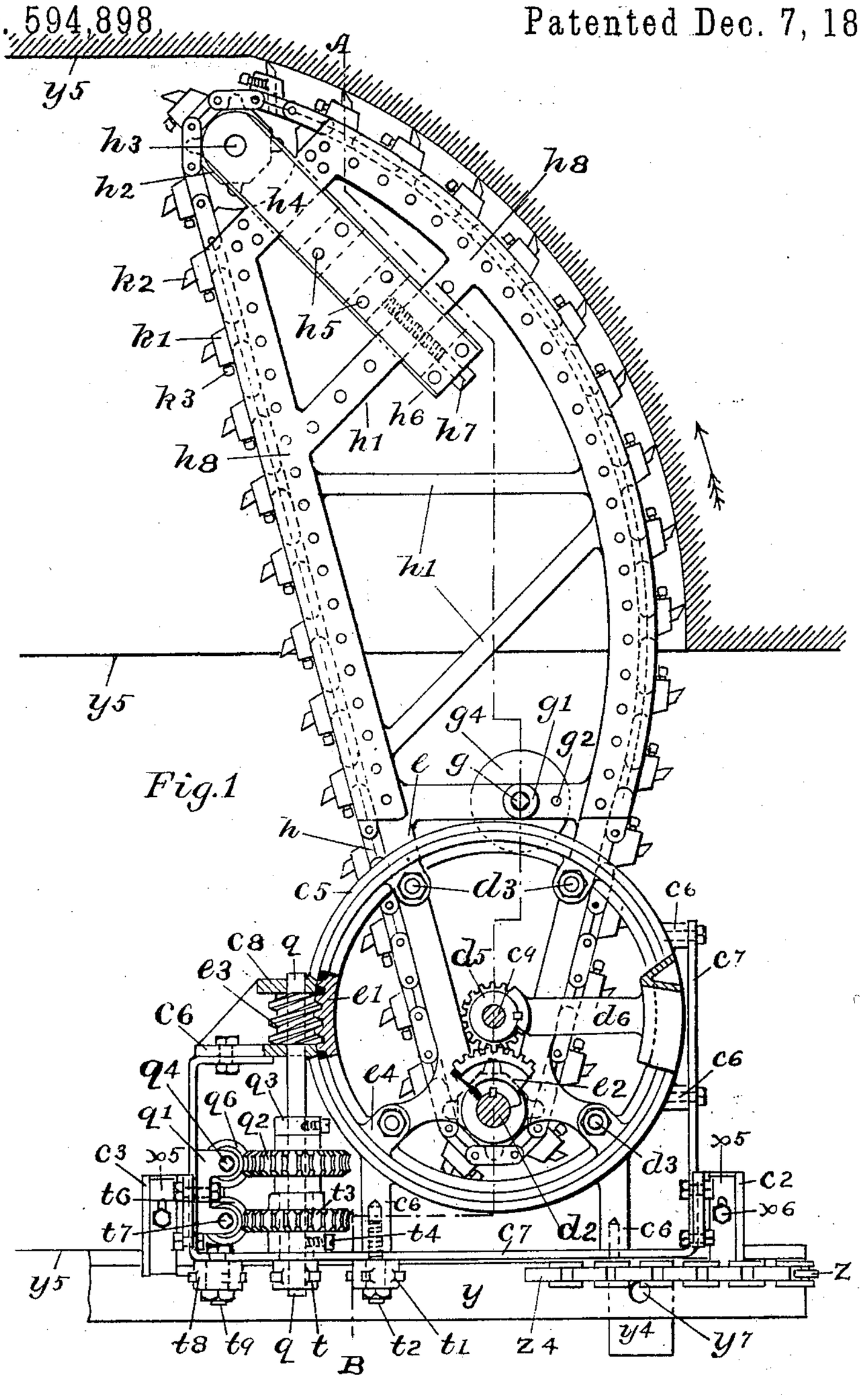
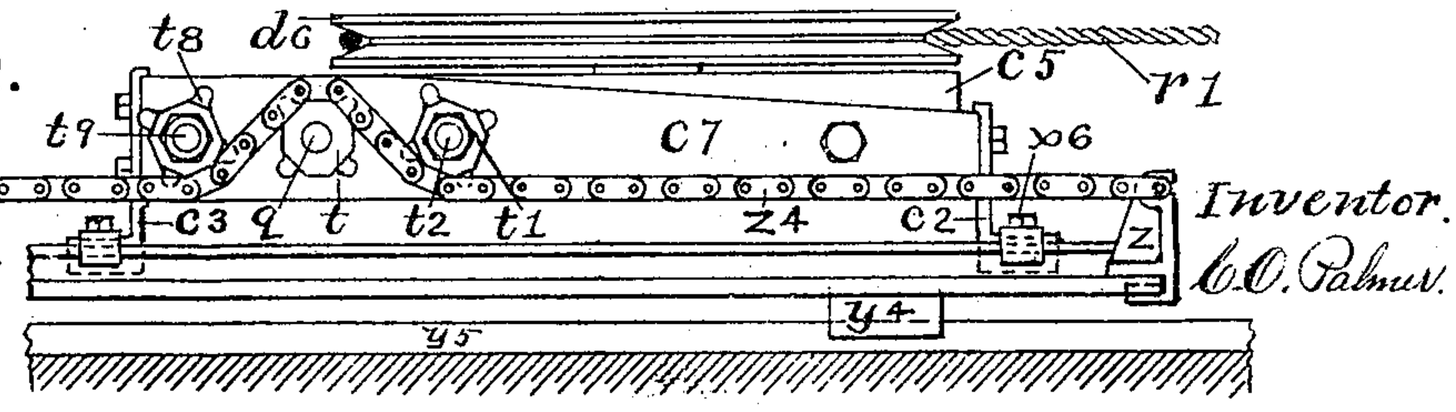
(No Model.) 3 Sheets—Sheet 1.

C. O. PALMER.

COAL CUTTING MACHINE.

No. 594,898. Patented Dec. 7, 1897.





Witnesses
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(No Model.) 3 Sheets—Sheet 2.

C. O. PALMER.

COAL CUTTING MACHINE.

No. 594,898. Patented Dec. 7, 1897.

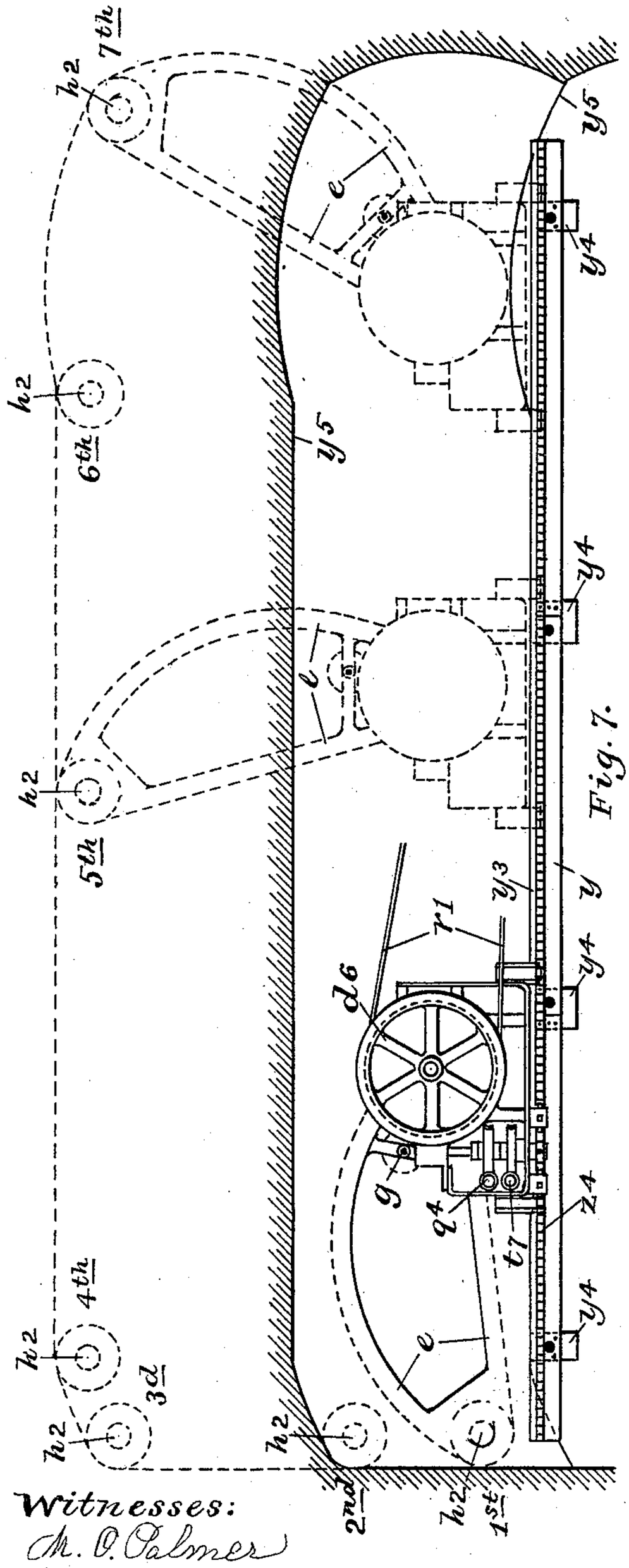

Fig. 7.

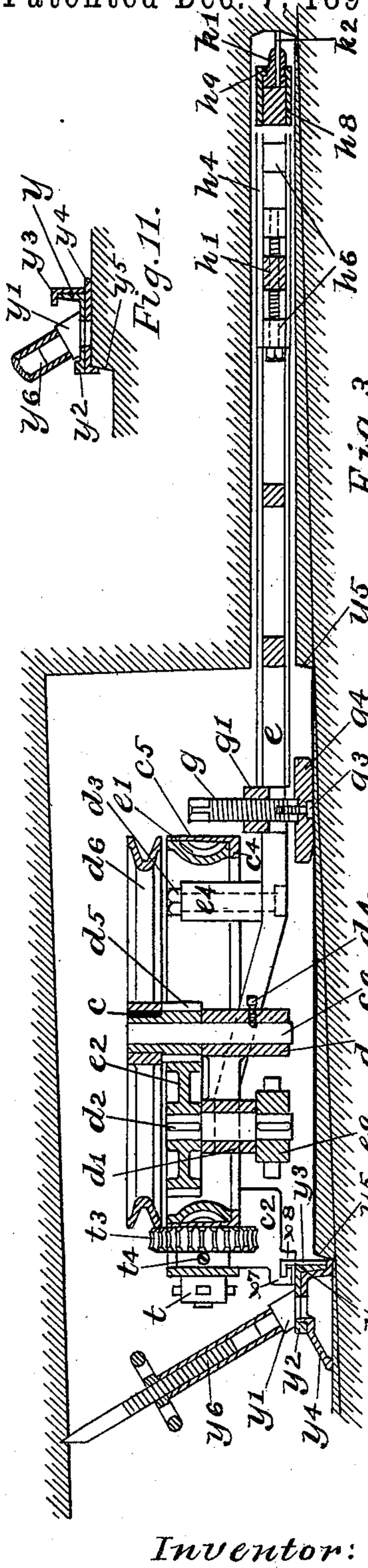

Fig. 11.

Fig. 3.

Witnesses:
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(No Model.) 3 Sheets—Sheet 3.

C. O. PALMER.

COAL CUTTING MACHINE.

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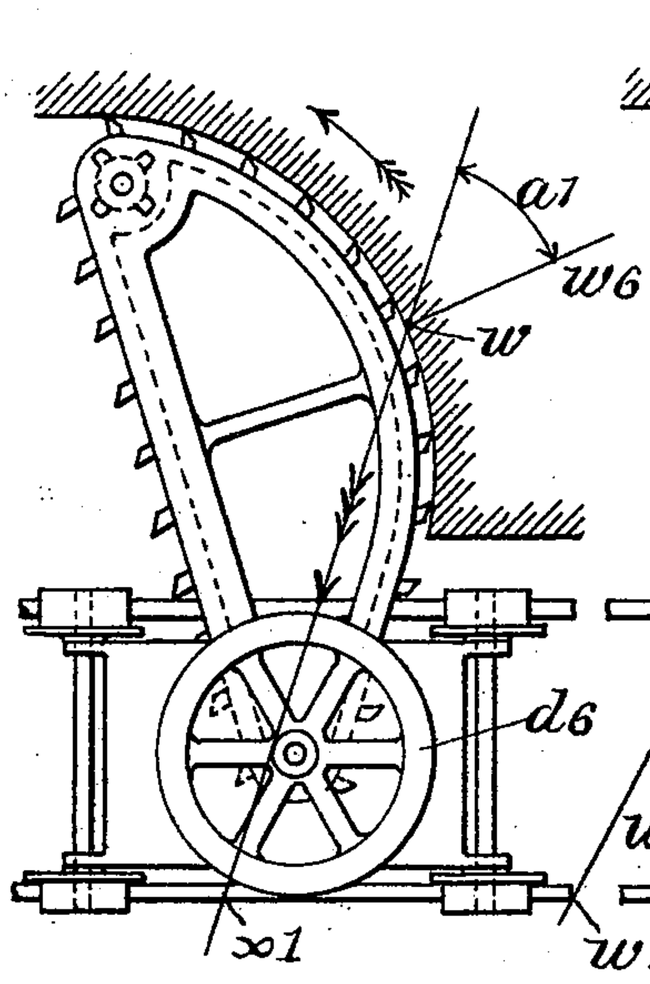


Fig. 10.

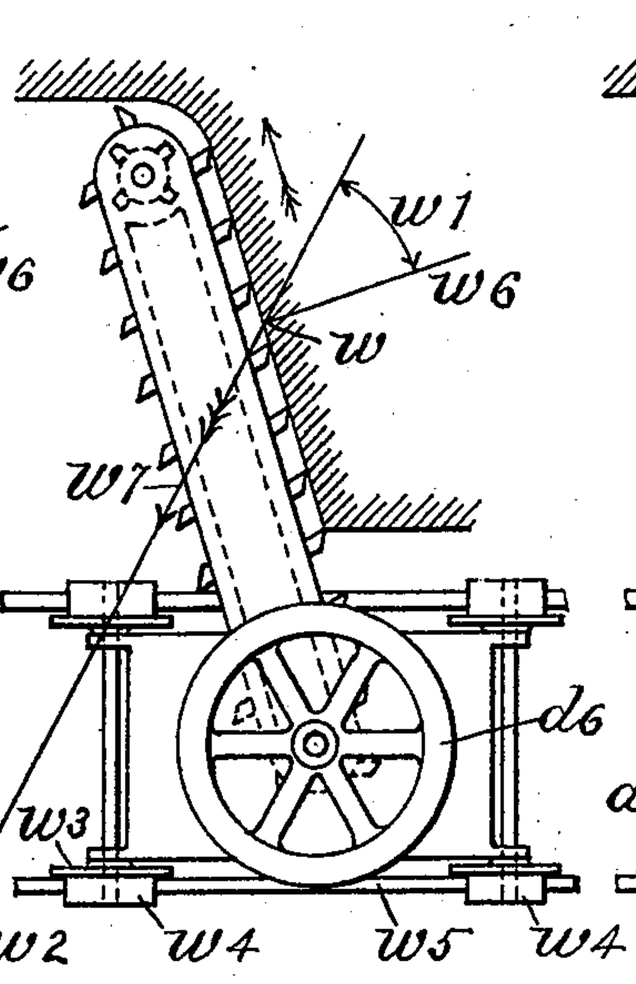


Fig. 8.

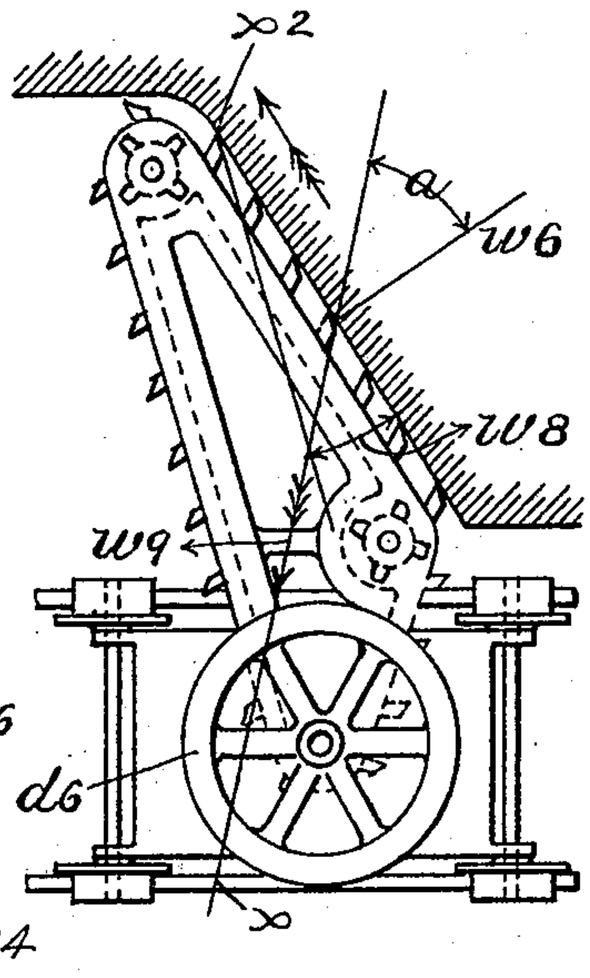


Fig. 9.

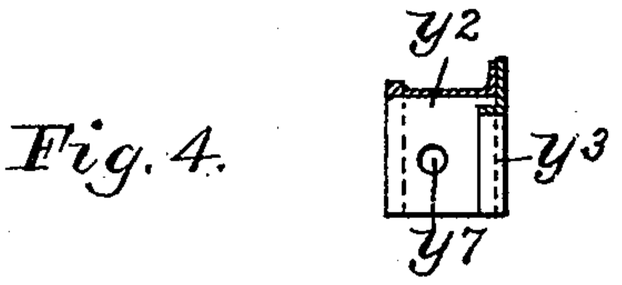


Fig. 4.

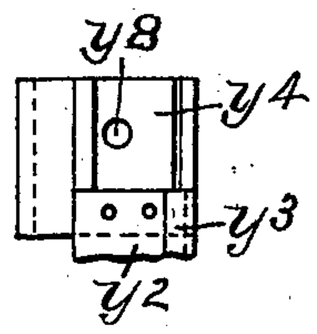


Fig. 5.

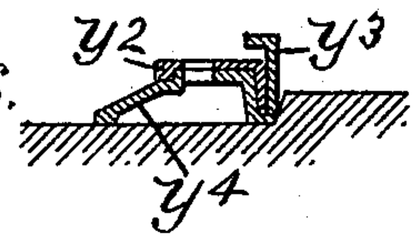
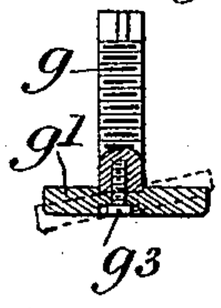


Fig. 6.

Fig. 12

Fig. 13.



Witnesses.
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Inventor.
C. O. Palmer.

UNITED STATES PATENT OFFICE.

CHARLES O. PALMER, OF CLEVELAND, OHIO.

COAL-CUTTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 594,898, dated December 7, 1897.

Application filed February 28, 1896. Serial No. 581,159. (No model.)

To all whom it may concern:

Be it known that I, CHARLES O. PALMER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Coal-Cutting Machines, of which the following is a description, reference being had to the accompanying drawings and to the letters of reference marked thereon.

My invention relates more especially to that class of coal-cutters having a horizontal arm with a horizontally-revolving cutter-chain on its periphery and whose direction of feed when operating is parallel to the working face of the coal.

The object of the invention is to produce a coal-cutter adapted to operate in the room system of mining where there is a low bad roof requiring props close to the working face of the coal, a combination of circumstances most adverse to the use of the coal-cutters now on the market.

The invention consists, substantially, of the construction, combination, and arrangement of parts intended to compact, simplify, and strengthen the mining-machine as well as to facilitate the operation and management of the same, as will be hereinafter more fully described, and pointed out in the claims.

In the drawings forming part of this specification, Figure 1 is a plan of the machine embodying my present improvements with certain of the top parts broken away. Fig. 2 is an end view of the machine shown in Fig. 1. Fig. 3 is a longitudinal section on the dot-dash line A B of Fig. 1. Fig. 4 is a top view of the track-rail. Fig. 5 is a top view of the track-chair with the end of the track attached thereto. Fig. 6 is a transverse section through the socket, the rail, and the chair. Fig. 7 is a diagram of the end of the mine-room, illustrating the mode of operating the coal-cutter in the room system of mining. Fig. 8 is a diagram showing the reaction of the coal against the cutters in the ordinary straight-arm coal-cutter. Fig. 9 is a diagram showing the reactions of the coal against the cutters in my improved form of coal-cutter. Fig. 10 is a diagram showing the reaction of the coal against the cutters in my preferred form of cutter-arm. Fig. 11 is a drawing showing an alternative mode of placing the track on the serrated floor. Fig. 12 is a detail of the hand-crank for operating the feeding mechanism. Fig. 13 is a detail showing the tilting leveling-shoe.

In Fig. 8, which represents a coal-cutter arm mounted on a truck and supported on a track in the ordinary manner, a cutter-arm of the ordinary type is shown, carrying a cutter-chain which projects underneath the coal and is held in the machine-frame in the usual way. The machine is adapted to be operated by a rope from a motor around the pulley d^6. The center of reaction of the coal against the cutters is at the point w, the direction of reaction, as shown by the arrow w^7, being at angle w', with a normal $w\ w^6$, to the cutting-surface at the point w. The reacting force thus found intersects the outer rail of the track at w^2 outside the wheel-base of the track-wheels w^4. The flange w^3 of the nearest track-wheel is therefore called on to resist an unduly large force and has caused the adoption of a very heavy machine and an inordinately long wheel-base to keep the machine in its proper place on the track. This not only makes it cumbersome in long wall work, but makes it entirely too long for its adoption on the room system of working, which will be hereinafter explained. In Figs. 8, 9, and 10 the sprocket-wheels at the extremities of the cutter-arm are each drawn in the same relative position to each other and to the machine.

In Fig. 9 is shown the same machine as in Fig. 8, except that the cutter-arm is bowed outward on the cutting side. The face being operated on by the cutters is thus rotated about the point x^2 through the angle w^8, and consequently the arrow w^9, representing the new resultant of the reaction, is rotated an equal amount. The resultant is thus made to intersect the outer rail at the point x between the track-wheels. This distributes the reaction to be resisted between the outer track-wheel and requires much less force to maintain the machine in its proper position on the track as well as to feed it to its work.

By curving the bowed cutting-face as shown in the diagram Fig. 10 the farther end with its greatest leverage is turned through the greater angle, so that the resultant force in-

tersects the outer rail at a point x' still farther to the right. This still more nearly equalizes the pressure of the two resisting-wheels on the track than in Fig. 9.

In Fig. 1 is seen a large horizontal turret-ring c^5, with a worm-wheel housing c^8 and with laterally-projecting lugs c^6 on the exterior thereof and provided with an interior flange c^4 on its lower edge. Passing around and bolted to the extremities of said lugs c^6 and forming three sides of a rectangle is the frame-bar c^7. By making the side of a separate piece from the turret-ring and casting straight headless lugs on the ring the casting in steel of the ring is very materially simplified, besides allowing of a thinner material in the frame-bar c^7 than is practicable in a strong steel casting of one piece. Attached to the frame-bar c^7 at its right-hand corner is the track-shoe c^2, and to the left-hand corner is the track-shoe c^3, said track-shoes forming the two rear supports of the machine. For the purpose of guiding the machine on the track the track-shoes c^2 and c^3 are furnished with downwardly-projecting flanges x^7 and x^8, which engage the top of the rail on either side, and for preventing the machine from tilting off the track each track-shoe has a clip x^5, sliding in a groove in the top surface thereof. Said clip x^5 has a hook-shaped end that engages under the top flange of the rail and is held in place by the screw x^6, which passes through a slotted hole in the clip and is screwed into a tapped hole in the shoe. When it is desired to lift the machine from the track, the screw x^6 is loosened and the clip is slid forward sufficient to disengage it from the flange of the track. This feature is also referred to in my application, Serial No. 508,022, filed April 18, 1894, and my Patent No. 472,177, dated April 5, 1892.

Situated under the turret-ring c^5 and bearing loosely on the under surface of its bottom flange c^4 is the cutter-arm e. Secured to the upper side of the cutter-arm e by the bolts d^3 and journaled in the turret-ring c^5 is the worm-wheel e', which rests on the interior flange c^4 and acts as a journal for the cutter-arm e. Engaging with the worm-wheel e' is the turret-worm e^3, which reaches through a hole in the side of and is situated in the housing c^8 on the exterior of turret-ring c^5. By having the worm-wheel within the turret-ring the height is reduced to a minimum, the worm-wheel teeth are protected from dust and injury from contact with external objects, and the rotary force is applied in a most direct manner—*i. e.*, between the ends of the bearing.

The cutter-arm e has a bow-shaped contour on its cutting side, and around its periphery revolves the cutter-chain h, carrying the cutters k^2 for operating on the coal. In the space between the sides of the arm lie the lateral braces h', and at its extremities are placed the sprocket-wheels h^2 and e^9, that engage the cutter-chain h. The idler sprocket-wheel h^2, at the outer extremity of cutter-arm e, is journaled on pin h^3, between the sprocket-wheel plates h^4, in a well-known manner. The plates h^4 are secured together by the countersunk bolts h^5, that screw into the distance-pieces h^6. Said plates h^4 slide longitudinally between gibs formed by the chain-guide plates h^8 and is pressed outwardly against the cutter-chain h by means of the adjusting-screw h^7, which passes through the outer distance-piece h^6 and screws into the brace h' of the cutter-arm e.

Tapped vertically through the hub g' on the lateral brace h' nearest the turret is the leveling-screw g. The lower end of leveling-screw g rests in a cavity in the top of leveling-shoe g^4 and is prevented from dropping down when the machine is lifted by the countersunk screw g^3, which passes loosely up through the shoe g^4 and is tapped into the end of the leveling-screw g. The leveling-shoe g^4 is prevented from turning by the pin g^2, which passes down through a hole in the lateral brace and is secured in the top of said leveling-shoe. This shoe g^4 is thus allowed a universal movement which enables it to accommodate itself to the irregularities of the floor. It is thus always made to lie flat on the floor and never gouge or sink into the somewhat soft floor by resting on a small spot only near the outer edge, as it sometimes does when the screw and shoe are made in one piece or secured rigidly together. The purpose of the leveling-screw is to adjust and maintain the cutter-arm at the required height to suit the irregularities of the floor under the machine.

The part of the cutter-arm which enters the kerf has riveted to its upper and lower surfaces and projecting somewhat beyond its periphery the chain-guide plates h^8, each having a flange h^9 on its inner side.

Secured to the cutter-arm near the center of turret-ring c^5 and rigid therewith is the vertical pulley-stud c^9, on which revolves the pulley-pinion d^5, having an upwardly-projecting shank, on which is secured by key c or otherwise the driving-pulley d^6. Journaled within worm-wheel e' and movable therewith is sprocket-wheel shaft d^2, and secured on its upper end also within the turret-ring is the intermediate gear e^2, that engages with pulley-pinion d^5. Secured on the lower end of shaft d^2 is sprocket-wheel e^9, that drives the cutter-chain h. In my former application for a mining-machine, Serial No. 508,022, filed April 18, 1894, the reduction-gearing was above the machine and unprotected; but by this construction the height of the machine is much reduced and the gears protected.

Passing through the frame-bar c^7 and journaled in the housing c^8 at its opposite end is the rotary-feed shaft q, on which is splined the turret-worm e^3. Keyed to shaft q is the rotary-feed worm-wheel q^2, which is driven by the rotary-feed worm q^6. Passing vertically through and splined in the worm q^6 and journaled in the worm-bracket q' is the rotary-

feed worm-stud q^4, having a square shank on its upper end for receiving the hand-crank g^8, by which it is operated.

On the outside of the frame-bar c^7 and fitting loosely around the feed-shaft q is the feed-chain sprocket-wheel t, whose shank extends through and is journaled in said frame-bar c^7. By journaling the sprocket-wheel t upon shaft q a long bearing is secured for shaft q and a long support for the sprocket-wheel t to prevent it bending on its journal. This also makes a very compact arrangement and does not require the further widening of the machine-frame. Secured on the outside of the shank of sprocket-wheel t, by the screw t^4 or otherwise, is the chain-feed worm-wheel t^3, that is operated by the chain-feed worm t^6. Passing vertically through and splined in the worm-wheel t^3 and journaled in the worm-bracket q' is the chain-feed worm-stud t^7, having a square shank on its upper end for receiving the hand-crank g^8, by which it is operated. The worm-bracket q' is secured to the frame-bar c^7 by bolts, as shown.

In my previous application, Serial No. 508,022, filed April 18, 1894, I have shown a mining-machine adapted to cut a groove in the floor by means of a router, and in said groove sets the track-flange; but by my present invention I have succeeded in simplifying the machine by doing away with said router entirely. This I accomplish by sloping the cutter-arm e, as shown in Fig. 3, so that the inner end (which is to the right) is on a level with the floor at the working face of the coal, while the other end is somewhat above it. The floor is thus cut in serrations that extend across the room parallel to the line of travel of the machine. The flanges of the track-chairs y^4 are made to butt against the sides y^5 of the floor, as shown in Figs. 11 and 6.

The track y in my preferred form consists of an angle y^2, placed horizontally, with the flange toward the working face. An angle y^3 has one leg riveted to said flange and the other leg extending horizontally a little above the angle y^2. To the track are bolted supporting-chairs y^4 at intervals along its length. In my former construction (shown in application, Serial No. 508,022, filed April 18, 1894) the track was placed directly on the floor; but the floor was not always smooth nor free from dirt, so that sometimes the support was not under the track-jacks. This caused a distortion of the rail, which I now avoid by supporting the track on chairs placed directly under the track-jacks.

To facilitate laying the track, the rail-joints are made at the chairs. Attached to the under side of the end of one rail is the chair y^4, having a vertical socket y^8 through its top side, as shown in Fig. 3. In the end of the abutting rail is also a vertical socket y^7, which registers with the aforesaid socket in the chair and when in position forms one continuous hole, through which passes the boss on the shoe y' of the track-jack y^6 when the ends of the rails are abutting. The different sections of the track are thus held securely together, as well as tightly to the floor, by the jacks y^6, which press firmly downward and do not require the use of any loose wedges or bolts, which are continually being misplaced and lost, besides requiring time for their insertion and removal. The upper end of said jacks y^6 are slanted backward to more effectually resist the thrust of the machine due to the reaction of the coal against the cutters. The tendency of the jack y^6 to push forward the track y is resisted by the riser y^5 of the floor-serration, against which the flange of the chair y^4 is made to press. Passing over the feed sprocket-wheel t and under the idler sprocket-wheels t' and t^8 on each side is the feed-chain z^4, which is secured to brackets z, that are hooked to each end of the track. A modified form of my track-support is shown in Fig. 11, in which the chair is placed at the top instead of the bottom of the floor-riser y^5.

To operate the machine in a mine worked by the room system, the track y is placed in position across the room and held in place by the jacks y^6, as shown in Figs. 3 and 7. The machine is placed on the track in the position shown in solid lines on the left side of the room, the cutter-arm being on the left of the machine. The machine is then hooked on the track y by the track-shoe clips x^5, the track-brackets z, hooked on the ends of the track, the hauling-chain z^4, passed around the sprocket-wheels t, t', and t^8, and the height of the cutter-arm adjusted by the leveling-screw g. A driving-rope from an electric or other motor is passed around the driving-pulley d^6, and the machine is started. The power is conveyed from pulley d^6 through gear d^5, gear e^2, shaft d^2 to the sprocket-wheel e^9, that drives the cutter-chain h on the periphery of the cutter-arm e.

One hand-crank g^8 is placed on the rotary-feed worm-stud q^4, and by operating through worm q^6, worm-wheel q^2, shaft q, worm e^3, and worm-wheel e' the cutter-arm e, bolted thereto, is given a slow rotary motion around the turret-ring c^5. Another hand-crank g^8 is placed on the chain-feed worm-stud t^7, and by operating through worm-wheel t^6, worm-wheel t^3, sprocket-wheel t, and chain z^4 the machine is fed slowly along the track.

By a prearranged system of successive alternate revolutions of studs q^4 and t^7 the machine is given a translation on the track toward the left and the cutter-arm e the requisite amount of revolution to the right. The sprocket-wheel h^2 at the extremity of said cutter-arm is made to assume the successive positions shown in Fig. 7 and marked "1st," "2nd," "3rd," and "4th." It is then in the same angular position as shown in Fig. 1, or in dotted lines in the middle position of Fig. 7. The chain-feed only is now operated through the stud t^7 and the machine traverses across the room, the said wheel h^2 occupying

successively the positions marked "5th" and "6th," the machine-frame in the meantime having reached its extreme position on the right end of the track. The straight or chain feed is then stopped and the rotary feed is again operated through the stud q^4 until the cutter-arm assumes the position shown in dotted lines on the right and wheel h^2 has reached its seventh position. The undercut is now completed, and the arm e is then swung around to the starting position on the left of the machine, the driving-rope disconnected, the track-clamps x^5 unhooked, the machine loaded on its truck and carried to another room, the track removed to one side, and the coal brought down in the usual manner.

I have not herein claimed, broadly, the particular construction of the turret worm-wheel shown in the accompanying drawings, nor of the machine track shoes and clips, nor of the mode of interlocking the jack-shoes and vertical sockets, as they form part of my Patent No. 472,177, granted April 5, 1892, and of my application, Serial No. 508,022, filed April 18, 1894. Neither have I shown mechanism for driving or regulating the tension on the driving-rope, as it may be of the kind mentioned in my patent for driving mechanism, No. 472,178, dated April 5, 1892, or my patent for a mining-machine, No. 472,177, granted April 5, 1892, or of any other kind known to the art, and does not form part of this invention.

Having described my invention, what I claim is—

1. The combination in a mining-machine of the machine-frame having a turret-ring formed on its forward end, worm-wheel e' mounted in said ring, cutter-arm e secured to said worm-wheel, together with the engaging gears d^5 and e^2 suitably supported within said turret-ring, and forming with pulley d^6 and sprocket-wheel e^9 a continuous driving-train, means for turning said pulley and supporting and moving said machine to its work.

2. In a coal-cutting machine, the combination with the driving mechanism, of the cutter-arm pivoted to, and radially movable with, said driving mechanism; an adjusting-screw g, with a suitable bearing therefor in the rearward portion of said arm, and the tilting leveling-shoe g^4 resting on the floor of the mine, and flexible connections between said shoe and the adjusting-screw g.

3. The combination in a coal-cutter of a horizontal turret-ring, lugs on the periphery thereof, a frame-bar extending around and attached to the ends of said lugs, track-shoes attached to the sides of said frame-bar and resting on the track, a cutter-arm journaled within said ring and carrying a turret worm-wheel thereon, a supporting-shoe under the cutter-arm, a worm journaled on its shaft and engaging said worm-wheel, a sprocket-wheel mounted on said shaft and in said frame-bar, a worm-wheel secured to said sprocket-wheel, a worm engaging said sprocket worm-wheel, a chain engaging said sprocket-wheel and attached to a stationary object, substantially as described.

4. The combination with a coal-cutter track composed of a horizontal web, having a flange or bulb on one edge thereof, a vertical flange on the other, and an angle-iron secured to said vertical flange, of a track-chair having a vertical orifice therein supporting the end of said track, a similar abutting rail resting upon said chair, and having a vertical socket in said chair and a jack having a boss on its lower end fitting said registering sockets and holding the rails together and to the floor, for the purpose herein shown.

5. The combination with a coal-cutter adapted to cut a serrated floor, of a machine-track therefor supported on chairs resting upon said floor and abutting against the riser of the floor, and a jack resting on the track and inclined backward from the working face, substantially as shown and described.

6. The combination with a serrated floor, of a coal-cutter track composed of an angle y^2, and angle y^3, riveted to its flange and projecting outward above said angle y^2, track-chairs y^4 secured under said angle y^2 and abutting the riser y^5 of the serrated floor, substantially as described.

7. The combination in a coal-cutter of a horizontal turret-ring, headless lugs on the periphery thereof, a frame-bar extending around, and attached to, the ends of said lugs, a swinging cutter-arm pivoted in said ring, coal-cutting apparatus mounted on said rotary arm, suitable supports carrying said frame and arm, together with means for driving said cutting mechanism and feeding the same to its work, substantially as described.

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

CHARLES O. PALMER.

Witnesses:
J. H. VAN DERVEER,
W. L. CORRIS.