(No Model.)

3 Sheets—Sheet 1.

# C. O. PALMER.

## MINING MACHINE.

No. 472,177. Patented Apr. 5, 1892.

Fig. 1

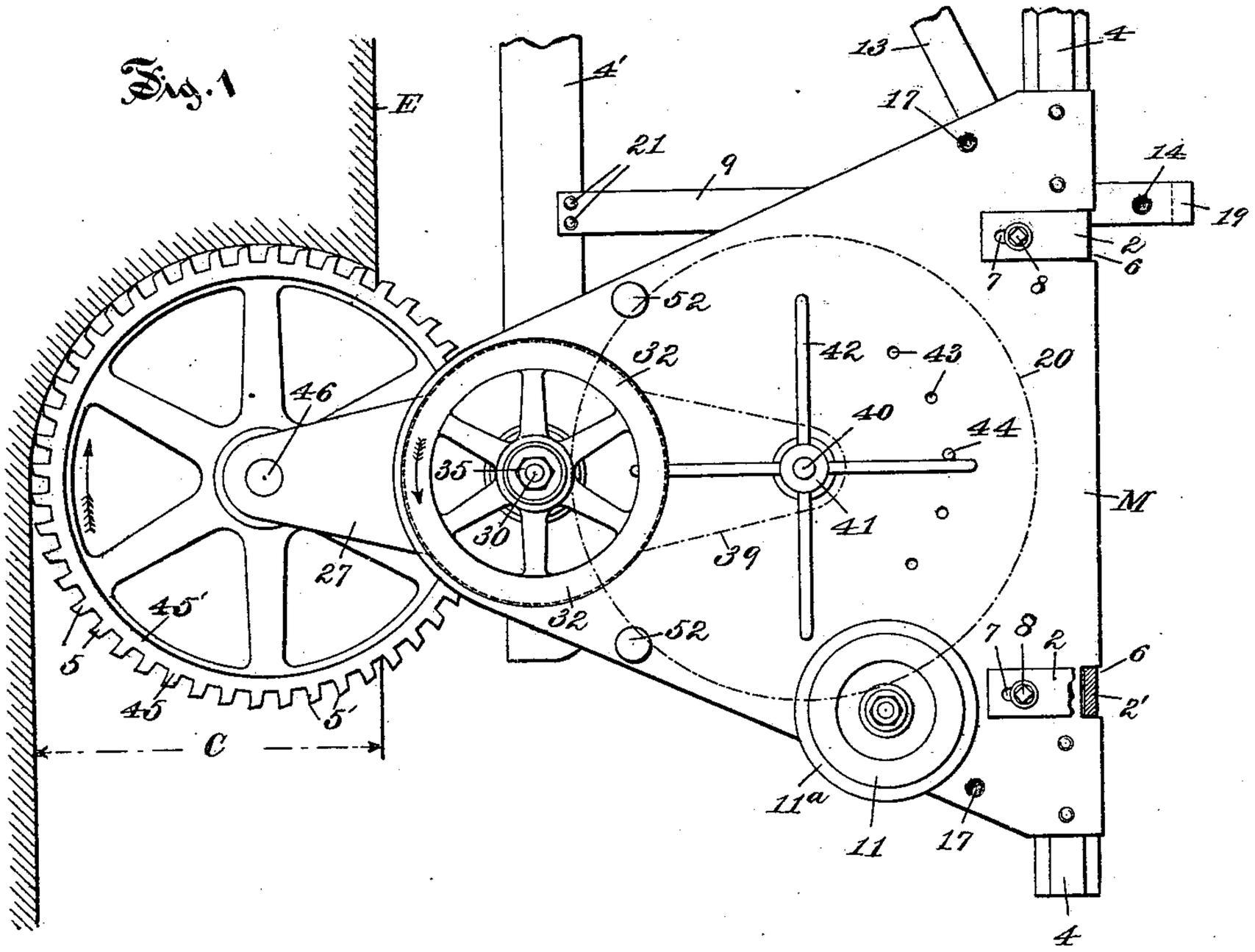
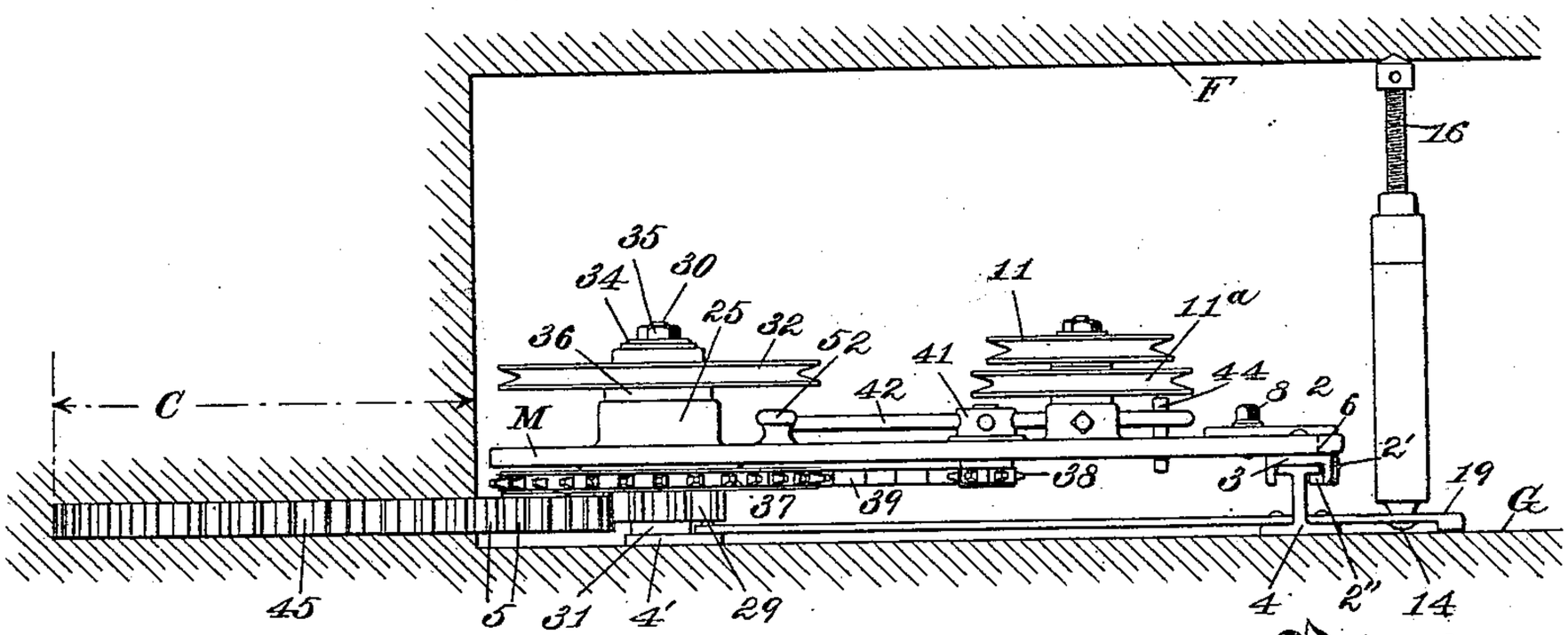



Fig. 2




Witnesses:

W. M. Byerkman,

Henry L. Reckard.

Inventor:

C. O. Palmer.

By his Attorneys,

F. A. Richards.

(No Model.) 3 Sheets—Sheet 2.

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## MINING MACHINE.

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Fig. 3

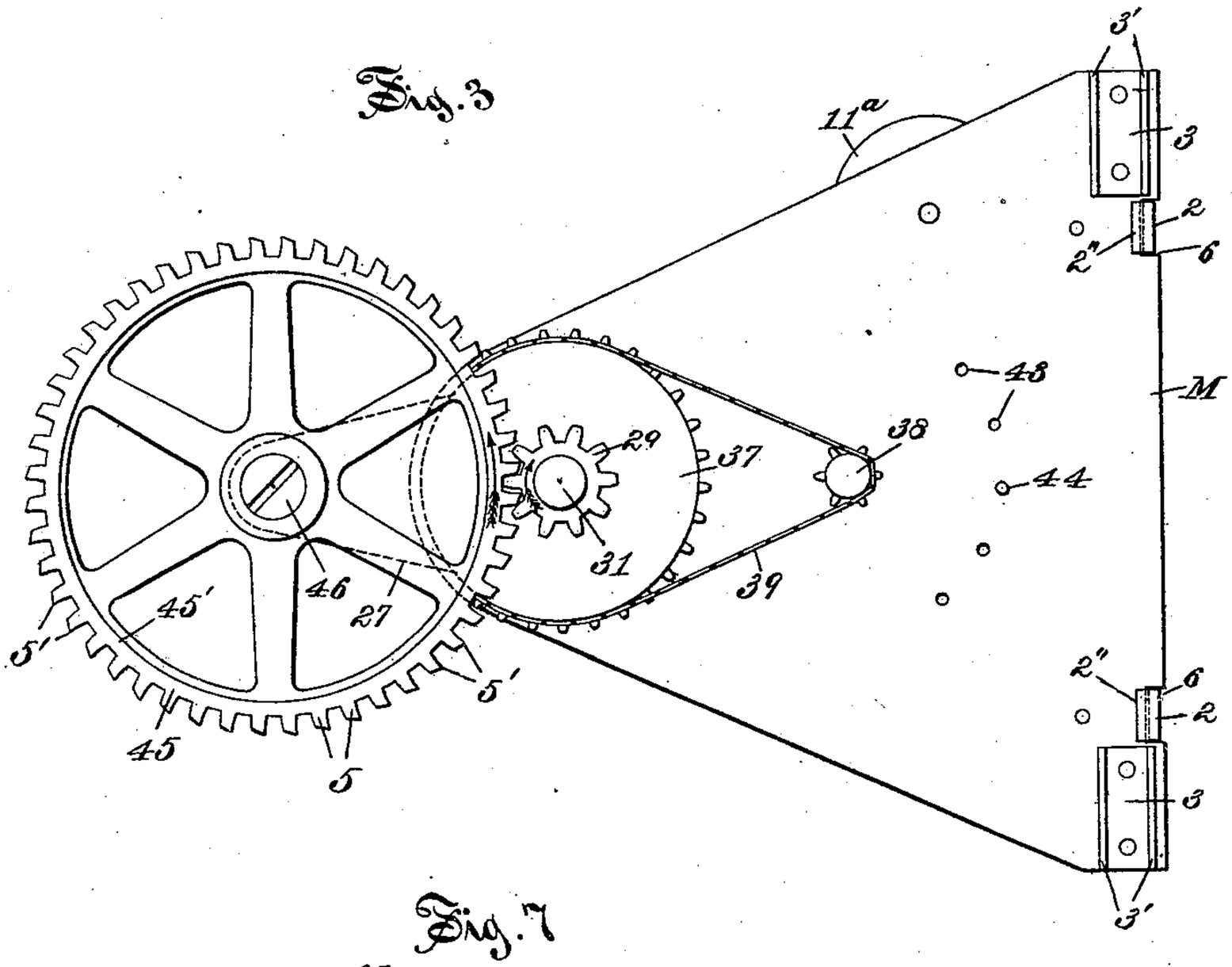



Fig. 7

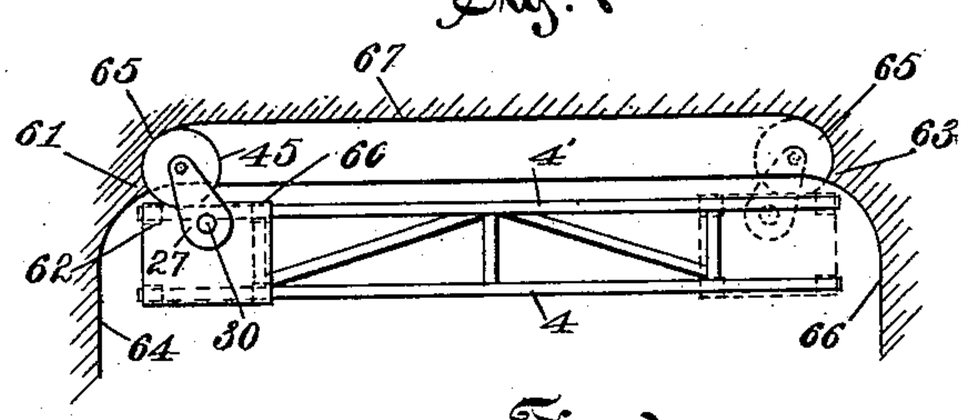
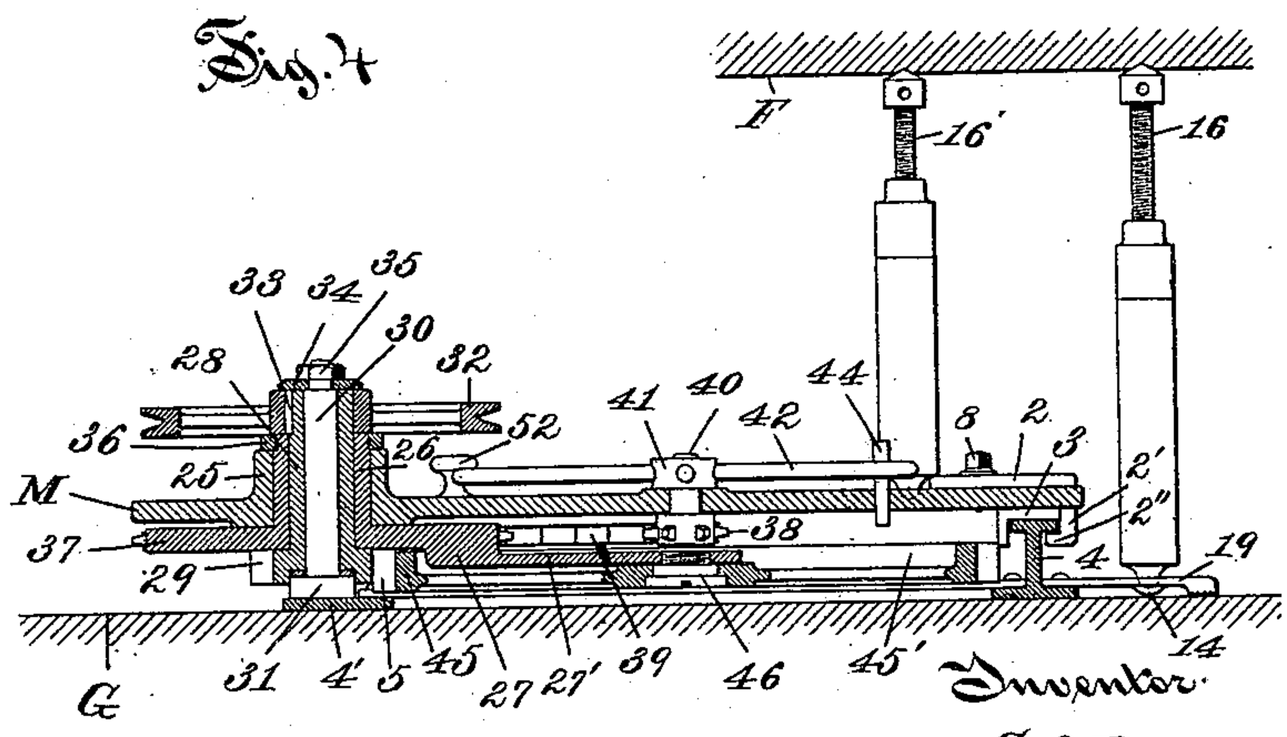



Fig. 4




Witnesses:

W. M. Byerkman.

Henry L. Reckard.

Inventor.

C. O. Palmer.

By his Attorneys.

F. A. Richards.

(No Model.) 3 Sheets—Sheet 3.

# C. O. PALMER.

## MINING MACHINE.

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Fig. 5

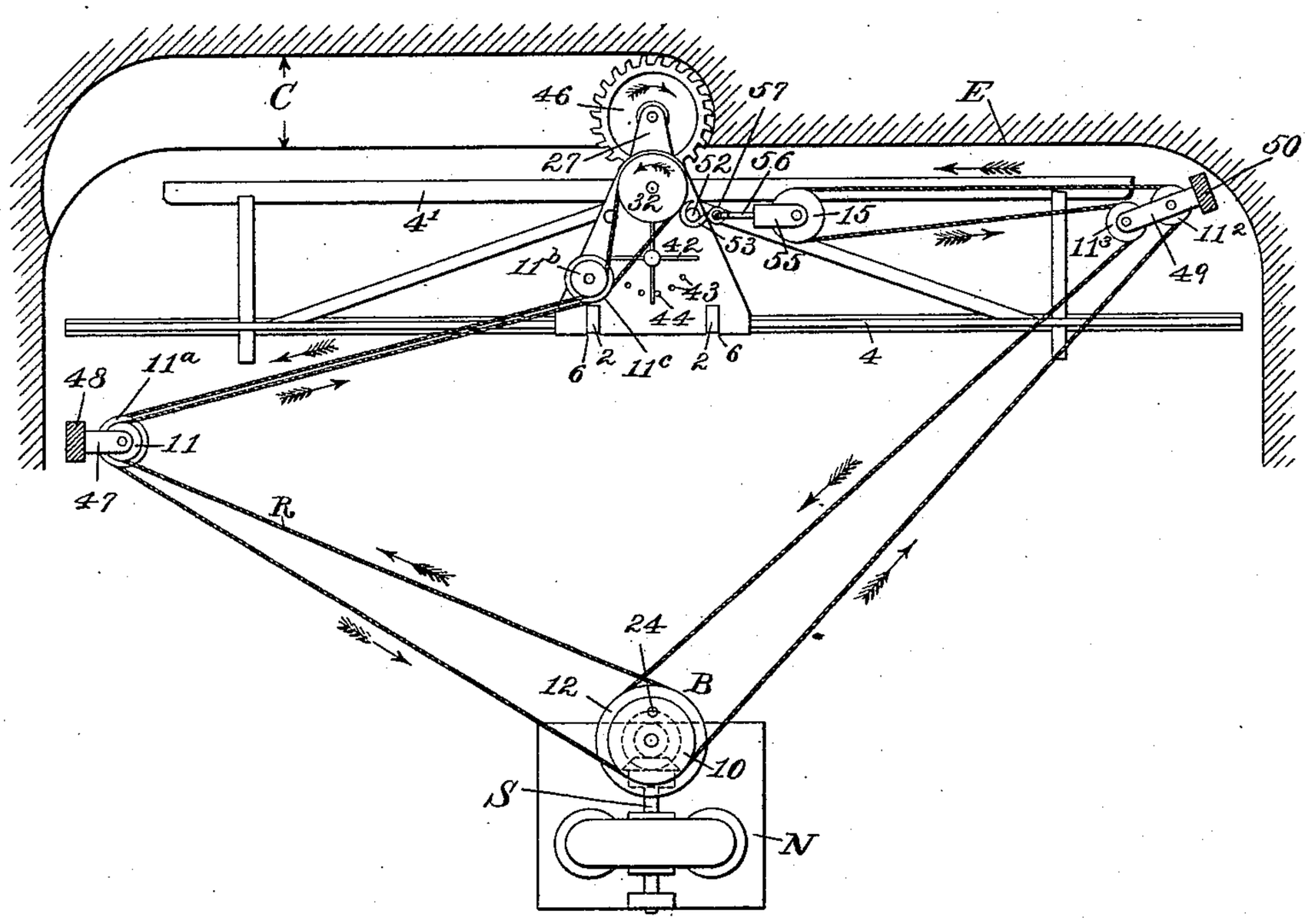
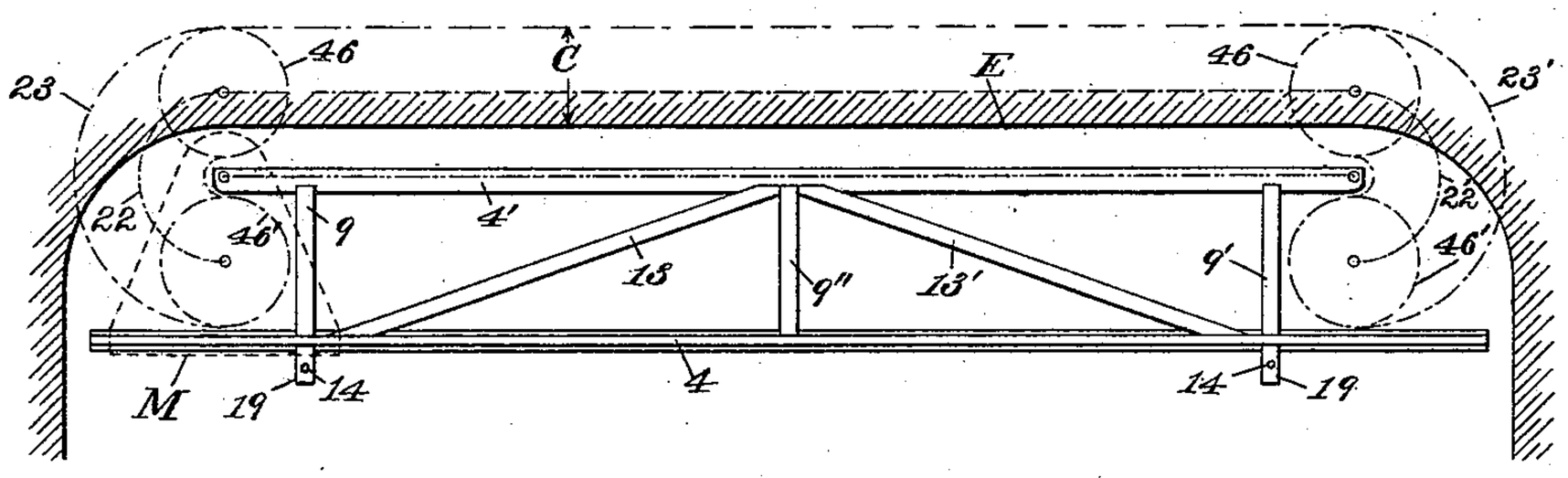



Fig. 6




Witnesses:

Wm. Pyorkman.

Henry L. Peckard.

Inventor:

C. O. Palmer;

By his Attorney.

F. A. Richards.

# UNITED STATES PATENT OFFICE.

CHARLES O. PALMER, OF CLEVELAND, OHIO.

## MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 472,177, dated April 5, 1892.

Application filed January 22, 1891. Serial No. 378,647. (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 Mining-Machines, of which the following is a specification.

This invention relates to that class of mining-machines which have a revolving cutter carried upon a swinging arm, the object being to furnish a portable machine adapted to undercut the mineral at the level of the floor and to cut the entire width of the room.

In the drawings accompanying and forming a part of this specification, Figure 1 is a plan view of a mining-machine embodying my invention. Fig. 2 is a side elevation of the same. Fig. 3 is an inverted plan view of the machine. Fig. 4 is a longitudinal central section of the machine. Fig. 5 is a plan view of the machine and the track on which said machine is fitted to move, together with a motor connected to drive said machine by means of a belt or rope driving system. Fig. 6 is a diagrammatic view illustrating the mode of operation of the machine at the beginning and end of a cut in the "room" system of mining. Fig. 7 is another diagrammatic view illustrative of one feature of the invention.

Similar characters designate like parts in all the figures.

In Figs. 1, 2, and 3 the cutting-wheel is shown extended toward the left hand of the frame-work of the machine, while in Fig. 4 said wheel is shown swung back under the frame-work and between the track-rails in the position for starting the cut. In practice it is usually desirable to swing the cutting-wheel-carrying arm, together with the cutting-wheel thereon, under the frame, as indicated in Fig. 4, and by the dotted lines 20 in Fig. 1, when about to transport the machine from place to place in the mine or elsewhere, because of the compactness and manageability thereby secured.

The machine comprises a frame-work, a cutter-carrying arm mounted to turn about a point at one side of said frame-work, a cutter or cutting-wheel mounted on the outer end of said arm, means for actuating the cutting-wheel, and means for feeding the cutting-wheel to its work. The frame-work consists of a plate furnished with suitable track-bearings and constructed to carry the operative parts of the machine. Said frame-work is designated in a general way by the reference-letter M.

The track on which the machine runs consists, in its preferred form herein shown, of the **I**-shaped beam or outer rail 4, the flat inner rail 4′, and suitable cross-ties 9, 9′, and 9″, and braces 13 13′ for uniting together the rails and holding them parallel. For preventing the lateral movement of the track the cross-ties 9 are two of them extended through mortises in the outer rail 4 and fitted—as, for instance, by having sockets, as 14, Fig. 1, formed therein—to receive the lower end of a suitable jack, as 16, Figs. 2 and 4, whereby said projecting end 19 may be firmly clamped to the floor G of the room of the mine.

It will be understood that the several elements of the track are to be connected by means of rivets, as 21, Fig. 1, or by other well-known means. In practice the inner rail 4′ is made somewhat shorter than the outer rail, and also the end cross-bars 9 and 9′ are set at some distance from the end of the rail, substantially as shown in Figs. 1, 5, and 6, so that the cutter-wheel of the machine may swing from the outward position around to the inner position between the ends of the rails outside of the end cross-bars, as indicated by the dotted circular lines 46′ in Fig. 6.

For the purpose of guiding the machine-frame M on the track said frame is furnished with the shoes 3, whose depending flanges 3′, Fig. 3, engage the top of the outer rail 4, as will be understood by comparison of Figs. 2, 3, and 4. For preventing the frame M from being lifted from its track I provide one or more adjustable clamps, as 2 2, which are fitted, as shown, to the top of the frame and engage in notches at 6, formed in the edge of the frame-plate, and whose depending ends 2′ are furnished with the hooks 2″, which engage under the top flange of the rail 4. Said clamps being slotted, as indicated at 7, Fig. 1, and held in place by clamp-screws 8, may, on the loosening of said clamp-screws, be slipped toward the right hand in Figs. 1 to 4, inclusive, so as to withdraw the hook 2″ from under the rail-flange, and thus disconnect or unlock the

machine from the track. By this means the machine is fitted to slide on the track and to be rigidly locked thereto and unlocked therefrom. Said frame M has a hub 25 bored to receive the hub 26 of the cutter-carrying arm 27, which said hub 26 is bored to receive the long hub or sleeve 28 of the cutter-driving pinion 29. The hub 28 is bored to receive the shaft or stud 30, whose enlarged lower end 31 forms a shoe or base resting on the aforesaid flat inner rail 4′. A grooved driving wheel or pulley 32 is fixed to the upper end of the sleeve 28 by means of a suitable key, as 33, Fig. 4, or otherwise, a washer 34 and nut 35 being provided to hold the said parts in place. The hub or tubular bearing 26 of the arm 27 is securely held in place within the hub 25 of the frame by means of a ring-nut 36 on the upper end thereof. (See Figs. 2 and 4.) The fixed chain-wheel 37 is shown formed integral with the said arm 27, (see Fig. 4,) said feed-wheel being driven by and from a feed-pinion 38 through and by means of the drive-chain 39. (See Figs. 2 and 3.) Said pinion 38 has a stem 40, which passes up through a bearing in the frame M, and has fixed to the upper end thereof a hub 41, having arms or levers 42, by means of which the cutter-carrying arm may be swung around by hand. A series of holes 43 are shown formed in the frame of the machine to receive a stop-pin, as 44, for engaging the said arms 42, and thus preventing retraction of said arms during the forward movement of the machine on the track.

The revolving cutter 45 is revolubly supported on the arm 27 by means of a suitable pivot screw or bearing, as 46. The cutter is revolved on said bearing by means of the pinion 29, whose teeth engage the teeth 5 of the cutter, as will be understood from Figs. 2, 3, and 4. The pinion 29 being driven in the direction of the arrow thereon in Fig. 3, the teeth thereof bear against the back sides of the cutter-teeth 5, and thus escape contact with the cutting-points 5′, Fig. 3, of the cutter-teeth. In some cases and whenever desired the teeth 5 may have suitable inserted cutters or points, (not herein shown,) the pinion 29 being shaped to clear the same.

For the purpose of cutting a channel, as C, Figs. 1, 2, 5, and 6, broader than the distance from the hub to the periphery of the cutter-wheel I construct the said wheel on the extending and down-set part or arm 27′ of the swinging carrier 27, which arm lies within the cutter-wheel rim 45′ and below the upper line thereof, as best shown in Fig. 4. By this means said arm 27′ passes, with the cutter-wheel, into the channel being made, as illustrated in Figs. 1, 2, and 5, thereby greatly increasing the normal capacity of the machine over what it otherwise would be. The feed-wheel portion 37 of said carrier lies altogether above the plane of the cutter-wheel, so as to connect properly with the feed-pinion by means of the chain 39 or some equivalent therefor.

The machine-frame M is provided at the rearward side thereof with suitable track-bearings for supporting the frame on the back rail of the track. On the opposite or forward side thereof the frame has a single support, which is usually and preferably located about midway of the aforesaid track-bearings measured longitudinally of the machine. The cutter-carrying arm 27 is journaled at one end thereof to the machine-frame at the place of said single frame-support and carries at the outer end thereof a revoluble cutter. This cutter and also the principal part of the length of the arm 27 are located below the the plane of the machine-frame, so that by swinging the said arm about its point of support the cutter may be swung under and from under the machine-frame on either side thereof, as may be required, and may pass entirely around said single frame-support. This arrangement of the triangular base secures a firm bearing on the track, notwithstanding the unavoidable irregularity thereof, whether the same be due to rudeness of construction or to the springing of the rails by the holding-jacks. The forward bearing being a single one permits the arm or carrier 27 to be swung entirely around the same, as required for starting and finishing a cut when working on the room system. (Illustrated in Figs. 5 and 6.) The forward end of the machine being supported by a single bearing substantially coincident with the axis of the swinging cutter-carrying arm enables the periphery of the cutting-wheel to reach the full width of the frame M on each side thereof. This would not be the case were the frame supported on the forward side thereof by bearings outside of the sweep of the wheel. This latter arrangement is shown in the diagrammatic view, Fig. 7, wherein the cutting-wheel 45 is shown carried by the arm 27 similarly as in the preceding figures; but said arm is here shown pivotally supported at a point 30 between the front bearings 60 and 62 on the rail 4′, the terminal portion of the cutting-wheel being shown by the line 65. This construction and arrangement of the machine leaves the corner 61 of the room to be undermined by hand, in order to preserve the width of the room uniform throughout the entire length thereof. The sides of the room are indicated at 64 and 66, while the normal extent of one cut made by the machine is shown by the line 67. This illustration is given for the purpose of bringing out more clearly the special utility and advantage of the improvements herein described and claimed, whereby the cutting-wheel may be swung entirely around the forward bearing of the machine, which important feature permits the machine, as above set forth, to be used more effectively, and makes it available for work otherwise necessarily done by hand.

In using this machine the single support thereof rests on a forward rail, which lies on the floor of the mine. The cutter-wheel cuts a kerf or channel, which is on a level with the floor of the mine, and whose lower side constitutes an extension thereof. For that purpose the lower face of the wheel is set substantially in the plane of the lower side of said forward rail, the cutter being carried upon a swinging arm, which is journaled concentrically with a pinion that engages with and drives the cutter. Said pinion stands immediately over the rail and the cutter projects below the pinion by a distance about equal to the height of said forward rail or a little in excess thereof. The single forward support for the machine-frame may consist of the lower side of the pinion, or, preferably, as herein shown, of a bearing, as 31, arranged and held in place substantially as hereinbefore more particularly set forth. By this method of cutting level with the floor on which the track rests, in connection with the improved construction of the machine whereby the cutter may be swung entirely around the single forward frame-support, the machine is adapted for undercutting the entire width of the room, (thus obviating the necessity for any undercutting by hand,) and the leveling up of the floor, usually necessary for preparing the same to receive the track, is avoided. For the cutting of one kerf or channel the forward rail rests upon that portion of the main floor made by the cutting of the preceding kerf.

When the cutter is fed to its work by the swinging of the carrier-arm, it is sometimes necessary to clamp the machine to its track. This may be done by means of one or more suitable jacks, as 16′, Fig. 4, set in properly-located sockets, as 17, Fig. 1, formed in the machine-frame, said jacks bearing, of course, against the roof F of the room or mine, as illustrated in Fig. 4. The sockets 17 17 being located at some distance, as shown, forward of the back rail 4, the jacks set in said sockets will of course tend to hold down the forward end of the frame onto the flat front rail 4′, thereby preventing the lifting or shifting of the frame by the action of the cutters on the mineral or by the draft of the driving-rope.

In Fig. 5 I have shown the machine connected to be driven by power supplied from some fixed source or motor by means of a belt or rope driving system having therein a differential element in accordance with the invention described in my concurrent application, Serial No. 379,333, filed January 27, 1891. The motor comprises, beside the base or frame work N, a driving-shaft S, connected to operate the driving pulley or pulleys for actuating the driving-rope. As shown in the drawings, the motor is supposed to be an electromotor; but any suitable engine or other available prime mover may be employed.

The driving system consists of the driving-pulley, the driven and intermediate pulleys, the fulcrum-pulley, and a driving belt or rope arranged to form a double circuit, in one of which circuits the differential element is located. In the arrangement shown in Fig. 5 the driving-pulley B consists of two pulleys 10 and 12, adapted to be rigidly locked or connected together (as, for instance, by the lock-pin 24) and of different diameters, thereby constituting the differential element, whose function is to effect the feeding forward of the machine on its track. The driven pulley 32 is a single pulley, similar in character to the driving-pulleys 10 and 12, and affixed, as aforesaid, to the driving-pinion 29. The intermediate pulleys 11, $11^a$, $11^b$, and $11^c$ are located at convenient points between the driving and driven pulleys. The fulcrum-pulley 15 is secured by a sheath or "block," as 55, to the machine at a point near the forward end thereof, a link 56, a hook 53, and stud 52 being provided for this purpose. The driving-rope R extends from the large pulley 12 to the intermediate pulleys 11 and $11^c$ and around the driven pulley 32, then back and around the intermediate pulleys $11^b$ and $11^a$, then to and around the smaller driving-pulley 10, then to and around the intermediate pulley $11^2$, and from thence to the fulcrum-pulley 15, and back around the intermediate pulley $11^3$, and to the driving-pulley 12, thus completing two circuits. The pulleys 11 $11^a$ are carried by any suitable and convenient device—as, for instance, the bracket 47—which may be supported at some convenient point by a jack or post 48. The intermediate pulleys $11^b$ and $11^c$ are carried, as shown, by a stud, which is supported on the frame-work of the machine. The other intermediate pulleys $11^2$ and $11^3$ are carried by a bracket 49, which is supported by the jack or post 50, similar to the post 48.

The two lines or "runs" of the driving-rope, which extend from the driving-wheels 10 and 12, respectively, to and around the driven pulley 32, constitute the "driving-circuit," while the opposite lines or runs, extending from said driving-wheels to the fulcrum-pulley 15, constitute the "feed-circuit" of the driving system. The operation of the differential wheels 10 and 12 when operated in the proper direction, as indicated by the arrows in Fig. 5, is to pay off the rope to the driving-circuit faster than it takes back the rope from said circuit, the difference being taken from the feed-circuit, thereby shortening the same. The lengthening of the one circuit and the shortening of the other is compensated by the drawing forward of the mining-machine on its track toward the right hand in Fig. 5, the rate of said movement depending of course on the relative sizes of the two wheels 10 and 12, which sizes may be made of a proportion suitable for any required rate of feed.

In preparing to use the mining-machine the miner or workman first places the track alongside of the face E of the room or mine,

as indicated in Fig. 6, and places the mining-machine at one end of said track, as indicated by the dotted line M at the left hand in said Fig. 6, the cutter being then located under the machine, as shown in Fig. 4 and as indicated by the dotted circle 46′ between the left-hand ends of the rails 4 and 4′ in Fig. 6. Next the operator sets the jacks 48 and 50 and reels on the driving-rope R, substantially as shown, ready for operating the mining-machine, and clamps down the machine by means of suitable jacks, as hereinbefore described. The cutter-wheel being now revolved in the direction shown by the arrow in Fig. 5, the operator gradually swings the carrier-arm and the cutter-wheel thereon around toward the right hand, as indicated by the dotted line 22, Fig. 6, thus cutting into the face of the wall, as indicated by the dotted line 23, until the cutter-carrier stands directly forward of the frame M, as indicated in Figs. 1, 2, 3, and 5. This position being reached, the detent-pin 44 is inserted into one of the holes 43, thereby locking the cutter-carrier from backward movement. The machine is now unclamped, and the lock-pin 24 is put through the two driving-wheels 10 and 12, thereby locking the same together, so that on the further operation of the apparatus the machine will be fed forward, as hereinbefore set forth, toward the right hand in Fig. 5. This operation is continued until the cutter reaches the point indicated by the dotted circle 46 at the right hand, Fig. 6, when the machine is again clamped to its track, the pin 24 removed from the driving-wheels 10 and 12, and the cutter swung farther forward, as indicated by the line 22′, thereby finishing the cutting of the channel, as indicated by the dotted line 23′. This finishes one operation, after which the machine and track are shifted back from the working breast or wall E, while the undercut mineral is broken down and removed in the ordinary way.

For the purpose of connecting thereto the block 15 to feed forward the machine the machine-frame may have suitable studs, as 52 52, to which the hook 53 of said block may be attached.

It will be understood that the entire apparatus may be set up to operate either right-handed, as shown, or left-handed, as may be desired, with the exception of the cutter-wheel, which should be constructed conformably to the said arrangement adopted.

Although my improved machine is adapted for operating on the "long-wall system," as hereinbefore described, it is especially adapt for use in "undercutting" in rooms and entries where it is required to undercut the full width of the room or entry. It will be understood that for the driving of the cutter I am not limited to the rope-driving feature herein described, since any well-known flexible connection may be adapted and arranged for the driving of the machine. It will also be understood that my improved machine is adapted to be used independently of a track, being set directly upon the floor of the mine in cases where the cutting is done, as in the driving entries, by swinging the cutter-carrying arm without sliding the machine-frame during the cutting.

Having thus described my invention, I claim—

1. In a mining-machine, the combination, with a track having a back rail and a shorter forward rail, of the frame having three frame-supports arranged in a triangular form, two of said supports bearing on the back rail and a single support bearing on the forward rail, a cutter-carrying arm supported on the frame at the place of said single frame-support and adapted to be swung around said single support, and a cutter-wheel revolubly mounted on said arm beyond said single frame-support, whereby said cutter may be swung under and from under said frame around the ends of said forward rail, substantially as described.

2. In a mining-machine, the combination, with the track having a rail flanged at the top thereof, of the mining-machine frame bearing on said flanged rail, the adjustable clamps engaging in notches in the frame and adapted to engage under the rail-flange, and means holding said clamps in place, substantially as described.

3. In a mining-machine, the combination, with the track having a flange-topped rail, of the machine-frame having the shoes 3 with depending flanges 3′ fitting on either side of the rail-top, and the adjustable clamps 2, constructed substantially as shown, for sliding adjustment on the frame to engage and disengage the same from the rail-flange, substantially as described.

4. In a mining-machine, the combination, with the track having the flanged back rail and the flat-topped front rail, of the machine-frame furnished for sliding engagement with the back rail and carrying the swinging cutter-carrying arm, and the stud located concentrically with the axis of said arm and having its lower end forming the bearing for the machine on the front rail, substantially as described.

5. In a mining-machine, the combination, with the machine-frame having the bearing for the carrier-arm, of the cutter-carrier 27, supported by a tubular journal in said bearing and having the down-set projecting arm carrying the cutter-wheel and lying within said wheel, substantially as described, the tubular shaft 26, having a pinion meshing with the teeth of the cutter-wheel and provided with means for revolving the pinion, and a central stud through said pinion-shaft and constituting a bearing for supporting the machine, substantially as described.

6. In a mining-machine, the combination, with a track having a back rail and a shorter forward rail, of the triangular frame having bearings on one side in sliding engagement

with the back rail and having a bearing at the point opposite said side and resting on the front rail, and a cutter carried on an arm constructed and arranged, substantially as described, to turn about said single bearing, whereby the cutter may be swung around the end of said shorter rail, substantially as described.

7. In a mining-machine, the combination, with a mining-machine frame having at one side thereof a single support, of a cutter-carrying arm, substantially as described, supported to swing around said frame-support, and a cutter revolubly supported on said arm beyond said frame-support, and means revolving the cutter and swinging said arm, substantially as described.

8. In a mining-machine, the combination, with a machine-frame provided with track-bearings at the rearward side thereof and provided with a single support at the forward side thereof, of the cutter-carrying arm journaled at one end thereof to the machine-frame at the place of said single frame-support and having its projecting end below the plane of said frame, and the cutter revolubly supported on the under side of said arm beyond said single support and below the plane of the machine-frame, whereby said cutter may be swung around said single support under and from under the machine-frame, substantially as described.

9. In a mining-machine, the combination, with the machine-frame having a bearing for the journal of the cutter-carrying arm, of the cutter-carrrying arm journaled in said bearing and located below the plane of the machine-frame, the pinion below said arm and concentric with the axis of the swinging movement of the arm, and the revoluble cutter carried on the extended end of said arm and meshing with said pinion, all substantially as shown and described.

10. In a mining-machine, the combination, with a track having a back rail and a shorter forward rail, of the frame supported on the track for longitudinal movement thereon and having a single support bearing on the forward rail, a cutter-carrying arm supported on the frame at the place of said single frame-support and adapted to be swung around said single support, and a cutter revolubly mounted on said arm beyond said single frame-support and extending downwardly below the plane of the upper side of said forward rail, whereby said cutter may be swung around the ends of said forward rail and the mineral undercut at the level of the floor, substantially as described.

CHARLES O. PALMER.

Witnesses:
EDGAR E. STARK,
ALBERT E. LYNCH.