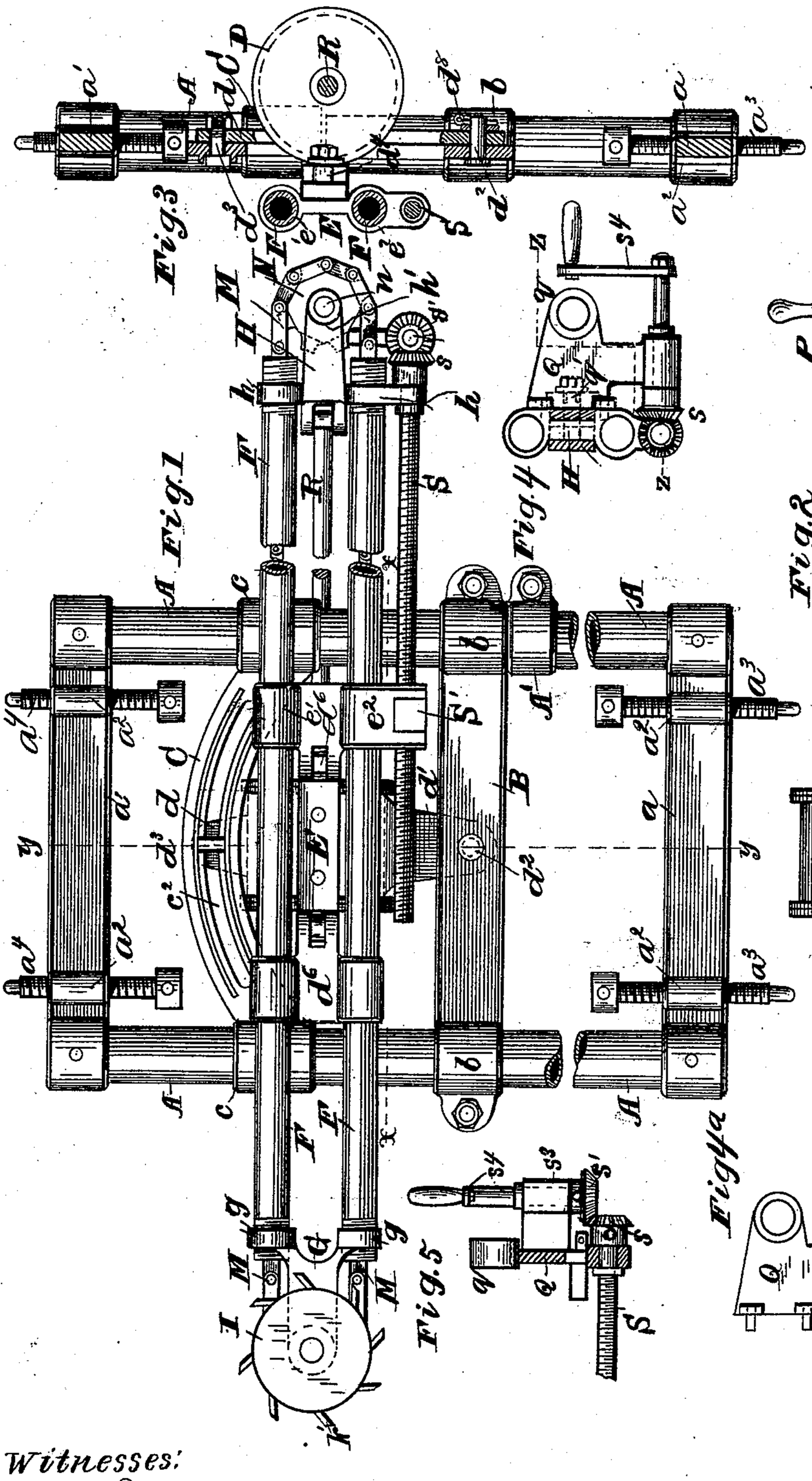
(No Model.) 4 Sheets—Sheet 1.

E. S. McKINLAY.

MINING MACHINE.

No. 551,140. Patented Dec. 10, 1895.



Witnesses:
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(No Model.) 4 Sheets—Sheet 2.

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MINING MACHINE.

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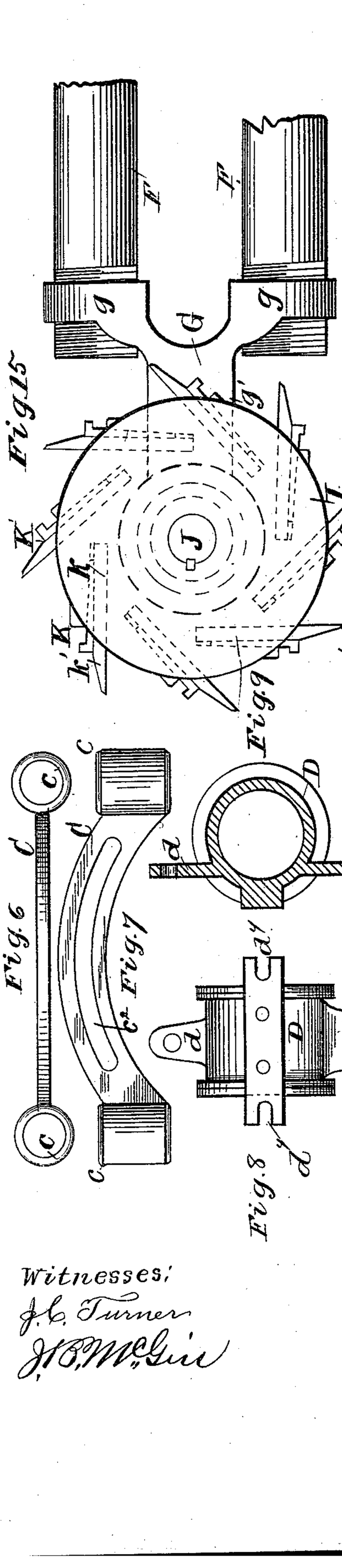

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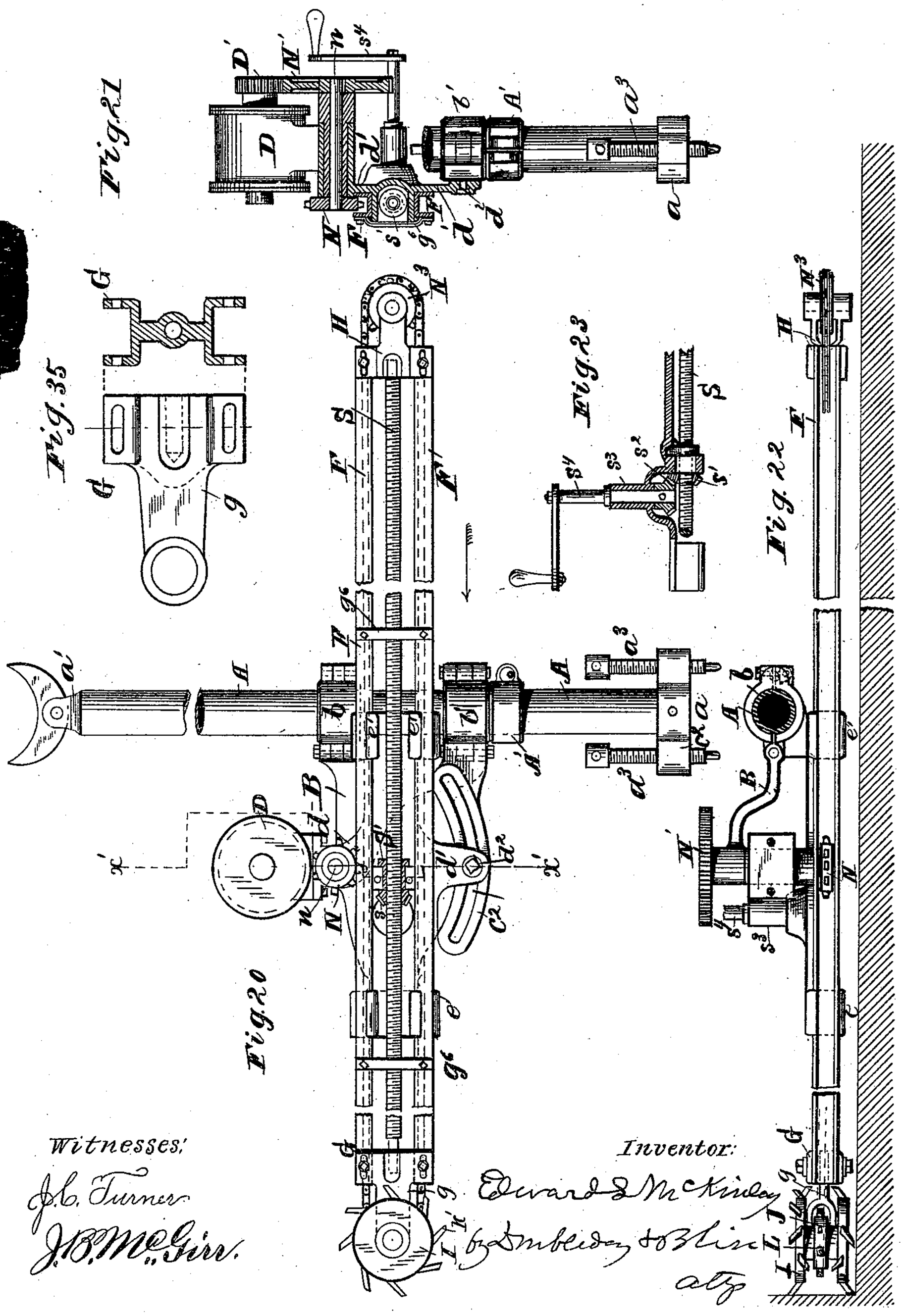
(No Model.) 4 Sheets—Sheet 3.

E. S. McKINLAY.

MINING MACHINE.

No. 551,140. Patented Dec. 10, 1895.



(No Model.) 4 Sheets—Sheet 4.

E. S. McKINLAY.

MINING MACHINE.

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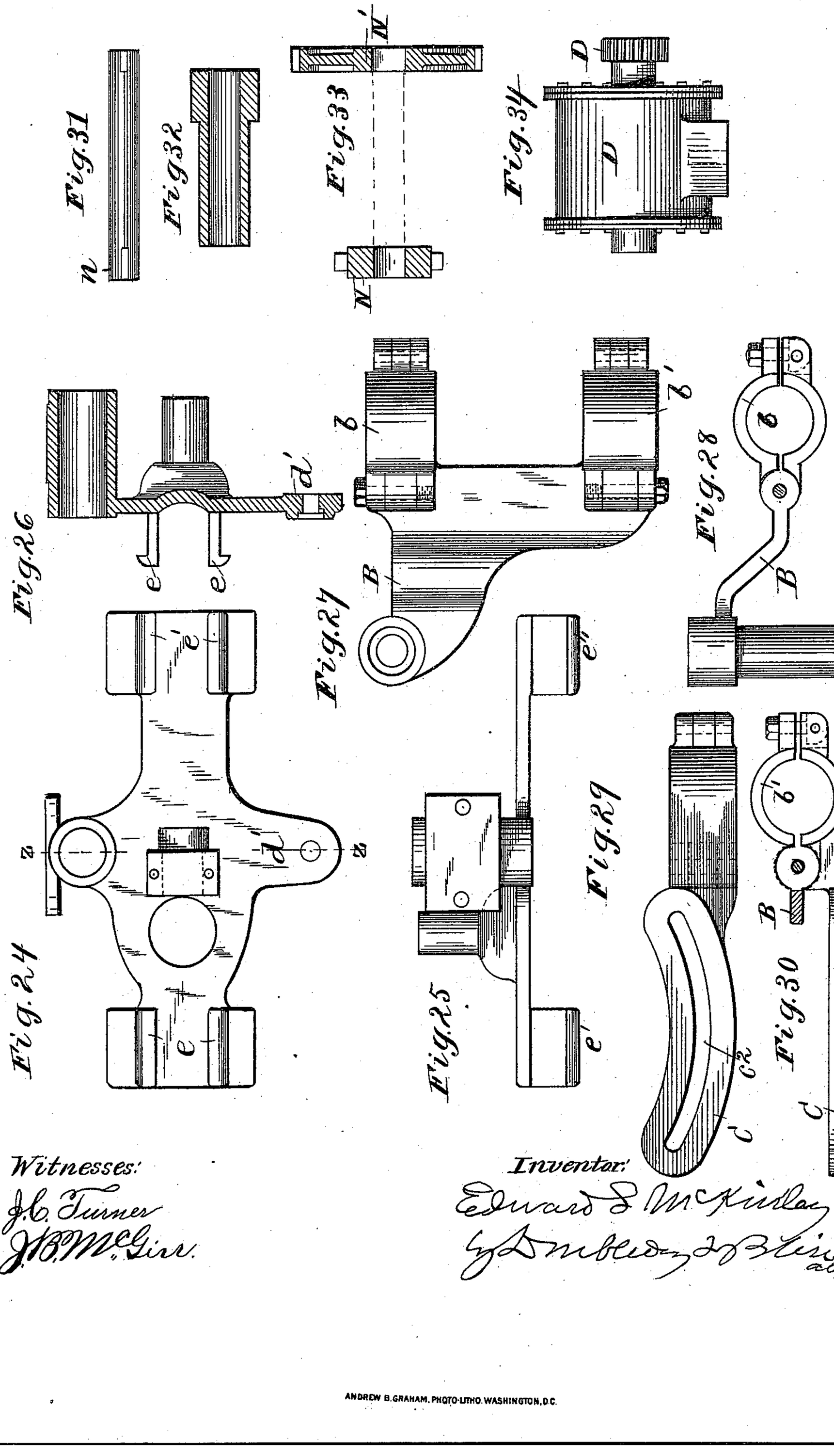

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UNITED STATES PATENT OFFICE.

EDWARD S. McKINLAY, OF DENVER, COLORADO.

MINING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 551,140, dated December 10, 1895.

Application filed July 14, 1888. Serial No. 279,930. (No model.)

To all whom it may concern:

Be it known that I, EDWARD S. MCKINLAY, a citizen of the United States, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Mining-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is a side elevation of a machine embodying my improvements, part of the bed-frame being broken away. Fig. 2 is a top plan view of the main operative parts, some of the details being shown in section, as is also the bed-frame on the line $x\,x$, Fig. 1. Fig. 3 is a section on the line $y\,y$, Fig. 1. Fig. 4 is an end view from the rear of the connecting-plates at the rear end of the carrier. Fig. 4^a is a face view of the plate which supports the rear end of the piston-rod and the rear end of the cutter-carrier. Fig. 5 is a sectional view on the line $z\,z$, Fig. 4. Figs. 6, 7, 8, 9, 10, 11, 12, and 13 are plans, elevations, and sections of details, these being on the same scale as Figs. 1, 2, and 3. Figs. 14, 15, 16, 17, 18, and 19 show other details on a larger scale. Fig. 20 is a side elevation of a modified form of machine. Fig. 21 is a vertical section on the line $x'\,x'$, Fig. 20. Fig. 22 is a plan view (partly in section) of Fig. 20. Figs. 23 to 35 show details of this modified form.

In the drawings, the vertical support is indicated at A $a\,a'$, there being at A a vertical column and at $a\,a'$ means for connecting the part or parts A rigidly with the roof and floor. As shown in the figures now being described, there are two of these columns or standards A A arranged parallel, a top connecting-bar a' with eyepieces adapted to be securely fastened to the upper ends of the columns, and the part a being a bottom connecting-bar similarly attached to the lower ends. The parts $a\,a'$ have threaded eyes a^2 for receiving, respectively, the clamping-screws a^3 a^4. On the stationary frame thus provided I support the movable and operative parts as follows: A′ is a split ring having ears provided with a nut and bolt whereby it can be strongly clamped to one of the columns A, so that it becomes available for vertically supporting said operative parts and for allowing their vertical adjustment.

The vertically-adjustable part of the frame which carries the operating devices consists, as shown, of the cross bars B C, united to the columns by eyepieces b c, those at B being similar to the clamp at A′ above described, so that they can be rigidly secured to the column. The upper one of these bars is provided with a longitudinal curvilinear slot c^2, the bar itself being formed on curved lines to save weight.

The rotary engine which I employ is generally indicated at D, the cylinder being cast with plates $d\,d'$ projecting up and down, respectively, and with lugs at d^4. The plate d' is joined to the cross frame bar B by a detachable pivot d^2, and the upper plate d can be clamped to the cross-bar C by means of the bolt d^3, which passes through slot c^2 and which has an expanded squared head. When thus constructed and arranged, it will be seen that the cylinder can be rocked in vertical planes from one line to another for purposes to be described.

The engine-plate carries the cutter-holder, which consists in the construction now being described of a supplemental frame. As shown, this frame comprises sliding arms, preferably tubular, and an arm-guide or tube-guide E. This guide has a vertical plate projected somewhat at the center toward the engine and eyes e' e^2. The vertical plate is fastened to the engine-plate by means of the aforesaid lugs d^4, they being slotted and adapted to receive hinged bolts d^5 with nuts d^6, there being guiding and bracing pins at d^7.

It will be seen that the main vertical supporting-frame, the engine and engine-frame, and the cutter-carrying frame are detachable one from another and do not even require the complete removal of a nut from any bolt. To separate the cutter-holder from the engine, it is necessary to only loosen the nuts d^6 somewhat from the bolts d^5 and turn the holder out of the slots in ears d^4. To release the engine from the vertical frame, it is only requisite to draw the lock-pin d^8 from the pivot-pin d^2, loosen the bolt d^3, and turn it part way round to have it pass through slot c^2.

When the parts are thus constructed and

arranged, the machine can be readily set up and got into proper position, the weight being thus divisible into several parts. A successful shearing-machine requires considerable weight of metal in order to attain the various necessary movements and to provide the several parts to give it necessary strength.

In the parts e' e^2 are mounted the sliding carriers F F, preferably hollow tubes. There are two of them joined at the forward ends by means of the connecting-plate G, having threaded eyes g, engaging with threads on the ends of the carriers F, and connecting at their rear ends by plate H, having threaded eyes h.

The forward connecting-plate G is formed with the supports or bearings g' of the connecting devices. As shown, the bearings are made integral with the plate G; but they may be made integral or secured thereto.

The cutting devices consist of disks or wheels I I', having sleeve-journals i, by which they are mounted in the aforesaid bearings g', being keyed to a short shaft J. They are formed with cutting-tools inserted into their peripheries. These tools are indicated by the letters K K'. Each comprises a shank portion k and a projecting operative part k'. The shanks and their apertures are arranged tangentially. The projecting cutting portions k' are bent relatively to the shanks and so arranged that the operative edge of one extends to the right and that of the next adjajent one turns to the left relatively to the transverse planes of the carrying-wheel. Those which turn outwardly from the central transverse plane of the cutter, as a whole, are carried far enough to insure a clearance for the edges of the wheels, and those which are turned inward are carried to points somewhat farther in order to bring them as nearly as possible to the said central plane.

By examining Fig. 19 it will be seen that the width of the plate G is considerably less than the distance between the outer sides of the bearing-arms g'; and the inwardly-projecting cutters K' have their edges carried as close as possible to the plate G, so as to cut a passage for the bearing.

Between the bearings g' g' is mounted a chain-wheel L, it being also keyed to the shaft J. M is the cutter-driving chain, extending back from the wheel L to the power devices, to be described.

In order to have the path for the chain and chain-wheel completely cleared, some of the sprocket-teeth, as at l l, are provided with chisel-cutters, their outer lines of cut coinciding as nearly as possible with the inner lines of cut of the cutters K'. The chain M extends backward to the driving-wheel N.

If the carriers F F are tubular, as is preferred and shown, the legs of the chain can be passed through these tubes. The tubes can be made sufficiently large to not only allow the chains to pass freely but also to receive and carry back the slack produced by the cutters.

The driving-wheel N is supported in bearings h', carried by the rear connecting-plate H, the said bearings consisting of a short outside sleeve h^2 and a longer inside sleeve h^3, in which is situated the shaft n of wheel N.

O is a bevel-wheel keyed to the chain-shaft n. With this a bevel-pinion P engages, the pinion being formed on the end of a sleeve-journal p, which is mounted in an eye-bearing q on the plate Q, that is detachably joined to the connecting-plate H.

The piston-rod R of the engine is prolonged beyond the cylinder and is fitted in the sleeve-bearing p, the projecting part having a groove into which is fitted a spline carried by the sleeve.

When the parts are in operation, the piston-rod R imparts rotation to the bevel-pinion P. From that motion is carried through the wheel O, shaft n, chain-wheel N, chain M, and chain-wheel L to the cutting device in front.

The cutter-carrier can be fed forward automatically by any of the well-known devices for attaining such an end, or it can be advanced by hand. I have shown a mechanism well adapted for feeding it forward in the manner last mentioned, it comprising a threaded shaft S, engaging with a nut S', which is carried by the eyepiece e^2, secured to the engine-frame. The screw-shaft is rotated by bevel-gearing s s', wheel s' being secured to the shaft s^2, mounted in a bearing s^3, carried by the aforesaid plate Q, and having a hand-crank s^4 at its inner end.

When the machine is at work, the operator can advance the cutters at will by means of the devices last described.

The nut S' may be made of separable parts in the well-known way, so that after the cutter-carrier has made its full movement forward the screw-shaft S can be released and the carrier brought back rapidly. The plate Q is fastened in place by means of a hinged bolt q' and a slotted lug q^2. In setting the machine up or taking it down this bolt can be quickly fastened in place or released, for the purposes hereinbefore described.

I have thus described in detail one form of mechanism embodying my improvements; but it will be readily understood that numerous modifications can be made without departing from the essential features of my invention.

In Figs. 20 to 35 I have shown one of the many modifications which may be employed. In the construction shown in the said figures there is but a single vertical column A, it having a supporting-clamp A' similar to that in the other construction. The engine-support consists of the plate B, projecting forward from the clamping-sleeves b b', having a slot c^2, concentric with the power-shaft. The engine-plate d d' can swing about said axis and is locked in place by means of a bolt at d^2. To the engine-plate is fastened or with it is cast the support for the cutter-carrier. Said support in this construction consists of

grooved brackets *e e'*. In these are placed the grooved sliding carrier-bars F F, one having its open side turned up and that of the other being turned down. These bars are joined together at the ends by plates G H, corresponding substantially with those similarly located in the construction above described, those in this case, however, having also intermediate parts or strap-pieces g^6 g^6.

The cutting devices at the forward end of the sliding carrier are substantially similar to those above described and the description need not be again given in detail.

The chains are situated in the sliding channel-bars and move forward and back therein. They are moved by a chain-wheel N on the power-shaft *n*, which in this construction is mounted under the rotary engine D and is geared to the piston-shaft by wheels N' D'. Chain-wheel N engages here somewhat differently with the chain, but in a way that will be readily understood by an examination of the drawings. When the parts are arranged in this way, the wheel at the rear end of the chain becomes virtually a mere guide-wheel, and it is indicated at N^3, although it is mounted on the connecting-plate H in a way similar to that followed in making the other construction.

The advancing of the cutter-carrier is effected by means of the non-rotary screw-shaft S, in this case mounted midway between the carrier-bars F F. The nut at S' carries a bevel-pinion *s'*, driven by a bevel-wheel which is mounted in the bearing s^3, and which is provided with a hand-crank. When the machine is at work, the operator can advance it by revolving the nut S', which causes the rod S to move longitudinally.

The invention set forth, whether embodied in the one or the other of the forms shown, or some other modified form, is particularly applicable to those mining-machines which are used for shearing, that is to say, machines adapted to effect a vertical cut to assist in breaking down a mass of coal after it has been undercut.

It will be seen that in the construction shown I have provided an upright frame or bed consisting of one or more uprights A and means for fastening it or them to the floor and roof, a vertically-sliding frame adjustable on the upright frame—to wit, the bars B C, (either, or both together,) with their eyes—a cutter-carrier comprising the arms F F and a bearing-plate G, a guide-frame for the cutter-carrier comprising guides *e e'*, and a frame (here consisting of the engine-plate) interposed between the cutter-carrier and the upright frame, being when arranged as shown secured to the aforesaid vertically-sliding frame. One of these frames—to wit, that formed of the engine-plate—is adapted to swing vertically and carry with it the cutter-carrier and the carrier-guides. One or more of these parts can be dispensed with, and those which are made adjustable can be made rigid without preventing the machine from attaining some of the ends for which it is intended.

When the machine is to be put in operation, the vertical columns are first fastened in place, and the vertically-sliding parts B C are adjusted thereon. Then the engine and its frame can be attached, after which the cutter-carrier and its guiding-frame can be secured to the other parts, attachment and detachment being permitted by means of the devices hereinbefore described in detail.

The cutter-carrier is situated on one side of the upright frame and the engine is so arranged that its axis is upon the other side. The carrier is so arranged that the cutters are supported in front of the upright frame, and it extends back therefrom to a point in the rear of said frame. By the two adjustments provided—to wit, the adjustment of the sliding frame B C bodily vertically on the upright frame and the swinging adjustment of the parts rigid with the carrier—the cutters can be brought to bear at any desired point and on any required line. The cutters form a kerf which is wider than the bars or tubes F F, and therefore the latter can follow them into the coal as far as may be desired.

The machine is mainly intended for the operation generally termed "shearing"—that is, forming a vertical kerf or cut along the side walls or "ribs" of a room. When it is at work, the fastener at b^3 can be left sufficiently loose to permit the cutters to be vibrated, so that a vertical kerf can be formed of a depth considerably greater than the diameter of the wheel I, all of the working parts maintaining permanently the same relation to each other, whether the frame between the cutter-carrier and the main frame is clamped stationary or arranged to permit the cutters and cutter-carrier to vibrate.

I am aware of the fact that drilling mechanisms of various forms have been used in each of which there has been an upright frame, a vertically-vibrating plate or frame secured to the upright frame, and a rotating shaft or stem for the drill, the latter having been generally screw-threaded, so that when it rotates it will advance the drill; but I believe myself to be the first to have devised a shearing-machine having the capabilities of that herein shown and described. The nature of the cut which must be made in shearing is radically different from the hole bored by a drill whose cutters revolve in planes transverse to the path of advance of the cutters. In my case the cutters revolve on lines parallel to said path of advance, and therefore they can be caused to cut a kerf such as aforesaid, that is, one deeper than the diameter of revolution of the cutters as they can be vibrated up and down.

Another important advantage in the machine shown is incident to the fact that the cutter-carrier and its guide-plate E can be

readily attached to or detached from the main frame, so that the machine can be easily manipulated and transported.

What I claim is—

1. The combination of the upright frame, the sliding cutter carrier on one side of said upright frame, the vertically adjustable engine on the other side of said upright frame, the rotary piston of said engine and the power devices connecting the rod of said piston with the cutters and adapted to slide along said rod while being actuated thereby, substantially as described.

2. The combintion of the upright frame, the vertically adjustable cutters, the engine pivoted to the upright frame, the fastener for securing the engine rigidly to the said frame, and the sliding cutter carrier arranged to move longitudinally relatively to the engine, substantially as described.

3. The combination of the upright frame, the engine adapted to swing or to be made stationary at will, the fastener for securing the engine rigidly to the upright frame, the cutters, and the sliding cutter carrier movable longitudinally relatively to the engine, substantially as set forth.

4. The combination of the upright frame, the swinging engine bodily adjustable vertically, the fastener or clasp for securing the engine rigidly to the upright frame, the cutters rotating in vertical planes to their path of advance and the cutter carrier movable longitudinally relatively to the engine into the kerf of the cutters, substantially as set forth.

5. The combination of the upright frame, the swinging engine bodily adjustable vertically, the sliding, non-rotating cutter carrier and the carrier guides which are fixed relatively to the engine, the cutter carrier being movable relatively to the said engine, and the cutters directly in front of said carrier rotating in planes parallel to the path of advance, and extending to lines outside of the side planes of said carrier, substantially as set forth.

6. The combination of the upright frame, the vertically revolving cutters, the sliding carrier arms F F extending both to the front and to the rear of the upright frame, and the power transmitting devices extending from the cutters back to the rear of the upright frame, the engine secured to said frame, and the power transmitting devices behind the supporting frame interposed between the engine and the cutters and adapted to the carrier arms F, F, substantially as set forth.

7. In a shearing machine, the combination with the upright frame having the two columns A, A, of the rotary and pivotally movable cutters, the longitudinally sliding, non-rotating cutter carrier on one side of said columns and extending backward from the cutters, and adapted to enter the kerf formed thereby, the cutter driving devices supported on said carrier, the engine situated on the opposite side of said columns A, A, and the connecting devices which unite and transmit power from said engine to said cutter driving devices, substantially as set forth.

8. The combination with the upright frame, of the vertically rotating cutter wheels, the chain for operating the cutters and the sliding vibratable carrier arms F F providing guides for the chain, substantially as set forth.

9. In a mining machine, the combination with the rotary cutters, and the chain which rotates the said cutters, of a tube through which the said chain is passed in going toward or returning from the cutters, substantially as described.

10. In a mining machine, the combination with the rotary cutters of the chain which carries power to rotate the said cutters, and the tubes, one for the advancing part and the other for the returning part of the chain, substantially as set forth.

11. In a mining machine, the combination with the rotary cutters and the chain which carries power for the said cutters, of the tubes which support the cutters and through which passes the chain, substantially as described.

12. In a mining machine, the combination with the supporting frame of the cutter carrier having tubes, the bearing plate which unites the tubes at their forward end, the chain wheel mounted in the said bearing plate, the bearing plate which connects the tubes at their rear ends, the chain wheel mounted in the said bearing plate, and the chain passing through the said tubes, substantially as described.

13. The combination with the cutters and the cutter carrier having parallel arms F F arranged, one vertically above the other, the cutter driving chain, a shaft n transverse to the carrier arms, the chain wheel thereon, the engine, the rod R, and the sliding gearing interposed between the rod R and the said shaft n, substantially as set forth.

14. The combination with the upright frame, the vertically arranged cutters, of the sliding cutter carrier having arms F F one above the other and narrower than the kerf formed by the cutters, of a power shaft, as at R, parallel to said carrier arms F, the feed shaft S in the vertical plane of the two arms F, and means engaging therewith for advancing the cutter carrier, substantially as set forth.

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

EDWARD S. McKINLAY.

Witnesses:
WM. A. McKINLAY,
LUCIUS P. MARSH.