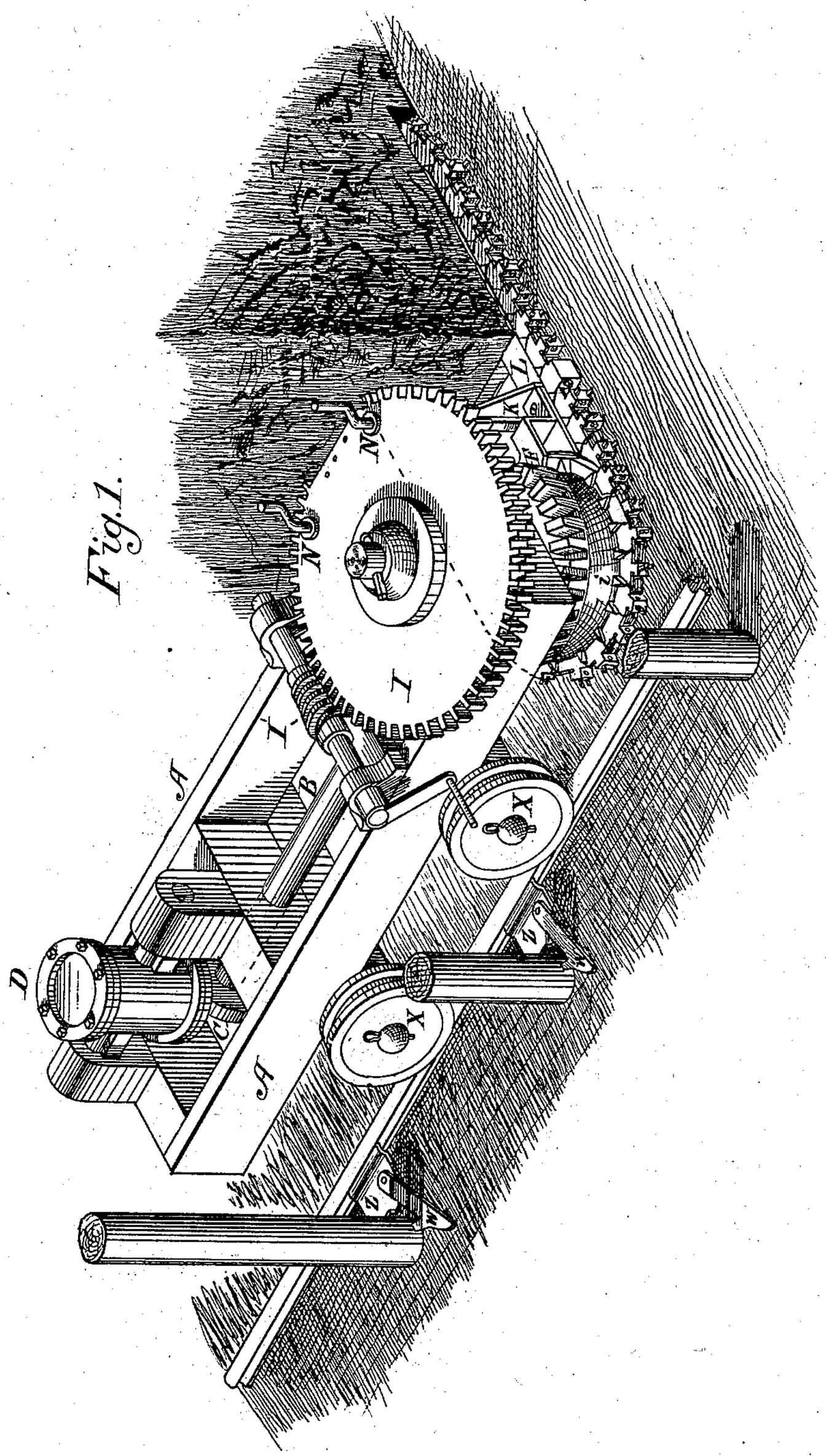
3 Sheets—Sheet 1.

H. F. BROWN.

COAL-CUTTING MACHINE.

No. 187,702. Patented Feb. 27, 1877.

Fig. 1.



Attest:
W. W. Adams

Inventor.
Horace F. Brown

3 Sheets—Sheet 2.

H. F. BROWN.

COAL-CUTTING MACHINE.

No. 187,702. Patented Feb. 27, 1877.

Fig. 2.

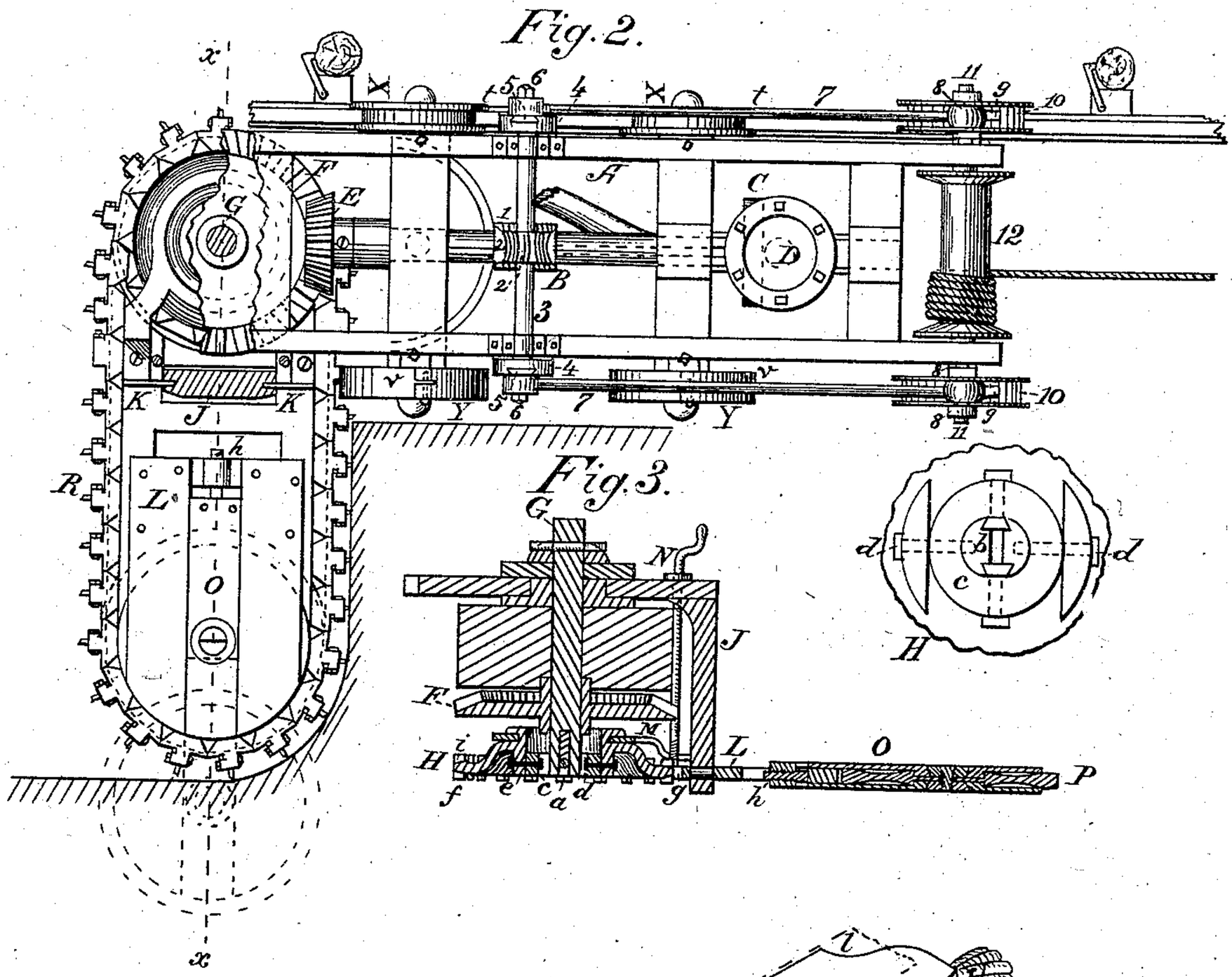


Fig. 3.

Fig. 4.

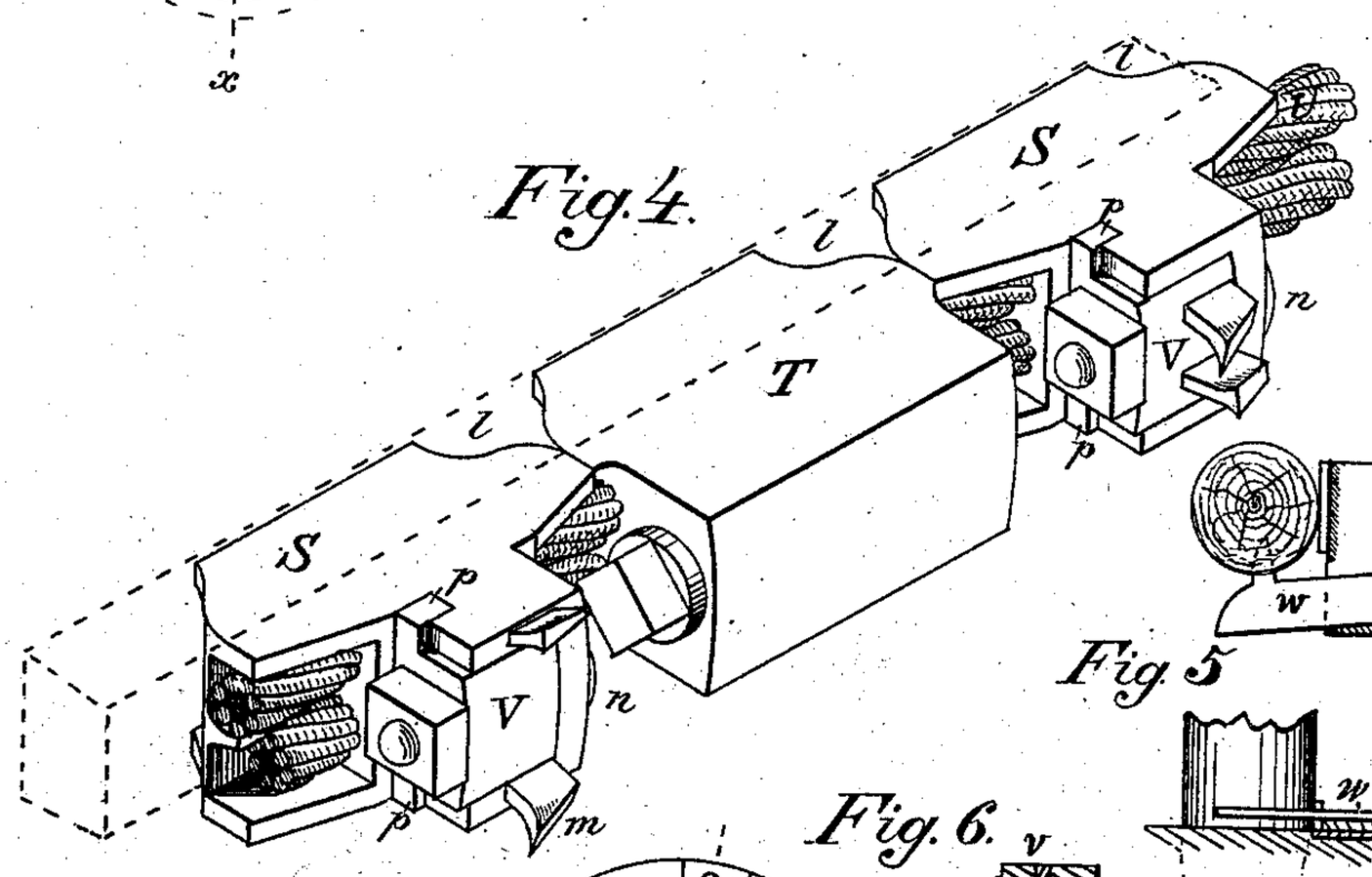
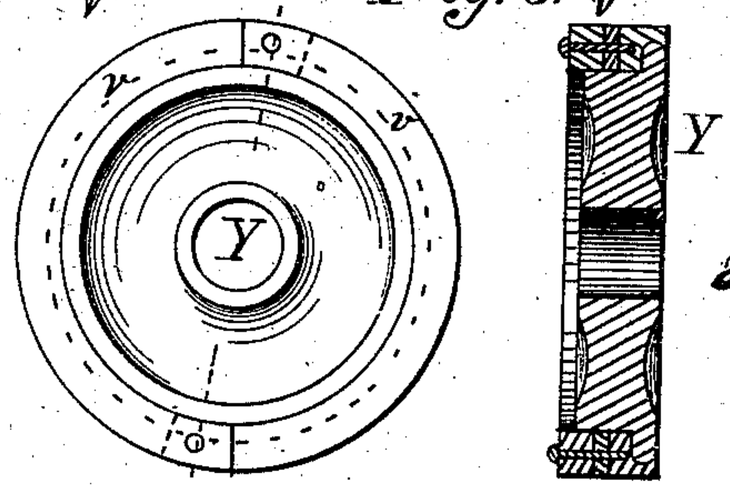


Fig. 5

Fig. 6.



Attest:
F. H. Schott.
W. W. Adams

Inventor:
Horace F. Brown

3 Sheets—Sheet 3.

H. F. BROWN.

COAL-CUTTING MACHINE.

No. 187,702. Patented Feb. 27, 1877.

Fig. 9.

Fig. 8.

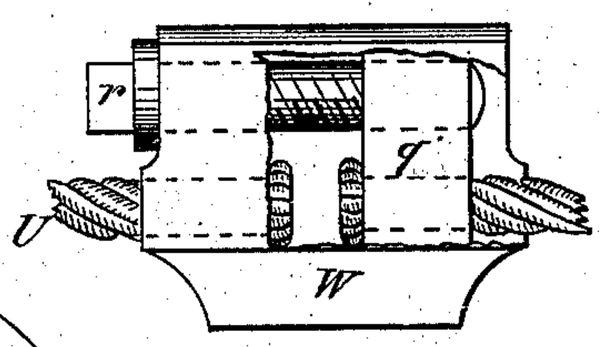


Fig. 10.

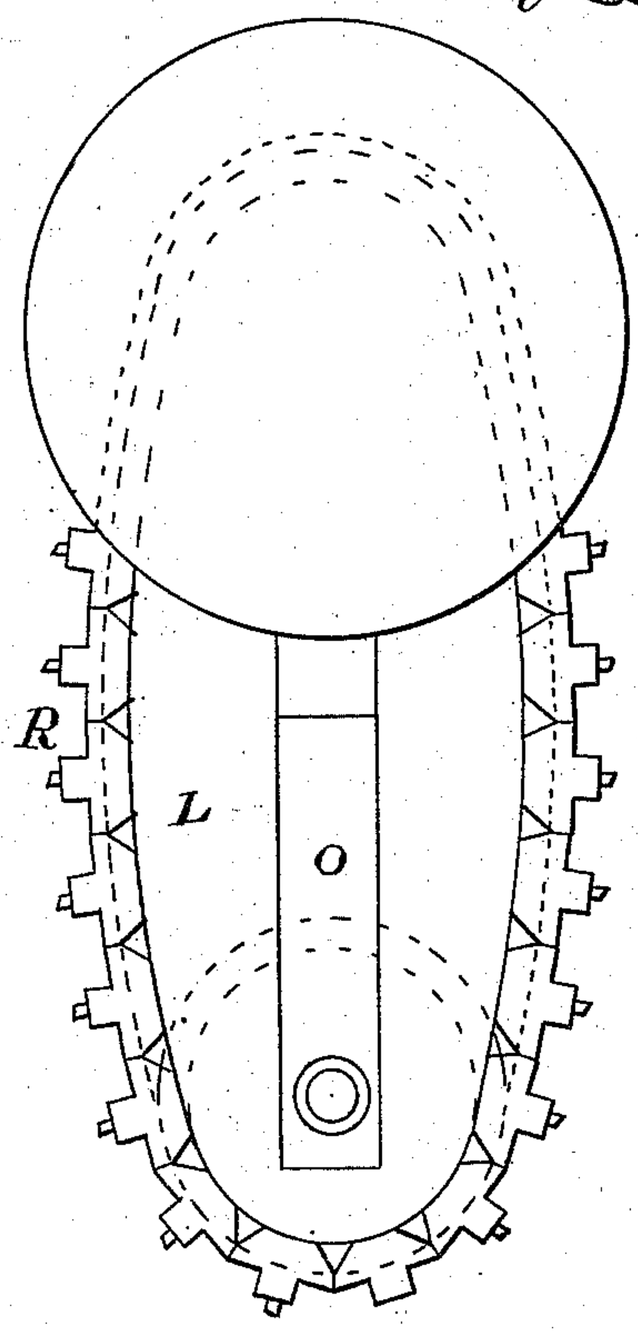


Fig. 7.

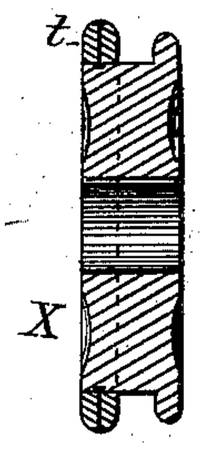


Fig. 13.

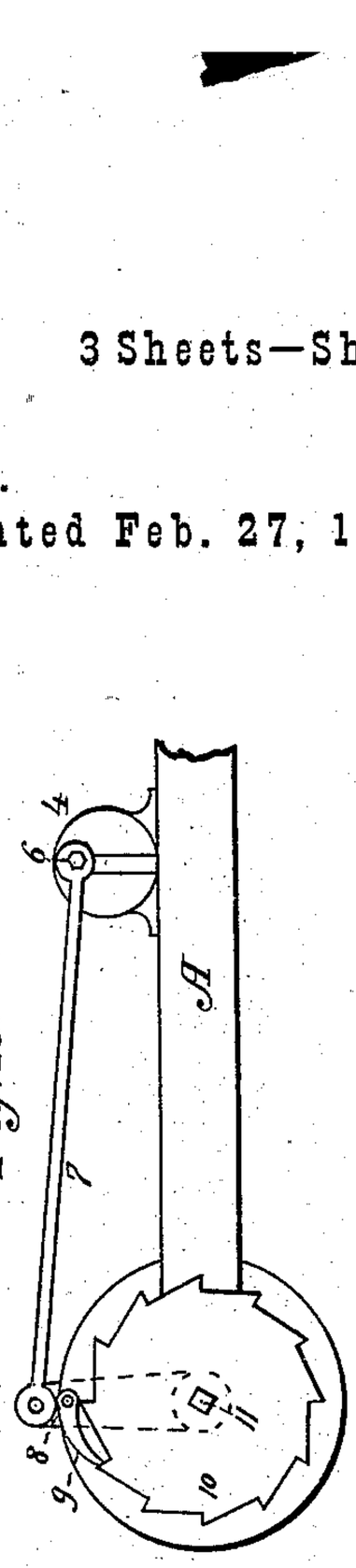


Fig. 11.

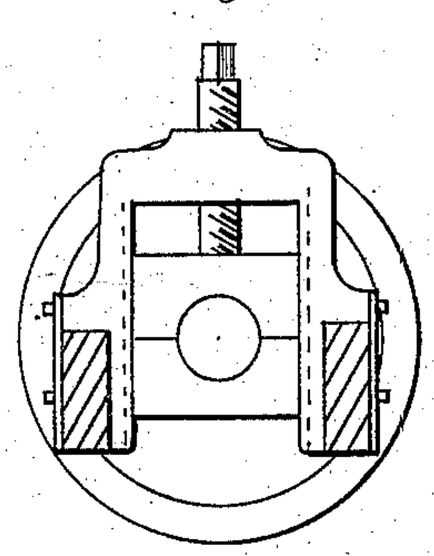
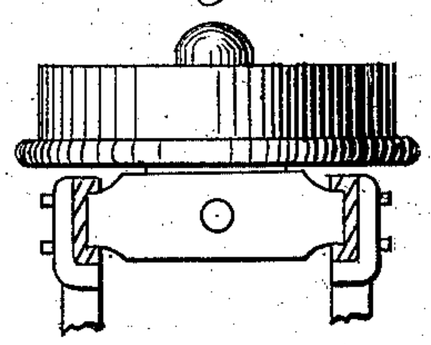


Fig 12.



Attest:
H. C. Schott
W. W. Adams

Inventor:
Horace F. Brown

UNITED STATES PATENT OFFICE.

HORACE F. BROWN, OF CORNING, NEW YORK.

IMPROVEMENT IN COAL-CUTTING MACHINES.

Specification forming part of Letters Patent No. **187,702**, dated February 27, 1877; application filed May 16, 1876.

To all whom it may concern:

Be it known that I, HORACE F. BROWN, of the town of Corning, county of Steuben and State of New York, have invented a new and useful Improvement in Coal-Cutting Machines, of which the following is such a full, clear, and exact description as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, in which similar letters of reference indicate corresponding parts in the different figures.

The object of this invention is to facilitate the operations connected with coal-getting by performing the laborious and (when done by hand) dangerous work of undercutting the coal through the agency of machinery put in motion by compressed air acting through a suitable motor upon the driving-shaft of the machine, or it may be operated by any other power suited to the confined space afforded by the workings of a mine; and the invention consists in the construction and arrangement of the chain-cutters and of the mechanism by which they are operated, as well as in the devices employed for moving and for retaining the machine in position, as will be hereinafter fully described, and then specifically pointed out in the claims.

Figure 1 of the drawings is a perspective view of the machine, showing the relative position of the different parts to each other and to the material to be operated upon. Fig. 2 is a plan, partly in section, and illustrates the arrangement of the mechanism for controlling and giving motion to the cutters. Fig. 3 represents a vertical section through the vertical driving-shaft and cutter-frame upon the line *x x* of Fig. 2. Fig. 4 shows, in perspective, the joint block and two of the cutter-holders, with portions of the wire rope by which they are connected. Fig. 5 presents views in detail of the rail upon which the machine runs when at work and the devices for securely holding it in position. Fig. 6 shows a side and sectional view of one of the wheels, illustrating the method of converting it from a flanged wheel to one having a flat tread. Fig. 7 shows the means employed for converting the single-flanged wheel into one with double flanges. Fig. 8 is a side view, partly in section, of the joint-block, and illustrates the method of securing together and tightening the ends of the cutter-chain. Fig. 9 is a section of one of the cutter-holders, and shows the method of securing the cutting-tools therein. Fig. 10 shows a modification of the cutter-carrying frame elliptical in form, by which change the cutting-chain may be run with less tension. Fig. 11 is an enlarged side view of one of the carrying-wheels and its adjustable bearings. Fig. 12 is a plan of the same, partly in section. Fig. 13 presents a side view of the devices for drawing the machine forward as it cuts away the coal.

A represents the frame to which the working parts of the machine are secured. It is constructed preferably of metal, of such shape and dimensions as will best fit it to receive and carry the working parts. A horizontal shaft, B, is carried upon suitable bearings, and occupies a central longitudinal position within the frame. It is provided with a crank-wheel, C, at one end, through which it receives motion from the piston of the oscillating cylinder-engine D. It may be rotated, however, by other means, if desired. The opposite end of the shaft B carries a beveled pinion, E, which gears into the wheel F upon the vertical shaft G. The lower end of this shaft is provided with a slot or mortise, *a*, through which passes the driver *b*, by means of which motion is communicated from the vertical shaft to the sprocket driving-wheel H through the universal joint formed by the ring *c* and bolts *d*. This driving-wheel is formed with a dome-shaped web, connecting its hub *e* with the toothed periphery *f*, by which means the latter may be brought into close proximity with the floor upon which the machine rests. Upon a suitable bearing secured to the top of the cross-bar or girt of the frame, and revolving around the upper part of the shaft G, is a segmental gear-wheel, I, to the under side of which is secured the vertical guide J, provided with grooves in its edges, which receive the vertical slides K attached to the cutter-carrying frame L. To the inner end of this frame is secured a collar, M, which enters a recess formed for its reception in the hub of the driving-wheel H. The latter is therefore supported through the agency of the collar by the cutter-carrying

frame L, and has the same movement vertically as the frame. Passing downward through the wheel I are two screws, N, the screw-threads upon the lower end of which engage with the nut *g*, secured to the frame L. The upper ends of these screws are provided with suitable hand-wheels or cranks, by which they may be turned and elevate or depress the cutter-frame, and by turning one of these screws one side of the carrying-frame L may be raised or depressed, so as to give the cutting-points lead up or down, thereby enabling the operator to guide the cutters above or below intermediate strata of rock or other obstacles, and to make it conform more readily to the inequalities of the bottom.

It is frequently desirable to use, in place of the straight-sided carrying-frame shown in Fig. 2, one having an elliptical contour, as exhibited in Fig. 10, upon the curved edge of which the chain runs, the same as upon the straight frame. The advantages resulting from this form are that the cutter-chain will work with less tension, and at the same time have a firm bearing on the arm.

This frame L is also provided with an adjustable slide, O, operated by the adjusting-screw *h*, and carrying the sprocket-wheel P.

It will be obvious that by turning the screw *h* the distance between the wheels H and P may be increased or diminished, thus keeping the cutting-chain R, which passes around this wheel and the driving-wheel H, in a proper state of tension to perform its work. This cutting-chain R is composed of cutter-holders S and the joint-blocks T, perforated and strung upon the wire ropes U, or connected by other equivalent devices, which shall allow perfect freedom of motion around the wheels H and P. The cutter-holders S are of metal, and are formed with two projecting flanges, *k*, which leaves a groove between them. This groove fits the periphery of the driving and idle sprocket-wheels H and P, the projections *i* upon the wheels entering the spaces between each two holders, formed by cutting off the corners of the flanges, as shown at *l* in Fig. 4, thus causing the movement of the cutters to be positive and without slip. The cutting-tools *m* are secured in the holders by placing them in suitable recesses formed in the follower V, or in the sides of a recess in the holder which receives the follower, and within which it is securely retained by means of the screw-bolts *n*, which pass through a hole in both follower and holder, and the tongues *p*, which enter cavities formed in the holder for their reception.

The cutting-tools are so arranged in the holders that if one set cuts out the center of the kerf formed by the machine those in the holder following will cut a little wider, and the next wider still, and so on until the whole width of the kerf is cleared.

Each of these cutter-holders is pierced longitudinally with one or more holes, through which the wire rope or ropes U pass, thus forming the whole series into a chain. The ends of this chain are brought together and secured by the joint-block T. This block resembles in shape and size one of the cutter-holders, but, instead of the devices for holding the cutting-tools, is provided with an internally-sliding block or piece, *q*, through suitable holes in which the ends of the wire-ropes pass and are secured. The other ends of the ropes are secured in orifices formed in one end of the block. A screw, *r*, passes through and turns loosely in the end of the block, while its threaded end enters a nut in the piece *q*.

It thus becomes plain that, by bringing the parts together and turning up the screw *r*, the two ends of the chain will be firmly united. It will be apparent that more than one of these blocks may be used in the chain, if found necessary. A screw-shaft, I′, rests in suitable bearings upon the frame A, and is provided with a crank-ratchet or other suitable device for imparting to it a rotatory motion, when its screw will act upon the teeth of the wheel I, turning it to the right or left, and with it the cutter-frame and its adjuncts, thus enabling the operator to place the frame L at any angle to the frame A that may be desired or the work require. For instance, in moving the machine from place to place it would be well to have the two frames in line with each other, but when it is placed beside a wall of coal the machine may be started and the frame L swung around until it has reached a position at right angles to that of the frame A, as shown in Fig. 1. The whole may then have a longitudinal movement along the wall imparted to it by any suitable mechanism; but I prefer to use the following: On the horizontal shaft B is formed or secured a worm or screw, which engages with the screw-gear 2 upon the cross-shaft 3, which shaft runs in suitable bearings upon the frame A. On each end of this cross-shaft is secured a disk-wheel, 4; diametrically through the face of these disks a dovetailed slot is cut, in which works the slide 5. Connected to this slide is the pin 6, which can be moved and fastened at any required distance from the center of the disk, so as to give a greater or less throw to the rods 7. These rods connect with the upper end of the uprights 8, to which the pawls 9 are attached. These pawls engage with the ratchet-wheels 10, which are keyed on the shaft 11, as is also the winding-drum 12. A rope is fastened to some point ahead of the machine, and as it is wound on the drum the machine is moved forward. The pins 6 are so arranged upon opposite sides of the center of the slotted disks that while one is moving one of the pawls forward the other is moving back, which gives nearly a continuous motion to the winding-drums. If desired, the drum 12 may be loose on its shaft and so arranged as to be released and slack the rope without disengaging the pawls. By this arrangement of the moving devices any desired rate of forward move-

ment can be obtained, and it can be varied as the different strata of coal vary in hardness. The ends of the shaft 11 are allowed to project beyond the ratchet-wheels, and are squared to allow the drum to be worked by a ratchet when it is desirable to move the machine rapidly. The wheels upon which the machine is carried are of peculiar construction, as by their arrangement the whole machine may be raised or lowered bodily, or any one or more of the wheels can be raised or lowered in order to suit the requirements of the bottom over which the machine is working, thereby keeping all the wheels bearing steadily.

The mechanism by which this result is obtained is clearly shown in Figs. 11 and 12, wherein it will be seen that the vertical position of the axle-bearings is made readily adjustable by a screw which passes through the cap of the journal-block and rests upon the bearing. As but a single track is used, and as the machine is used for cutting both to the right and left, it becomes necessary to change the wheels from the ordinary wheels with a single flange to those having double flanges for that side of the machine which rests upon the track, while the opposite side must have wheels with a broad plane face to rest upon the floor of the mine. In order to effect this, I provide a set of removable flanges, *t*, in the form of an annulus, as shown in Fig. 7, which may be placed upon the outer edge of the tread of the wheel X, and secured thereto by bolts or other suitable devices.

In order to give the wheels Y a tread having a plain surface I provide the segmental cases *v*, formed in two or more pieces united by screws, as shown in Fig. 6. These are placed around the wheel and secured by screw-bolts, as shown.

The peculiar form of the segmental cases enables them to be readily and easily applied, it being only necessary when the machine is brought to its work to place one of the segments at the end of a rail, run the wheel into it, and then apply the remaining portion of the case to the uncovered portion of the wheel and bolt it together. In removing this casing the operation above described may be reversed. It being necessary to make the under cut as low as possible the rail next to the wall of coal is dispensed with, the broad plain tread applied to the wheels Y taking its place while the wheels X upon the opposite side of the machine are converted into double-flanged wheels by adding the flange *t*. The rail used may be of the ordinary T-pattern, and held firmly in place by means of the chairs Z, formed preferably of metal plates, provided with suitable lugs for holding the rails, and also with a hook, W, which is pivoted to the plate, and may be driven into the timber-props of the mine, while an upwardly-projecting flange upon the end of the chair Z bears against them, thus locking the chair and with it the rail firmly in position.

The operation of the machine will be clearly understood from the foregoing description of its construction.

I am aware that coal-cutting machines have been heretofore constructed in which the wheels could be raised and lowered, and in which the cutters could be moved from side to side; also, the cutters forming a chain have been used; but I am not aware that any such machines have been constructed before my invention thereof, in which the cutters had both a horizontal and vertical movement, by which they could be adjusted to any desired angle, or that a coal-cutting chain has been made by placing the cutting-tools in holders, which were then placed close together upon a rope, the ends of which were brought together, and the whole secured in manner described.

Having thus described my invention, I claim and desire to secure by Letters Patent of the United States of America the following:

1. In a machine for cutting or mining coal, a cutting-chain composed of a series of cutter-holders, constructed substantially as described, and connected by wire ropes or their equivalents, in the manner and for the purpose described.

2. The joint-block T, in combination with the ropes U and cutter-holders S, as and for the purpose set forth.

3. The vertically-adjustable driving-wheel H, in combination with the frame L, adjustable wheel P, and the endless chain of cutters R, as and for the purpose specified.

4. The driving-wheel H, in combination with the ring *c*, bolts *b*, drivers *d*, and slotted vertical shaft G, as and for the purpose described.

5. The vertically and horizontally adjustable cutter-frame, provided with the slides K, in combination with the guides J, wheel I, and screw-shaft I′, as and for the purpose specified.

6. The cutter-holders S, provided with the followers V, bolt *n*, cutters *m*, and pierced with holes for the passage of the ropes U, as set forth.

7. In a coal-cutting machine, the driving-shaft B, pinion E, wheel F, and vertical shaft G, in combination with the cutter-frame L, elevating-screws N, wheel I, and screw-shaft I′, for the purpose of giving motion to the cutters, and adjusting them at any desired angle, as set forth.

8. The chair Z, constructed as set forth, and provided with the hook *w*, in combination with the rail and props, as set forth.

In testimony whereof I have hereunto affixed my signature this 10th day of April, 1876, in presence of two witnesses.

HORACE F. BROWN.

Witnesses:

W. W. ADAMS,

GEORGE W. FULLER.