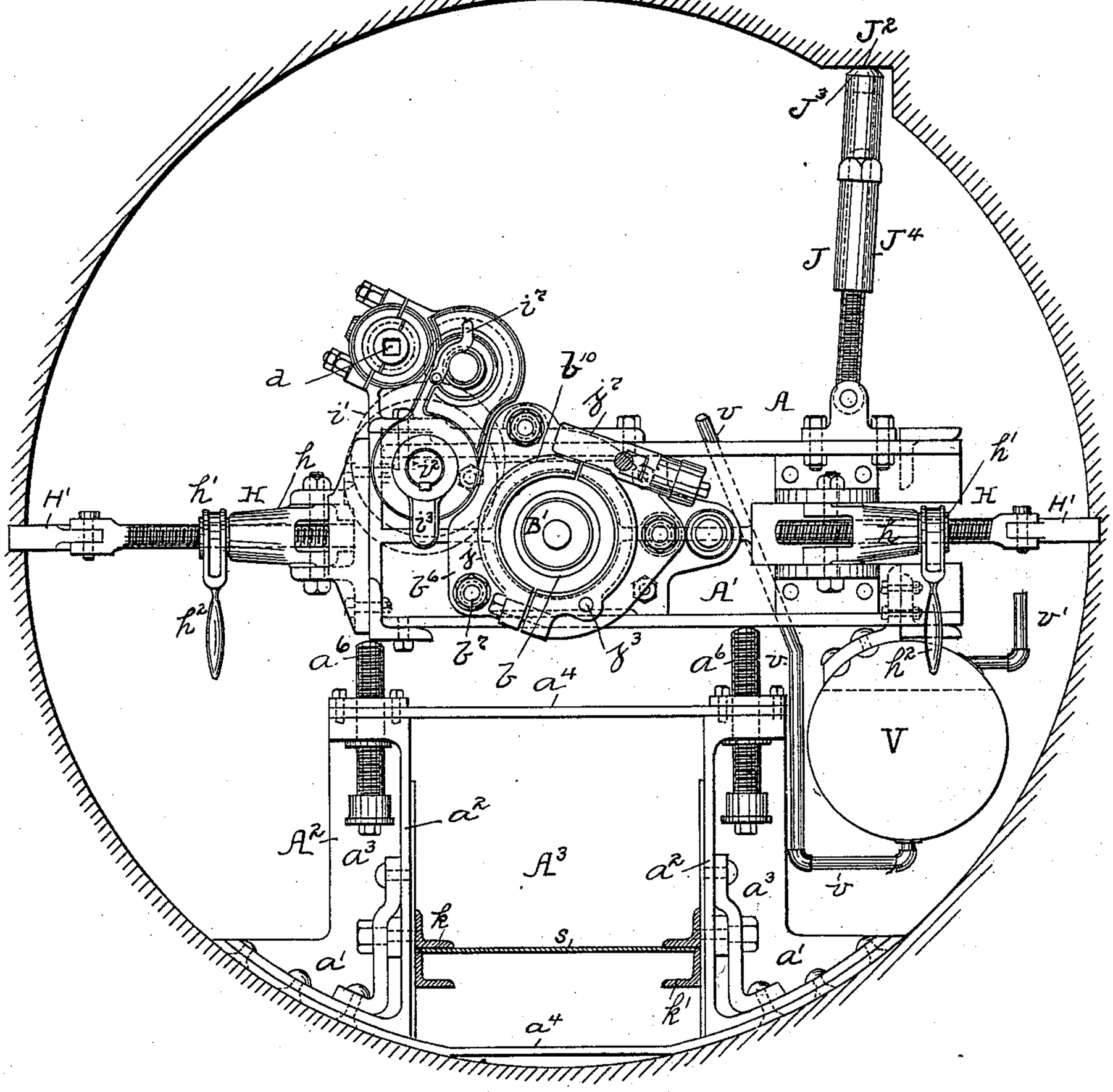
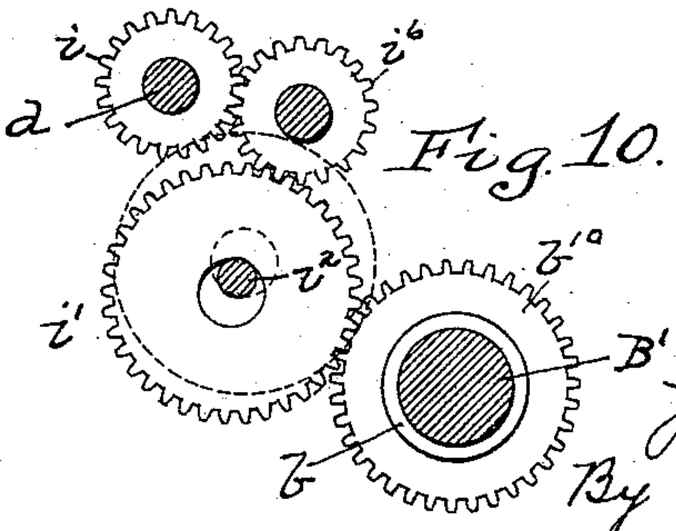


Fig. 10.



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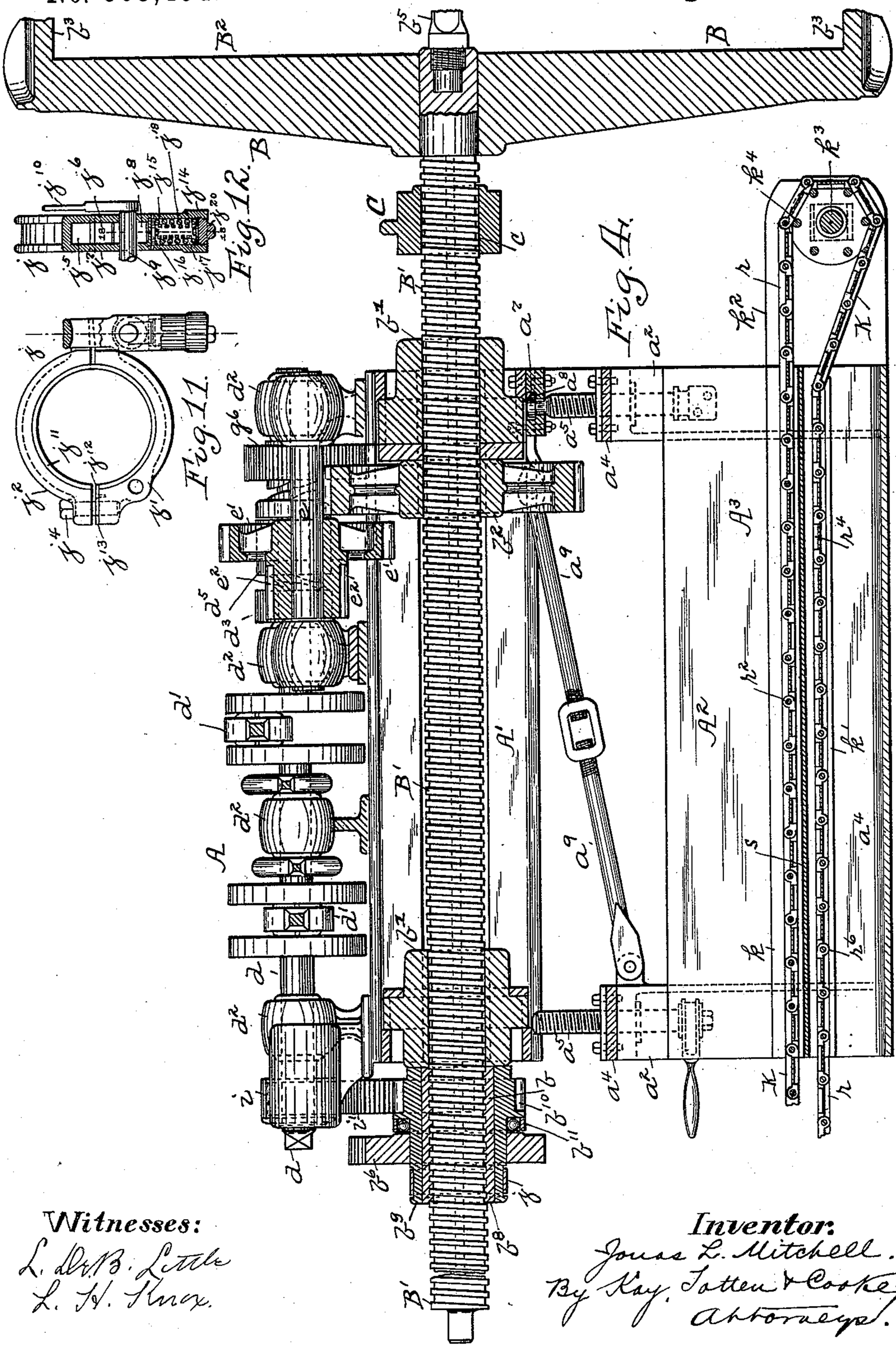
6 Sheets—Sheet 4.

J. L. MITCHELL.

TUNNELING MACHINE.

No. 565,494. Patented Aug. 11, 1896.



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(No Model.) 6 Sheets—Sheet 5.

J. L. MITCHELL.

TUNNELING MACHINE.

No. 565,494. Patented Aug. 11, 1896.

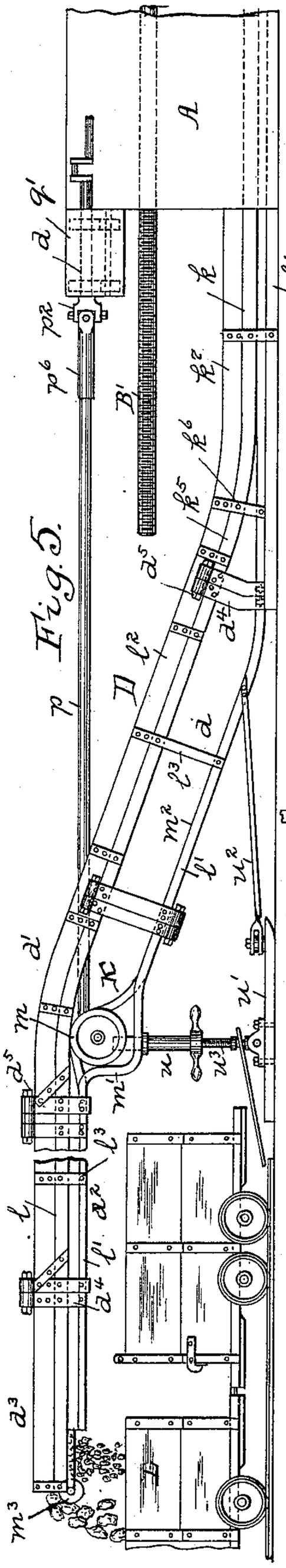

Fig. 5.

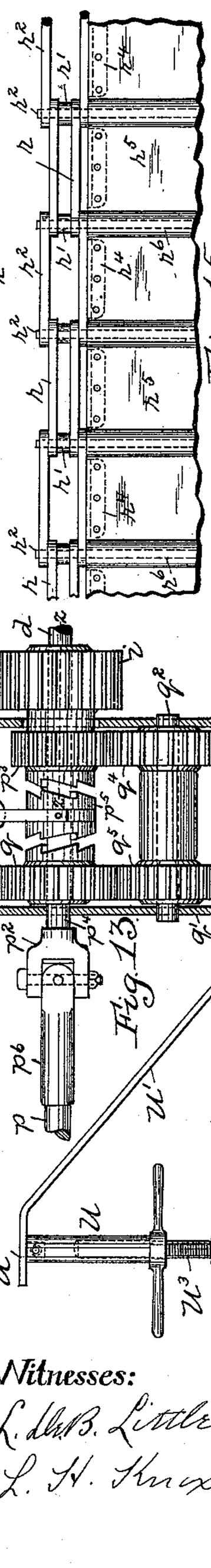

Fig. 15.

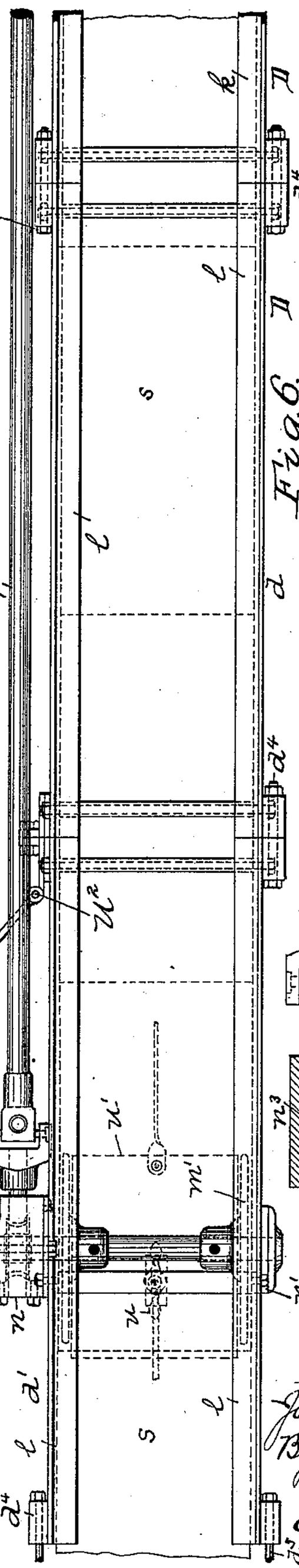

Fig. 6.

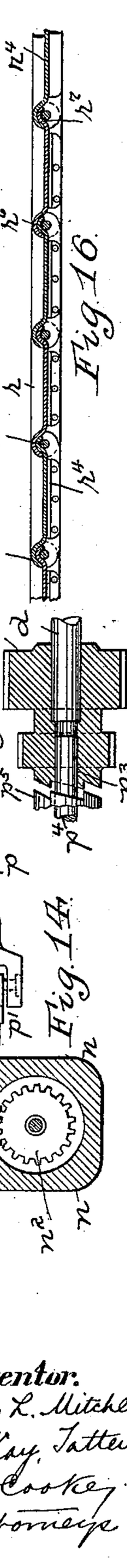

Fig. 16.

Fig. 13.

Fig. 17.

Fig. 14.

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(No Model.) 6 Sheets—Sheet 6.

J. L. MITCHELL.

TUNNELING MACHINE.

No. 565,494. Patented Aug. 11, 1896.

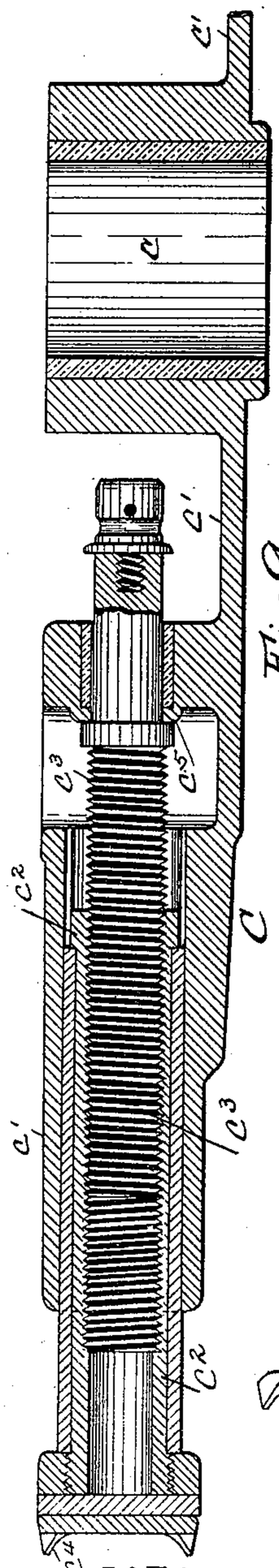

Fig. 9.

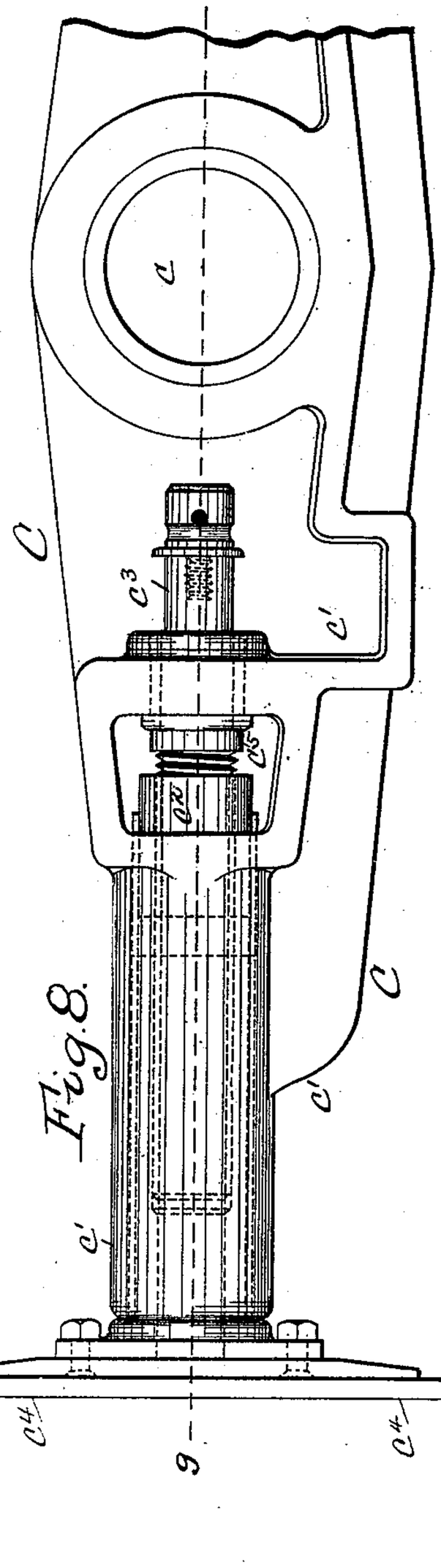

Fig. 8.

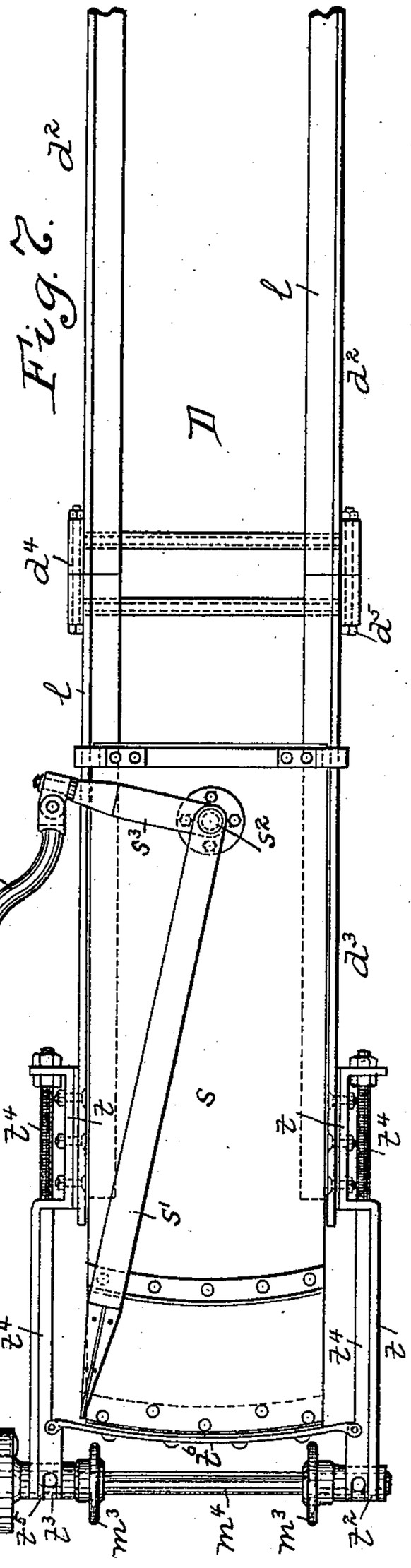

Fig. 7.

Witnesses:
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UNITED STATES PATENT OFFICE.

JONAS L. MITCHELL, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE SULLIVAN MACHINERY COMPANY, OF SAME PLACE AND CLAREMONT, NEW HAMPSHIRE.

TUNNELING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 565,494, dated August 11, 1896.

Application filed March 17, 1894. Serial No. 504,036. (No model.)

To all whom it may concern:

Be it known that I, JONAS L. MITCHELL, a resident of Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Tunneling-Machines; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to certain improvements in tunneling-machines, and has for its object the general improvement in the construction of what is known as the "Stanley" tunneling-machine, the broad features of the construction of which are shown in Letters Patent granted to Reginald Stanley November 12, 1889, No. 414,893, and the reissue thereof dated May 9, 1893, Reissue No. 11,333.

In that machine a main frame was employed in which was mounted centrally and longitudinally a shaft to which power was applied from engines carried on the main frame, and which carried a cutter-frame having at its forward end a head adapted to cut a circular course or kerf of sufficient size to receive the main frame of the machine, this cutter-frame being fed forward gradually during the making of the cut and the main frame being held stationary during such operation and sustaining the strain of the cutting operation. As soon as the cutter-frame was fed out to its full length, however, as it had cut a course for the full diameter of the machine, in order to advance the main frame within the tunnel so formed, so as to prepare for the next cut, the cutter-frame was anchored and the anchors of the main frame loosened, and by means of the engines on the main frame that frame was drawn up through the connection between the cutter-frame and the main frame until the main frame was brought close to the cutter-head of the cutter-frame, when it was again locked and the cutting operation repeated.

This class of machinery has proved very efficient for the purpose, and the object of the present invention is to improve the construction thereof in certain particulars, among which are the following: to provide for the anchoring of the cutter-frame and the supporting of the cutter-shaft thereof in advance of the main frame by a separate anchor fitting around the central shaft between the main frame and the cutter-head of the cutter-frame, which can be advanced as the cutter-frame advances and form a support for the cutter-frame in advance of the main frame, and may also be employed as the anchor when the main frame is to be advanced; to support the part carrying the operative mechanism of the main frame so that it may be properly adjusted in case of irregularities in the mine-floor, and to provide for the carrying away of the coal, rock, or other cuttings by means of a central conveyer which can deliver the same back of the machine in position to be automatically fed to the cars, these results being accomplished by the placing of the part of the frame carrying the operative parts in a horizontal position and supporting it on a secondary or lower section adjustable with relation to the upper section of the main frame and arranging the traveling conveyer centrally in such lower section; to provide for the supporting of the main frame by means of shoes on the lower section corresponding to the curve of the tunnel cut, so providing for the movement of the main frame directly into the circular tunnel formed by the cutter-frame; to provide a rear conveyer-frame for supporting the traveling conveyer or carrier by which the cuttings can be carried back of the main frame and delivered into the cars, as well as to improve the machine in other particulars, as will be hereinafter more particularly set forth and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a top or plan view of the main frame and cutter-frame; Fig. 2, a cross-section on the line 2 2, Fig. 1, looking forward. Fig. 3 is a rear view of the main frame. Fig. 4 is a longitudinal central section of the main frame and cutter-frame. Fig. 5 is a side view of the main frame in diagram and the rear or conveyer frame in which the traveling conveyer moves. Fig. 6 is an enlarged top or plan view illustrating part of the conveyer-frame. Fig. 7 is a view, partly in section, of the rear end of a carrier-frame, illustrating

the means for clearing the cuttings dropping through the carrier, so as to prevent the clogging of the same. Fig. 8 is a side view of part of the anchoring-jack employed between the main frame and the cutter-head of the cutter-frame. Fig. 9 is a cross-section on the lines 9 9 of the anchoring-jack. Fig. 10 is a diagram view of the reversing-gearing for driving the feed-nut. Figs. 11 and 12 are detail views of the brake or friction device for holding the feed-nut. Fig. 13 is a detail view of the connection between the engine-shaft and the driving-shaft for the conveyer. Fig. 14 is a section through the box containing the gearing connecting said driving-shaft and the sprocket-shaft of the conveyer. Figs. 15 and 16 are views of the conveyer-chain. Fig. 17 is a cross-section on the line Z Z, Fig. 13; and Fig. 18 is a cross-section on the line 18 18, Fig. 12.

Like letters of reference indicate like parts in each of the figures.

In the accompanying drawings, A is the main frame, in which is mounted the cutter-frame B, formed of the central shaft B′ and the cutter-head B^2. C is the anchoring-jack, which fits around the shaft B′ between the main frame and the cutter-head B^2. D is the conveyer-frame extending back of the main frame, by which the rock, coal, or other material is carried to the cars. These constitute the main parts of the machine.

The main frame A is formed of the upper section A′, in which the engines a and the operative parts are mounted and through which the central shaft B′ passes, and the lower section A^2, which supports the machine in the mine. The lower section A^2 has the shoes a', which are curved corresponding to the cut made by the cutter-frame and rest upon the curved base of the cut, so as to give support to the machine, and said section is formed of two longitudinally-extending parts between which is the space A^3, through which the coal or other material operated upon is removed, the forward end of the conveyer K being mounted in said lower section, as hereinafter described. At each side of said space A^3 and extending up from the shoes a' are the side plates a^2, which are rigidly secured to the shoes and suitably braced by upwardly-extending parts or plates a^3, the two plates being connected by cross-braces a^4 at the top and bottom thereof. Extending up from this lower section are the supporting-screws a^5 a^6, there being four of these screws, which extend upwardly through the lower section at the four corners thereof and on which the upper section A′ rests, the lower ends of said screws extending on the outsides of the plates a^2 and being easy of access, so that the upper section A′ may be adjusted vertically by means of said screws. To connect the two sections, I provide the forward screws a^5 with heads a^7, fitting in seats a^8, secured to the upper section, so that the forward end of the two sections is held in line, and I further connect the two sections by straps a^9, extending from the forward end of the upper section A′ to the rear end of the lower section a^2 and pivoted to brackets thereon, so that while the two sections may be adjusted through said screws a^5 a^6 they are connected together by means of the forward screws a^5 and side straps a^9 and move as one frame. The adjusting-screws a^5 a^6, as well as other like adjusting-screws for jacks or other purposes, illustrated in the drawings, may be turned by means of suitable ratchet or other wrenches.

The central shaft B′ of the cutter-frame B extends through suitable bearings b', provided therefor in the upper section A′ of the main frame, and has one or more longitudinal keyways or grooves by which the gear-wheel b^2 engages with the shaft B′ to turn the same through power connections hereinafter described, and the said bar is threaded to engage with the nut b, mounted in the frame, as hereinafter described, by which the said screw-shaft is fed forward or back. The said shaft B′ carries at its forward end the cutter-head B^2, which is of the ordinary construction employed in said Stanley machine, and requires no detailed description here further than that it is practically the full width of the kerf to be cut and has cutter-arms b^3 extending out at its forward end and carrying the bits b^4, and preferably has the central auger b^5 to center the same during the cutting, and it may have as many other cutters or cutter-arms as are considered desirable. The engines a, through their pitman d', engage with the crank or engine shaft d, mounted in bearings d^2, the engines extending transversely of the frame and at a slight incline from the horizontal and the engine-shaft carrying gearing at both ends, one set of gearing for rotating the cutter-frame and the other for advancing the same. The weight of the engines is thus distributed on each side of the center of the machine, and this is of great advantage both in distributing the weight of the machine and in giving a central space in the central part of the machine below the operative mechanism through which the material cut may be removed.

Neither the gearing for rotating nor the gearing for advancing and retracting the cutter-frame forms part of the present invention, but they are illustrated and described to make the operation of the machine clear. Two sets of gearing are employed for rotating the cutter-frame, one acting to drive the cutter-frame at a higher speed, while the other acts to drive the same with more power. The first set of gears is constructed as follows: Secured to the engine-shaft is the pinion d^3, having a clutch-face on the side thereof, and mounted and sliding on the engine-shaft is a long pinion d^5, having clutch-faces on either side thereof, and a lever operating to move the long pinion d^5 while permitting the rotation thereof. This long pinion d^5 engages with the gear-wheel e', secured upon the shaft e,

said shaft *e* also carrying the pinion e^2, which meshes with the gear-wheel f', secured on the shaft *f*, which also carries the pinion f^2, which meshes with the gear-wheel b^2, which has a feather or key f^3, sliding in the groove or keyway of the central screw-shaft B′ to rotate the same. Said shaft *f* is mounted in bearings f^4. In this way power is transmitted from the engine-shaft through the pinions d^3 d^5, (when their clutch-faces engage,) the gear-wheel e', the pinion e^2, the gear-wheel f', the pinion f^2, and gear-wheel b^2 to the central cutter-shaft. It is in some cases desirable to run the cutter-frame at a very slow speed but with great power, and for that purpose is employed the auxiliary set of gearing mounted in the bearing g' at one side of the engine-shaft. Said shaft *g* passes through an eccentric-sleeve g^2, which is directly mounted in the bearing g', so that when this set of gearing is not in use the sleeve g^2 may be turned by a suitable handle, as at g^3, to hold the set of gearing out of mesh with the driving-gearing. On said shaft *g* is the pinion g^4, adapted to mesh with the pinion d^3 on the engine-shaft, and at the opposite end of the shaft *g* the pinion g^5, which is adapted to mesh with the loosely-running pinion g^6 on the engine-shaft and in line with the long pinion d^5 and having a clutch-face thereon. When it is desired to apply the greater driving power, the eccentric-sleeve g^2 is turned to bring the pinions g^4 and g^5 into mesh with the pinions d^3 and g^6, and the clutch-pinion d^5 is thrown into engagement with the pinion g^6, when the power passes from the engine-shaft *d* through the pinion d^3, pinion g^4, the shaft *g*, and pinions g^5 and g^6 to the clutch-pinion d^5, and thence through the same set of gearing above described to the central cutter-shaft B′. When said set of auxiliary gearing is not employed, to overcome the necessity of the turning of the auxiliary gearing he turns the eccentric-sleeve g^2 in the bearing g', and so draws the pinions g^4 g^5 out of mesh with the pinions d^3 g^6, in which position they remain until required for use.

As above stated, when the main frame is to be drawn forward by the cutter-frame in order to bring it to position for feeding the cutter-frame still farther forward the nut *b* is rotated on the central threaded shaft B′, and I will now describe the gearing for producing this result, first stating that it is desirable that said gearing shall be capable of turning the nut in either direction, so as to move the cutter-frame and main frame in either direction with relation to each other, such, for example, as where it is desired to quickly withdraw the cutter-frame in order to break down the coal or rock and remove it and afterward to feed forward the cutter-frame. For the main operation of feeding forward the main frame the following gearing is employed: On the engine-shaft *d* is mounted the pinion *i*, which meshes with the pinion *i′*, running loosely on an eccentric-shaft i^2, mounted in bearings and gearing directly with the pinion b^{10} on the nut *b*, the operation of the gearing being that as the engine-shaft is turned through the gearing *i*, *i′*, and b^{10} the nut *b* is rotated around the central threaded shaft B′, which is not rotated, and so draws the two frames toward each other, either drawing the main frame toward the cutter-head when the cutter-head is anchored or drawing the cutter-head toward the main frame when the main frame is anchored. When, however, it is desired to force the cutter-head away from the main frame, the gearing is arranged as follows: By means of the lever i^3 turning the eccentric-shaft i^2 the pinion *i′* is drawn out of mesh with the pinion *i*, still remaining in mesh with the pinion b^{10} on the nut *b*. Mounted and sliding in bearings is a shaft carrying a pinion i^6, and said shaft can be moved longitudinally by means of a knob in the rear end of the shaft to draw said pinion i^6 into mesh with the pinion *i* and the pinion *i′* when said pinion is lowered out of mesh with the pinion *i*, so forming a line of gearing to transmit the power as follows: from the pinion *i* to the pinion i^6, thence to the pinion *i′*, and thence to the pinion b^{10} on the nut *b*, the direction of the rotation of the pinion b^{10} and the nut *b* being thus reversed without reversing the engines, so that the central shaft B′ is moved in the opposite direction and forces the cutter-head B^2 away from the main frame. The shaft carrying the pinion i^6 has an annular recess formed therein, and the swinging clip i^7 fits in such recess to hold the pinion i^6 in gear with the pinions *i* and *i′*. When it is desired to throw the gearing for turning the nut *b* out of action, the operator lifts said clip and slides the pinion i^6 forward, so as to force the pinion i^6 out of mesh with the other pinions, leaving the nut-rotating parts entirely out of action. He can throw them into action either by sliding the said pinion i^6 into mesh with the pinions *i* and *i′* or by turning the lever i^3 to bring the pinion *i′* into mesh with the pinion *i*.

At the rear end of the main frame is the thrust or resistance plate b^6, secured to the main frame by heavy bolts b^7, this plate receiving the pressure of the nut *b*, with which the threaded shaft B′ engages.

In the ordinary operation of the machine in cutting, the nut *b* at the rear end of the machine is either locked stationary or it is held by what is termed a "brake-friction," so that the central screw-shaft feeds forward through the nut, or if too heavy a strain is brought upon the cutter-shaft, such as in striking upon hard rock, the brake permits of the turning of the nut with the shaft and prevents serious injury to the cutting-bits or cutter-frame. The general construction of this brake does not form part of the present invention, but it has been improved in some particulars by me, which will be here de-

scribed. Secured loosely to the thrust or resistance plate b^6 is one section or half of the friction brake or strap j, said brake being supported in place by means of a bolt j^3, passing through the strap-section j' and entering the resistance-plate. The brake is formed of two strap-sections j' j^2, cast to shape and secured together at one end by the bolt j^4, passing through lugs on the strap-sections, and the bolt passing through a hole in one strap-section of greater diameter than the bolt and screwing into the other strap-section, so as to form a loose connection between the two. At the other end of the strap-sections are the clamping-lugs j^5 j^6, around which fits the yoke j^7, which by means of an eccentric j^8 on the shaft j^9 connects with the hand-lever j^{10} to clamp together the two strap-sections and to cause them to bind upon the nut to create the necessary friction, the nut extending through the resistance-plate b^6 and the brake being clamped around a cylindrical face therein.

The construction so far described does not form any part of the present invention. My improvements employed therewith are as follows: In order to provide for a lining in the brake-body formed of the two strap-sections, I preferably employ vulcanized fiber, a ring j^{11} of this material being fitted in a seat formed therefor in the strap-sections, this ring being cut through at one point, as at j^{12}, and fitted within the two strap-sections, so as to form the friction-surface around the nut. To prevent this ring from turning within the strap-sections, I employ the plate j^{13}, bolted to one of the strap-sections and extending out between the ends of the ring j^{11}, so that the lip of the plate j^{13} bears against the end of the vulcanized-fiber ring and prevents the turning of the same by the frictional action of the nut thereon. For the practical operation of this brake or friction-holder for the nut it is desirable that the two friction-straps may yield slightly under very heavy strain, and yet that the two straps may be held with such power as to resist the frictional action brought upon the brake-straps except under extreme strain. It is also desirable that provision be made to hold the eccentric j^8 at any desired position, so that by the mere turning of the lever operating the eccentric to the position desired it will be held in that position without any special mechanical lock. This result is accomplished in the following way: The yoke j^{14} is extended below the eccentric, and fitting in the yoke in guideways j^{15} is a pedestal-box j^{16}, which bears upon the eccentric-shaft and within which the eccentric fits. Below this pedestal-box is the spring-chamber j^{17}, within which are contained powerful springs j^{18}, bearing upon the pedestal-box with such force as to bind upon the eccentric-shaft with such friction as to hold it at any point to which it is turned, and also to resist the strain brought upon the eccentric through the friction upon the straps fitting around the nut. I find for this purpose that it is necessary to have a cluster of springs in the chamber j^{17}, and, as shown in the drawings, this cluster of springs is confined within the chamber j^{17} between the washers j^{19}, one washer bearing upon the pedestal-box j^{16}, while the other washer is confined within the chamber by a screw-plug j^{20}, by which the springs can be so compressed as to both regulate their pressure and bring an exceedingly heavy pressure upon the pedestal-box and through the same upon the eccentric-shaft. As a result of such construction, I am enabled to apply an exceedingly great frictional force upon the nut b through the brake fitting around the same and yet provide for the yielding of the nut under excessive strain, which can be regulated by the compression of the springs within the spring-box j^{17}, and at the same time the eccentric controlling the brake is held in any desired position to which it is moved by its hand-lever.

The nut itself has the body portion b^9, in which is rigidly secured the inner threaded portion or brass bushing b^8 and around which the brake j fits, the pinion b^{10} being formed as part of the nut and having at its rear end an enlarged collar b^{11}, which forms around the nut-body an annular seat, in which are confined a series of antifriction-balls which bear against the thrust-plate b^6 and fit around the body b^8 and receive the thrust of the central screw-shaft B'.

In this connection I will also describe the means of locking the main frame in the tunnel to enable it to sustain the thrust of the cutter-frame.

At the rear end of the machine are the two jack-screws H H, having threaded bodies which extend back through trunnions h, mounted on vertical pivots on the jack-frame, so permitting the jack-screws to swing horizontally. The trunnions h form the abutments against which the nuts h' press, these nuts being turned by wrenches h^2. The outer end of each jack-screw engages with a jack-lever H', which is pivoted at the forward end of the machine, as at h^3, on a vertical pivot and extends back to the jack-screw, so that it can, through the jack-screw H, be forced outwardly or drawn back from the tunnel-wall. These jack-levers are arranged to be forced into the mine-wall, and they obtain a very strong hold thereupon to sustain the end thrust brought upon the machine by the cutter-frame, the thrust or pressure being in the direction of the length of the jack-lever H', as the end thrust on the spreading-jack levers tends to thrust them into the tunnel-way and increase their hold thereon, such jacking means being found all that is necessary to sustain the end thrust of the machine. For the purpose of holding down the rear end of the machine I also employ what I term a "sprag-jack," which is hinged to the rear end of the main frame, at the right side thereof looking forward, and just above the

trunnion h, in order to sustain the rear portion of the frame against the twisting strain brought upon the frame by the turning of the cutter-frame therein. This sprag-jack is shown at J, and it extends up and is seated against the top wall of the tunnel and may be adjusted by the ordinary jacking means against the same. To obtain the necessary hold, a seat is generally made for the same at the top of the tunnel-wall, as shown at J^2, the abutments J^3 at the upper end of the sprag-jack fitting in said seat, and the threaded sleeve j^4, carrying such abutment, turning on the main portion or screw-bar of the jack.

In the use of the machine it is very desirable to employ as long a threaded central shaft as possible, and so provide for the cutting for as great a distance as practicable without the movement of the main frame. The weight of the cutter-head has, however, been liable to cause the sagging of the same if a long central shaft were employed, so that the exact desired line of the tunnel could not be maintained. It is also desirable to accomplish the forward movement of the main frame by a pulling rather than a pushing strain upon the cutter-frame. To accomplish these results, the anchoring-jack C is placed around the cutter-shaft B between the cutter-head B^2 and the main frame A, the shaft passing through the central opening c of the anchor which swings around on said shaft. The anchor is made so that it may be extended for the full width of the tunnel and take an exceedingly strong hold therein, so forming a rigid bearing for this cutter-shaft at any desired point in front of the main frame, such, for example, as where the cutter-shaft is extended part way and it is desired to give support to the cutter-head. This anchor C is pushed along the central shaft close to the cutter-head, and the jacks at each end thereof are forced out, so that the anchor gives a rigid support to the cutter-frame in front of the main frame, and this anchor may be adjusted two or three times in the cutting for the length of the cutter and will prevent the sagging or swaying of the cutter-frame during the regular tunneling operation. When it is desired to advance the main frame, this anchor can be forced close to the cutter-head and anchored there and the holding-jacks of the main frame loosened, and through the gearing above described the main frame A be drawn up to the anchor by the rotation of the nut b around the central screw-shaft B'. This anchor is made heavy and strong to sustain the strains brought upon it and is provided with the arms c', extending out in line with the central opening c, said arms having sockets therein in which the sleeves c^2, which are interiorly threaded, fit, the sleeves being keyed to slide in said sockets, and the jack-screws c^3 screwing within the sleeves c^2 and being turned by suitable wrenches, so as to force out the sleeves and with them the feet or grips c^4, which engage with the wall, the jack-screws having annular shoulders c^5, engaging with abutments on the anchor. Any other suitable form of jacking device upon the anchor can of course be employed, if desired.

In addition to providing by the placing of the frame carrying the operative parts in a horizontal position and placing it above an independent lower section to the main frame, which acts to balance the main frame and to distribute the weight more evenly, I am enabled to provide in said lower frame or section A^2 a passage-way for the carrying out of the cuttings or material removed by the machine without interfering with the generally-desirable positions of the operative parts. As part of this arrangement, I provide behind the machine a conveyer-frame D, which forms, practically, part of the main frame, and in the two frames I mount the traveling conveyer by means of which the material cut is carried back to the car. In the lower section A^2 of the main frame are the guideways k k', the one above the other, which are formed by means of angle-irons secured longitudinally to the inner faces of the plates a^2, and extending beyond the main frame and carried thereby are side plates k^2, which have bearings at the forward end for a bar k^3, carrying sprockets k^4, which engage with the traveling conveyer K, the conveyer passing forward along the guides k', passing over said sprockets k^4, and passing back through the space A^3 along the guideways k, the operator shoveling the material onto the conveyer, where it extends forward of the main frame, and the material being carried back by the conveyer K through the space A^3, and thence along the conveyer-frame D, and being dumped or discharged at the rear end of said conveyer-frame into the car L.

The conveyer-frame may be formed in sections, as a long frame is desired, and is illustrated as constructed in the following way: The two sets of angle-irons k k' extend out beyond the main frame A, and the upper angle-irons k are preferably curved up at their ends, as at k^5, while the lower angle-irons k' extend out straight, and supported by said angle-irons and bolted thereto by straps k^6 are the side plates k^7, which confine the coal or other material on the conveyer traveling in the guides k. These parts form either part of the conveyer-frame or of the main frame; but they are illustrated in the drawings as extending out from the main frame, and secured thereto is the conveyer-frame D, which may be made in any desired number of parts or sections, the frame being shown in the four sections d d' d^2 d^3, which are connected together by the coupling-plates d^4, through which suitable bolts, as at d^5, pass. The guideways on these conveyers are made of the same angle-iron, the upper guideway l being connected to the bars k, the lower guideway l' to the bars k', and these guideways extending to the rear end of the con-

veyer-frame, though not parallel with each other, and the courses of the said guide-bars being illustrated in the drawings, and though the course of the same may be changed according to the desire of the operator they illustrate the most desirable course for the guiding of the conveyer. For example, the guide-bars l have an upward incline, so as to direct the carrier to the upper part of the tunnel and thence in a substantially horizontal course to the point at which the coal is discharged from the car.

Extending above the guide-bars l are the retaining-plates l^2, which serve to hold the material upon the conveyer as it is carried back thereby, and in the different sections of the conveyer-frame the two guide-bars l l' and the retaining-plates l^2 are secured together by cross-braces l^3. The lower guide-bars l' extend from the rear of the frame forward parallel with the upper guide-bars to the point where the driving-sprockets m are placed, and they are thence bent downwardly, as at m', so as to give space between the two for the reception of the driving-sprockets m, and thence extend at a downward incline, as at m^2, to the guide-bars k', to which they are connected. The driving-sprockets m are secured to a shaft mounted in suitable brackets or bearings n n', supported on the conveyer-frame, and at one side in the bracket n is a worm-wheel n^2, Fig. 14, which is driven by a worm n^3 and mounted in said bearing n, the forward end of the worm-shaft carrying a universal joint p', to which is connected the driving-bar p, which also connects by a universal joint p^2, through a suitable clutch connection, with the engine-shaft d.

The driving-bar p for driving the conveyer is connected to the engine-shaft d by a combined clutch and differential gearing, by which the conveyer can be driven at different speeds, or by the throwing of the clutch left idle while the main part of the machine is running. For this purpose the pinion i has a socket p^3, extending back therefrom, having a geared face thereon which extends out beyond the end of the engine-shaft and forms a seat for the end of the shaft p^4, which forms part of the universal joint p^2, connected to the driving-bar p. This shaft p^4 fits in the geared socket p^3 on the pinion i and carries the clutch p^5, which is rigidly secured to the shaft p^4, said shaft and the universal joint p^2 being capable of sufficient longitudinal movement through the splineway connection p^6 with the driving-bar p to throw the clutch p^5, into engagement with a clutch-face on the geared socket p^3 of the pinion i. Running loosely on the shaft p^4 on the other side of the clutch p^5 is a pinion q, having a clutch-face with which the clutch p^5 engages when desired, and mounted in the box q', which forms the bearing for the shaft q^2, and at the side of the pinion q and geared socket p^3 is the shaft q^3, carrying the pinions q^4 and q^5, meshing with the geared socket p^3 and loose pinion q. When it is not desired to operate the conveyer K, the shaft p^4 is moved, so that the clutch p^5 does not engage either with the geared socket p^3 or the pinion q. When it is desired to drive the conveyer at a rapid speed, the shaft p^4 is moved longitudinally to bring the clutch p^5 into engagement with the geared socket p^3, and when it is desired to drive the conveyer at a slower speed the clutch p^5 is moved into engagement with the loose pinion q, when the power passes from the geared socket p^3 through the pinions q^5 and q^4 to the loose pinion q, and thence through the clutch to the shaft p^4. In this way during the operation of the machine the conveyer K may be driven continuously from the engine-shaft to the shaft p, worm n^3, and worm-wheel n^2, the conveyer-chains passing over the sprockets m in the forward course of the lower guideways l' from the rear of the machine, as shown more particularly in Fig. 5, the operation being that the conveyer is drawn forward by said sprockets, carrying the coal through the passage-way A^3 and passing along the guideways k and over the conveyer-frame along the guideways l to the rear of the machine, where the coal is dumped, and passing around the sprockets m^3, thence along the guideways l' and over the driving-sprockets m, the loose chain thence passing back along the lower guideways l' and k' to the sprockets k^4 at the forward end of the main frame.

Any suitable form of conveyer or carrier may be employed, the one employed in the machine as constructed and preferred by me being as follows: Two lines of chains are employed, the one traveling in the guideway on one side and the other in the guideway on the other side of the machine, and between the same are sheet-metal plates or "buckets," as they are termed. In Figs. 15 and 16 is shown the general construction of the chain, the plan view showing one side of the chain, the chain being formed of two links r, separated by rollers r', links r^2, fitting on the outside of the links r, and pins r^3, passing through holes in the ends of the links and through the rollers r', so as to form the chain, the sprockets of the sprocket-wheels entering between the links and bearing on the rollers. To connect the buckets to the chains, lips r^4 extend out on the inner links of the chains and the buckets r^5 are riveted directly to these plates, so connecting them to the chains on each side of the buckets.

To prevent the cuttings, slack, or dust from passing between the buckets r^5, the following construction is adopted: In line with the pivotal points or junctures of the chains the buckets r^5 have on one side thereof the curved lips r^6 r^7, the curve of one lip, r^6, as shown in Fig. 16, extending upward and over to a point about at the top of the adjoining bucket when the buckets are on the same plane, while at the other edge of the bucket is the curved lip r^7, which is formed on about the

same curve as the lip r^6, but about one-half the width thereof, the lip r^7 extending up under the lip r^6, and so covering the point of juncture of the two buckets, so that when the buckets are passing around any curved place in the guideways these lips will move the one over the other and prevent the dropping of the coal-dust between the buckets. Even though this form of bucket is employed, it is found in practice that the cuttings are liable to work between the lips r^6 and r^7 of the buckets and to be carried back on the tops of the buckets when reversed, that is, in their movement toward the main frame, and to be carried to the forward end of the conveyer in front of the main frame and clog the same, packing at the point where the conveyer passes around the forward sprockets k^4 and preventing the easy movement of the conveyer. To prevent this, I insert a horizontal stationary metal sheet between the upper and lower course of the conveyer, so that the cuttings will fall on this sheet and, if gathering too thick thereon, be carried by the scraping of the conveyer back to the rear end of the conveyor-frame; and at the rear end of the conveyer-frame I employ a plate s, supported between the upper and lower course of the conveyer, and acting to receive any of the dust or slack carried back by the conveyer or falling through the conveyer at that point, which is the one where the dust is most liable to drop between the buckets; and I employ a sweep s', playing over this plate s, to sweep any such material from the plates and into the car which extends under the same. This construction is more particularly shown in Fig. 7, the sweep s' being pivoted to the plate s, as at s^2, and having an arm s^3 extending out to the side of the conveyer-frame, and a rod s^4 extends from the rod s^3 of the sweep back to a crank s^5 in the end of the shaft carrying the rear sprockets m^3. As the shaft m^4, carrying the sprockets m^3, is turned through the crank s^5 and rod s^4, this sweep is caused to reciprocate over the plate s and to sweep dust or slack from said plate into the coal-car at each side of the conveyer. The end of the sweep may carry a plate or a series of brushes for that purpose. Said Fig. 7 also illustrates the means of taking up the slack of the conveyer. Secured to the conveyer-frame are brackets t, which have arms t' extending back, and having forks t^2 to support the boxes t^3, in which the sprocket-shafts m^4 are journaled. Extending through the brackets t and thence to the ends of the frame are the bearing-bars t^4, which have at their rear ends the slotted forked bearings t^5 to receive the same journal-boxes t^3, the rear ends of the bearing-bars being threaded and adjusting-nuts thereon engaging with the brackets t, so providing means for stretching the conveyer-chain by the longitudinal adjustment of the bearing-bars t^4 through said brackets. The boxes t^3 have pins thereon which fit in the slots in the bearings t^5 and prevent the boxes from turning.

It will be noticed that the bearing-bars t^4 are connected to the cross-bar t^6, which is also connected to the plate s, that plate resting on supports on the frame, but being longitudinally movable thereon, so that the plate and the operative parts of the sweep are longitudinally adjustable with the sprocket-shaft m^4.

As the conveyer-frame extends a considerable distance back from the main frame, and it is desirable that the conveyer-frame shall be supported so as to permit one or more cars to pass under the same, and as this rear portion of the conveyer-frame might be liable to swing over to one side the following construction to overcome this difficulty is employed: Connected to the conveyer-frame at a suitable point is the jack u, which extends down and rests upon a sled u', which is connected by the bar or link u^2 to the conveyer-frame D in front of the sled, so that the sled is drawn forward by the main frame. This jack u is provided with the jack-screw u^3, and is thus made adjustable, so as to raise or lower the rear end of the conveyer-frame, as found desirable. On one or both sides of the conveyer-frame I also employ a jack U, which connects to the bearing n, in which the worm n^3 and worm-wheel n^2 are mounted, this jack extending out horizontally, and its outer end having one end of the bearing-plate U′ connected thereto, the said bearing-plate extending forward to a point on the conveyer-frame and being connected thereto, as at U^2, and by means of the jack-screw U^3, the jack being made adjustable against the wall, so as to support the bearing-plate U′ in proper position to give the side support to the rear of the conveyer-frame. By means of the jack u, sled u', and of this bearing-plate U′, I am able to give the proper support to the rear portion of the conveyer-frame.

The operation of the apparatus may be briefly stated as follows: In the cutting of the tunnel the main frame is supported therein on the shoes a' of the lower section A^2 thereof, and the upper section A′ is properly adjusted thereon, so as to bring the central screw-shaft of the cutter-frame into proper position, and by means of the jacks H and the brace-bar h' the main frame is secured and anchored in place, the several jacks engaging with the tunnel-wall. The anchoring-jack C is also secured against the walls and acts in connection with the main frame in properly centering the cutter-frame and its shaft, the parts being so located as to give proper direction of cut to the cutter-frame, and it being evident that where it is desired to deflect the same either horizontally or vertically this may be accomplished by means of the several jacks and the anchoring-jack above referred to. The connections to turn the nut b on the central screw-shaft B′ are disengaged, and the brake is applied to the nut b, so as to hold it

from rotation except when severe strain is brought upon the same. The machine is then ready for operation, and if it is desired to rotate the cutter-frame rapidly the clutch-pinion d^5 is thrown into engagement with the pinion d^3, and the engines are started, the power being transmitted from the engine-shaft through the clutch-pinion d^5, gear-wheel e', pinion e^2, gear-wheel f', pinion f^2, and gear-wheel b^2 to the central screw-shaft B′ of the cutter-frame, and as the nut b is held from rotation the cutter-frame is both rotated and gradually fed forward, the bits b^4, at the forward end thereof, and the central auger b^5 engage with the mine-wall and cut the kerf therein, or, if desired, cut and break down the entire wall through other arms and bits on the cutter-frame. This is continued until the cutter-frame is advanced such distance that it is considered wise to brace the same in front of the machine, when the machine is stopped and the anchoring-jack C slid along the tunnel close to the cutter-head and secured to the tunnel-walls, when the operation is continued, the anchoring-jack being moved in this way from time to time and giving support to the cutter-frame near the cutter-head thereof during the operation of cutting and enabling me to employ a much longer central screw-shaft, and therefore to continue the cutting much longer without the necessity of moving the main frame. During this operation, as the coal or rock is broken down, the operator can pass along between the main frame and the tunnel-wall and feed the coal or other material cut onto the conveyer K, which carries the same back and feeds it to the cars, the conveyer traveling in the guideways of the main frame and the conveyer-frame and carrying back the material cut, raising it up in such position that it may be dumped into the car. If the material cut is hard, so that it is desirable to drive the cutter-frame at a slow speed, the operator throws the clutch-pinion d^5 into engagement with the pinion g^6, and then, through the arm g^8, turns the eccentric-sleeve g^2 and brings the gears g^4 g^5 into mesh with the pinions d^3 g^6, respectively, when the power is transmitted from the pinion d^3 through the pinions g^4, g^5, and g^6 to the clutch-pinion d^5, and thence through the same gearing to the cutter-shaft. If it becomes necessary to break down the coal or other material being mined, the cutter-frame is stopped, and if it is necessary to withdraw the same the clutch-pinion d^5 is thrown out of engagement, so that the cutter-frame is not rotated, and the operator then, by means of the lever i^3, raises the pinion i' into engagement with the pinion i upon the engine-shaft, when the power is transmitted from the engine-shaft through the pinions i, i', and b^{10} to the nut b, which is rotated and draws back the cutter-frame, giving access for the removal of the coal. To advance the cutter-frame, he then, by the lever i^3, drops the pinion i' out of mesh with the pinion i on the engine-shaft and draws forward the pinion i^8 into mesh with the pinion i and the pinion i', when, though the engine-shaft is turned in the same direction, power is transmitted through the pinions i, i', i^8, and b^{10} to the nut, which is rotated in the opposite direction and advances the cutter-frame. After the cutter-frame has been advanced as far as practicable, according to the length of the central screw-shaft thereof, it is necessary to advance the main frame, and the operator carries forward the anchoring-jack C close to the cutter-head B² and locks it, so as to anchor the cutter-frame from longitudinal movement. He then releases the several jacks holding the main frame and throws the pinion i' into mesh with the pinion i on the engine-shaft, and through the gearing i, i', and b^{10} turns the nut b on the central screw-shaft B′, when, as the cutter-frame is locked from movement and the main frame is free to move, the main frame is necessarily drawn toward the cutter-frame, being thus advanced so that it occupies a new position close to the cutter-head, when it can be again jacked to the tunnel-wall, and it is only necessary to draw the pinion i' out of mesh with the pinion i and throw the clutch-pinion d^5 into engagement with the driving-gearing, and the operation can then be continued. When the main frame is drawn forward, as above described, the conveyer-frame, which is connected thereto, is drawn forward with it, the frame traveling upon the sled u', which forms a sliding support therefor, while the bearing-plate U′ will contact with the side of the mine-wall and prevent the conveyer-frame from swinging over to the side.

It is a well-known fact that in the cutting of coal a large amount of dust is formed, and this dust, especially in connection with these tunneling-machines, is so fine and impalpable that it floats in the air, and this has led to some serious explosions, known as "dust" explosions, which it is very desirable to prevent. The accidents are understood to occur from the presence of finely-divided carbon and the oxygen of the air. The carbon becomes ignited from the torches of the workmen or a shot in blasting, which leads to the union of the carbon and oxygen, and the dust explodes. If this dust can be laid in any way, however, the accidents can be prevented, and for that purpose I support upon the upper section of the main frame the water-drum V, to which water may be feed from time to time by hose connections, and from the lower end of which a pipe v leads into convenient position for spraying, and leading into the upper part of the drum above the water is the air-pipe v', which connects with the main air-pipe carrying the compressed air to operate the engines, the pipes v v' being controlled by suitable valves, and when it is desired to spray the air and settle the dust contained therein the operator turns the valves, and through the pressure of the compressed air upon the water forces the same from the drum through the

spray-pipe *v*, and is enabled thereby to thoroughly dampen the atmosphere and settle the dust, and so prevent the explosion.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of a stationary main frame, a cutter-frame mounted in and having a rotary and advancing movement with relation to the main frame, and carrying the cutter-head at the forward end, and an independent anchoring-jack engaging with the cutter-frame between the cutter-head thereof and the main frame and adapted to be anchored to the tunnel-wall, substantially as set forth.

2. The combination of a stationary frame, a cutter-frame formed of a horizontal axial shaft carrying a cutter-head and mounted in the main frame and having a rotary and advancing movement with relation thereto, an independent anchoring-jack fitting around said axial shaft between said cutter-head and the main frame adapted to be anchored to the tunnel-wall, substantially as set forth.

3. The combination of a stationary main frame, a cutter-frame having a cutter-head, and a horizontal axial threaded shaft mounted in the main frame, said shaft engaging with the nut on the main frame, and an independent anchoring-jack fitting around said axial shaft between the cutter-head and the main frame, and adapted to be anchored to the tunnel-wall, substantially as set forth.

4. The combination of a stationary main frame, a cutter-frame having a cutter-head and an axial threaded shaft mounted in the main frame and having a rotary and advancing movement with relation thereto, and an anchoring-jack between the cutter-head and main frame having a central opening through which the axial shaft of the cutter-frame passes so that the anchoring-jack can slide thereon, said anchoring-jack having arms provided with jaws to engage with the tunnel-wall, and mechanism for forcing said jaws into engagement with the wall to anchor the jack, substantially as set forth.

5. The combination of a main frame, a cutter-frame having a cutter-head and an axial shaft mounted in the main frame, an anchoring-jack having a central opening through which the shaft passes and having the two arms *c'* having sleeves sliding but not rotatable therein provided with jaws at their outer ends, and jack-screws mounted to turn in the arms and engaging with the threaded interior of said sleeves, said jack-screws having collars c^5 bearing against shoulders on the arms, substantially as set forth.

6. The combination of a stationary main frame carrying the driving-engines and supporting a nut, a cutter-frame having a cutter-head and an axial threaded shaft engaging with said nut and having a sliding connection with the driving-gear, gearing between the engines and said driving-gear, and an independent anchoring-jack between the cutter-head and the main frame, attached to the interior of the tunnel-wall and held thereto during the cutting operation, substantially as set forth.

7. The combination of a main frame formed of a lower section resting on the tunnel-floor, an upper section supported by the lower section and adjustable with relation thereto and supporting the driving and cutting mechanism, and longitudinally-extending straps connecting said two sections, substantially as set forth.

8. The combination of a main frame having a lower section and an upper section supported thereon and adjustable with relation thereto and supporting the driving and cutting mechanism, said lower section carrying adjusting-screws upon which the upper section rests, and longitudinally-extending straps connecting said sections, substantially as set forth.

9. The combination of a main frame formed of a lower section and an upper section supported thereby and carrying the driving and cutting mechanism, said lower section having adjusting-screws on which said upper section rests, and the forward adjusting-screws having swivel connections with the upper section, substantially as set forth.

10. A tunneling-machine having a stationary main frame formed of a lower section and a horizontally and a longitudinally extending upper section supported and vertically adjustable thereon, the lower section having a central space and a conveyer traveling in said central space, and the upper section having engines extending transversely thereof, and connections from said engines to the operative mechanism, substantially as set forth.

11. The combination of a main frame having a central space in the lower part thereof and a conveyer traveling in said central space and the transversely-extending engines in the upper part thereof, an engine-shaft at one side of the machine, a cutter-frame having an axial shaft mounted centrally of the machine and having a rotary and advancing movement with relation thereto, and connections between said engine-shaft and the axial shaft and cutter-frame, substantially as set forth.

12. The combination with a main frame, a horizontal axial threaded shaft mounted therein and a nut mounted in the main frame and engaging with the threaded shaft and having a friction-surface thereon, a friction-brake formed of two semicircular straps or brake-sections loosely connected at one end and having lugs at the other end, a yoke fitting over said lugs, a shaft mounted in the yoke and carrying an eccentric engaging with the lugs, and a spring-bearing in said yoke for the eccentric-shaft, substantially as set forth.

13. The combination with a main frame, a cutter-frame having a horizontal axial threaded shaft mounted therein and a nut mounted on the main frame and engaging

with the threaded shaft and having a friction-surface thereon, of a friction-brake fitting around the friction-surface and engaging with a yoke, a shaft mounted in the yoke and carrying an eccentric engaging with the brake, and a spring-bearing in said yoke for the eccentric-shaft, said spring-bearing being formed of a pedestal-box engaging with the shaft on each side of the eccentric and a spring supported in a spring-chamber in the yoke-body and pressing against said pedestal-box, substantially as set forth.

14. The combination with a main frame, a cutter-frame having a horizontal axial threaded shaft mounted therein and a nut mounted on the main frame and engaging with the threaded shaft and having a friction-surface thereon, of a friction-brake fitting around the friction-surface and engaging with a yoke, a shaft mounted in the yoke and carrying an eccentric engaging with the brake, and a spring-bearing in said yoke for the eccentric-shaft, said spring-bearing being formed of a pedestal-box engaging with the shaft on each side of the eccentric and a spring inclosed within a spring-chamber in the yoke-body and pressing against said pedestal-box, said spring-chamber being closed by an adjustable plug to regulate the pressure, substantially as set forth.

15. The combination of a main frame, a horizontal axial threaded shaft mounted therein, a nut mounted in the main frame and engaging with said shaft and having a friction-surface thereon, a friction-brake formed of two semicircular brake-straps loosely connected at one end and clamped together at the other end, a lining formed of a vulcanized-fiber split ring within the brake, and a stop-plate bolted to the brake and having its inner end extending between the ends of the ring to hold it from turning, substantially as set forth.

16. The combination of a stationary main frame, a cutter-frame mounted in said main frame, a conveyer-frame consisting of an independent extension extending back from the main frame and connected to the same, said conveyer-frame being independently supported by the tunnel-wall, and a conveyer mounted in said main frame on said conveyer-frame, substantially as set forth.

17. The combination of a stationary main frame having a passage centrally of the lower part thereof, a cutter-frame mounted in said main frame, guides in the walls of said passage, a sprocket at the forward end of the main frame, a conveyer-frame consisting of an independent extension extending back from the main frame and connected to the same, said conveyer-frame being independently supported by the tunnel-wall, and a conveyer mounted in the main frame and the conveyer-frame and passing through the passage in the main frame, substantially as set forth.

18. The combination of a stationary main frame having a passage centrally of the lower part thereof, guides in the walls of said passage, a sprocket at the forward end of the main frame, a conveyer-frame consisting of an independent extension extending back from the main frame and connected to the same, said conveyer-frame being independently supported by the tunnel-wall, a conveyer mounted in the main frame and the conveyer-frame and passing through the passage in the main frame, an engine on the main frame, and connections from said engine to drive the conveyer, substantially as set forth.

19. In tunneling and like machines, the combination of a stationary main frame having an engine thereon, a conveyer-frame back of the main frame and supported by the tunnel-wall, a conveyer mounted in the main frame and the conveyer-frame, a driving-sprocket on the conveyer-frame, and a flexible connection from the engine-shaft on the main frame for driving said sprocket, substantially as set forth.

20. In tunneling and like machines, the combination of a main frame, an engine mounted thereon, a conveyer-frame back of the main frame, a conveyer mounted in said frames, a driving-sprocket on the conveyer-frame and gearing for driving the same, and a driving-bar having flexible connections with the engine-shaft and the gearing driving the sprocket, substantially as set forth.

21. In tunneling and like machines, the combination of a main frame, a power-shaft mounted thereon, the conveyer-frame back of the main frame and the conveyer mounted in said frames, a driving-sprocket on the conveyer-frame and gearing for driving the same, and a driving-bar operating said gearing, said driving-bar having a flexible and clutch connection with the power-shaft, substantially as set forth.

22. In tunneling and like machines, the combination of the main frame, a power-shaft mounted thereon, the conveyer-frame back of the main frame and the conveyer mounted in said frames, a driving-sprocket on the conveyer-frame and gearing for driving the same, and a driving-bar operating said gearing, said driving-bar having a splineway-joint therein and one section thereof carrying a clutch rigid thereon but adapted to move longitudinally to engage with the power-shaft, substantially as set forth.

23. In tunneling and like machines, the combination of a main frame, a power-shaft mounted thereon having a socket with a clutch-face at its rear end, a conveyer-frame back of the main frame, a conveyer mounted in said frames, a driving-sprocket on the conveyer-frame and gearing for driving the same, and a driving-bar having a splineway connection therein and carrying a clutch rigid therewith, the forward end of said driving-bar fitting in the socket of the power-shaft

and being adapted to engage therewith by the longitudinal movement of the bar-section, substantially as set forth.

24. As a means for driving connecting-shafts in tunneling or like machines, the combination of a power-shaft having a socket provided with a clutch-face and a geared outer surface, a longitudinally-movable shaft fitting in the socket and carrying a clutch-section, a clutch-gear mounted loosely on said latter shaft, and an auxiliary shaft mounted at the side of said shafts having gearing engaging with the geared socket and the loose pinion on the longitudinally-movable shaft, substantially as set forth.

25. In tunneling and like machines, the combination with a rotary and advancing cutter-frame of a stationary main frame having a passage in the lower part thereof centrally of the frame, guideways in said passage and a sprocket at the forward end of the frame, and a conveyer-frame secured to the main frame back of the same, said conveyer-frame having guideways connected to the guides of the main frame and inclined upward back of the main frame, and then extending horizontally in the upper part of the conveyer-frame and a conveyer mounted in the guides of the main frame and the conveyer-frame, whereby the material may be carried through the lower part of the main frame and raised upwardly and discharged at the back of the conveyer-frame, substantially as set forth.

26. In tunneling and like machines, the combination with a rotary and advancing cutter-frame of a stationary main frame having a passage in the lower part centrally of the main frame provided with guideways for a conveyer, a conveyer-frame back of the main frame having guideways coinciding with those of the main frame, a conveyer mounted in the guides of the main frame and the conveyer-frame, and side plates on the conveyer-frame for confining the material carried by the conveyer, substantially as set forth.

27. In tunneling and like machines, the combination with a rotary and advancing cutter-frame of a main frame, a conveyer-frame secured thereto and back of the same, and a sled connected to and supporting the conveyer-frame back of the main frame, substantially as set forth.

28. In tunneling and like machines, the combination with a rotary and advancing cutter-frame of a main frame, a conveyer-frame secured thereto and back of the same, a sled connected to and supporting the conveyer-frame back of the main frame, and a jack carried on the sled and supporting the conveyer-frame thereon, substantially as set forth.

29. In tunneling and like machines, the combination of a main frame, a conveyer-frame secured thereto and back of the same, and a sled connected to and supporting the conveyer-frame back of the main frame, said sled being connected to the conveyer-frame by a link, whereby the sled and conveyer-frame are adjustable with relation to each other, substantially as set forth.

30. In tunneling and like machines, the combination of a main frame, a conveyer-frame connected to and back of the same and supported from the tunnel-wall, and a bearing-plate extending out from the side of the conveyer-frame and adapted to bear against the tunnel-wall, substantially as set forth.

31. In tunneling and like machines, the combination of a main frame, a conveyer-frame connected to and back of the same and supported from the tunnel-wall, a bearing-plate extending out from the side of the conveyer-frame and adapted to bear against the tunnel-wall, and a jack connected to the conveyer-frame and bearing-plate for adjusting the plate, substantially as set forth.

32. In tunneling and like machines, the combination of a main frame, a conveyer-frame connected to and back of the same and supported from the tunnel-wall, a bearing-plate extending out from the side of the conveyer-frame and adapted to bear against the tunnel-wall, and a jack connected to the conveyer-frame and bearing-plate for adjusting the plate, the bearing-plate extending forward of the jack and being connected to the conveyer-frame, substantially as set forth.

33. In tunneling or like machines, a conveyer-frame having a conveyer traveling therein, and having a plate extending horizontally between the upper and lower guideways for the conveyer and a sweep traveling over said plate, substantially as set forth.

34. In tunneling or like machines, a conveyer-frame having sprockets and a conveyer engaging with said sprockets, a plate extending horizontally between the upper and lower guideways of the conveyer, a sweep moving over said plate, and connections from the sprocket-shaft to said sweep to operate the same, substantially as set forth.

35. In tunneling or like machines, the combination of the conveyer-frame having guides for the conveyer, the sprocket-shaft m^4 having a crank at the end thereof, the plate s extending horizontally between the upper and the lower guides for the conveyer, the sweep s' mounted on said plate and having an arm extending out therefrom, and a bar connecting said arm and the crank of the sprocket-shaft, substantially as set forth.

36. In tunneling or like machines, the combination of a conveyer-frame having brackets at the rear ends thereof, arms extending out from said brackets to support a sprocket-shaft, and adjustable bearing-bars mounted in said brackets and extending back to and forming an adjusting means for said sprocket-shaft, said adjustable bearing-bars having forked bearings and supporting the journal-boxes of the shaft, substantially as set forth.

37. In tunneling or like machines, the combination of a conveyer-frame having brackets at the rear ends thereof, arms extending out from said brackets to support a sprocket-shaft, and adjustable bearing-bars mounted in said brackets and extending back to and forming an adjusting means for said sprocket-shaft, said bearing-bars having slotted forked bearings at the end, and journal-boxes fitting therein and having lugs fitting in the slots of the bearings, substantially as set forth.

38. In tunneling or like machines, the combination of a conveyer-frame having brackets at the rear end provided with arms extending back and supporting a sprocket-shaft, a plate extending horizontally between the upper and lower guideways of the conveyer, adjustable bearing-bars mounted in the brackets and extending back to the sprocket-shaft, said bearing-bars being connected to said horizontal plate, and a sweep traveling over said plate and operated by the sprocket-shaft, substantially as set forth.

In testimony whereof I, the said JONAS L. MITCHELL, have hereunto set my hand.

JONAS L. MITCHELL.

Witnesses:
JAMES I. KAY,
J. N. COOKE.