(No Model.)

3 Sheets—Sheet 1.

E. S. McKINLAY.

APPARATUS FOR AND ART OF TRANSPORTING COAL.

No. 550,051. Patented Nov. 19, 1895.

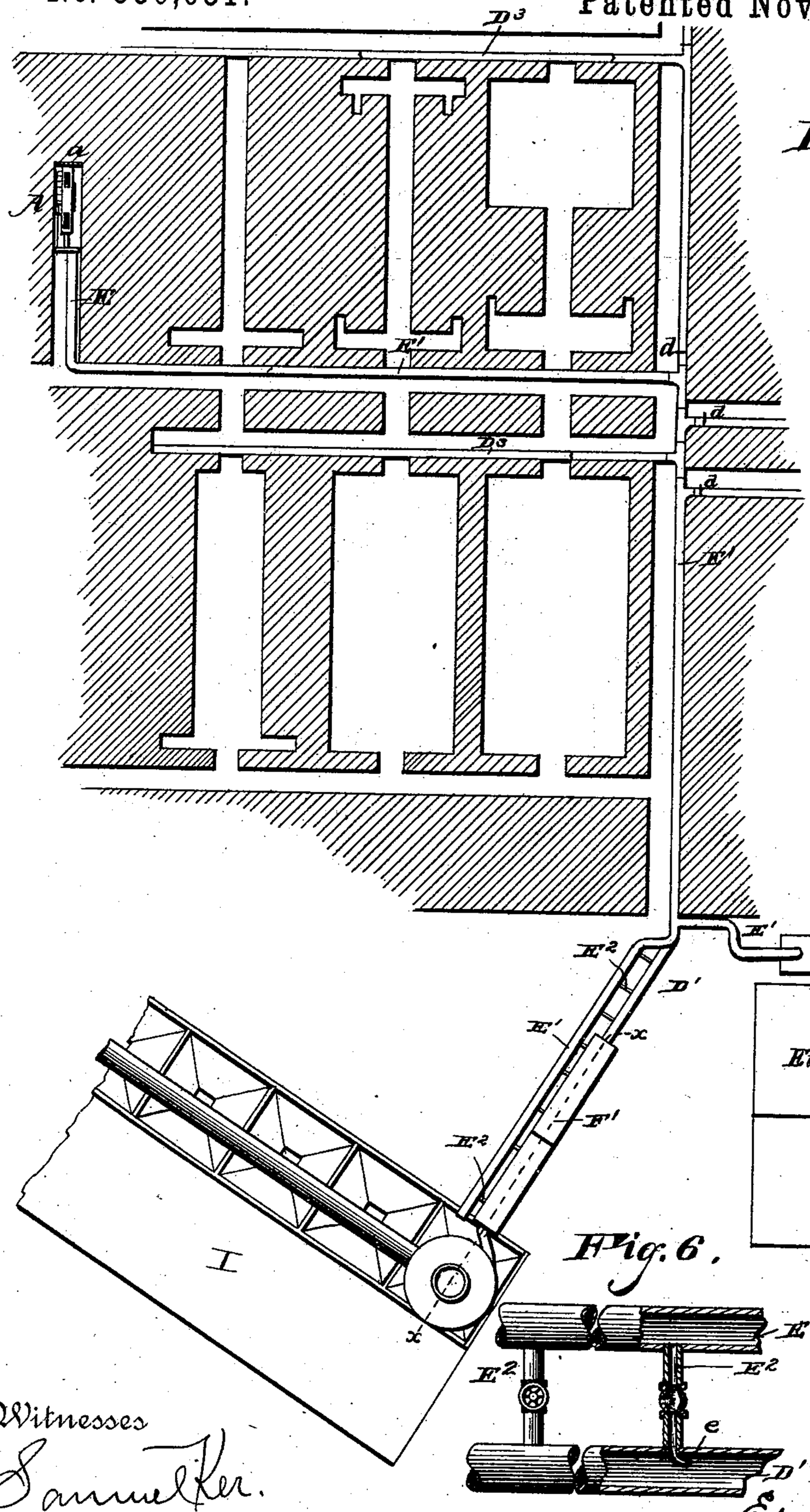

Fig. 1.

Fig. 6.

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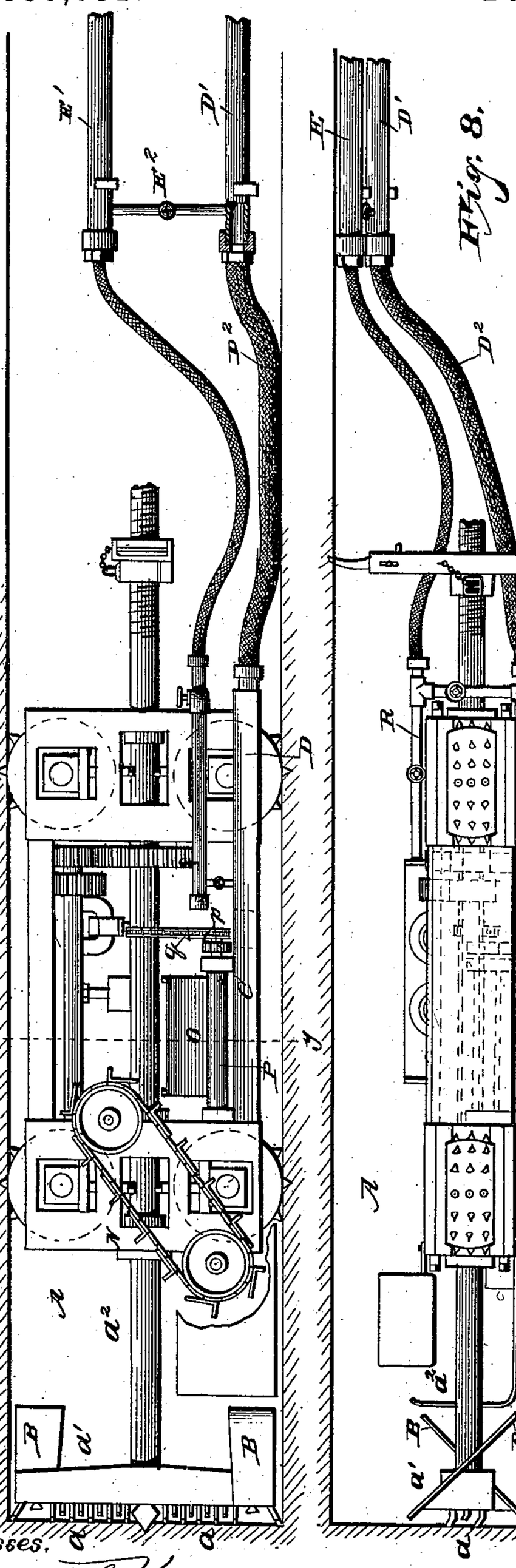

Fig. 7.

Fig. 8.

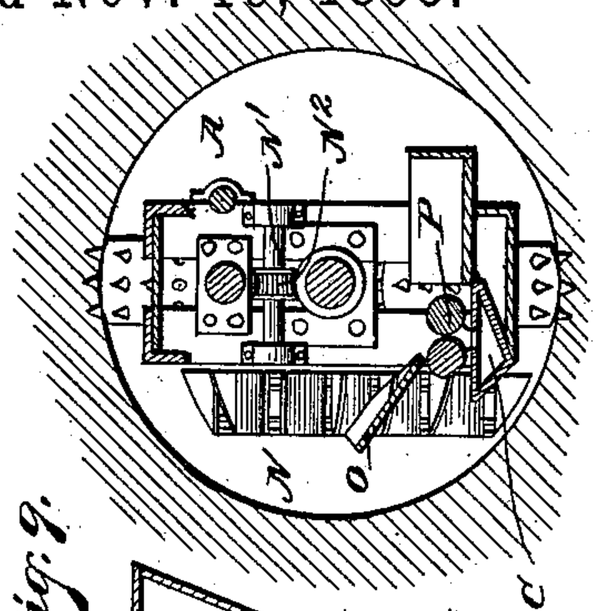

Fig. 9.

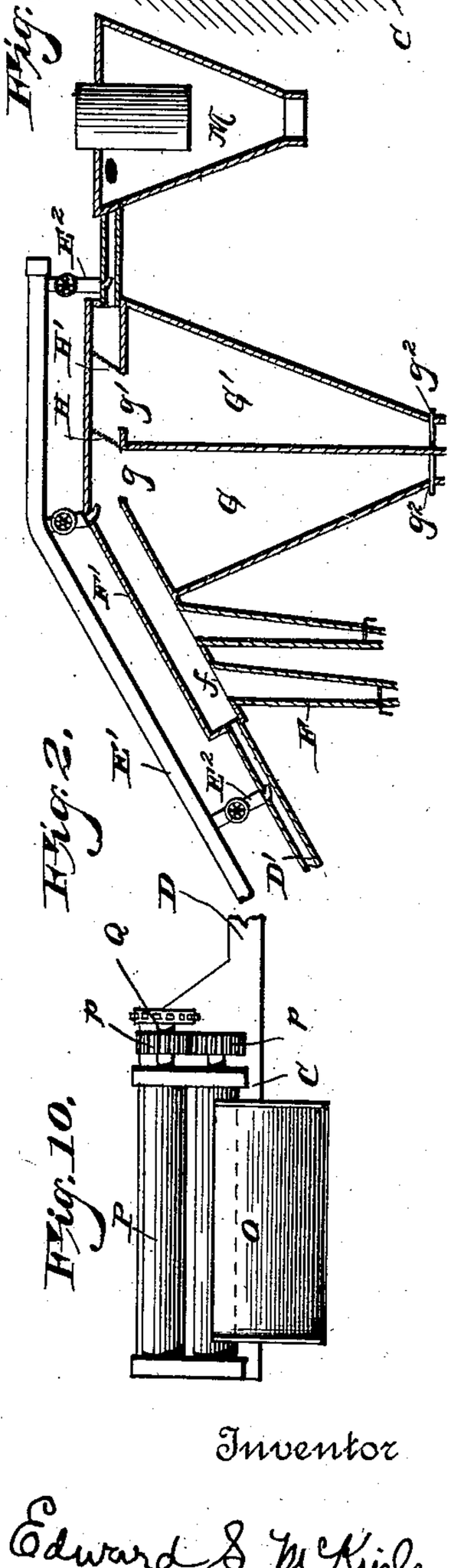

Fig. 2.

Fig. 10.

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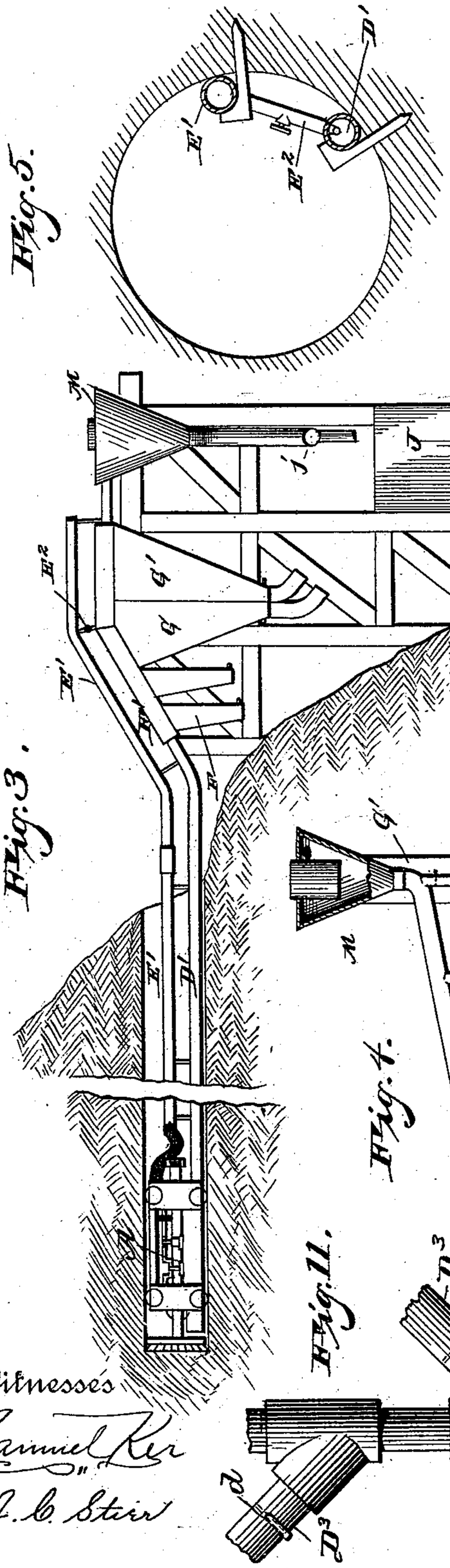

Fig. 5.

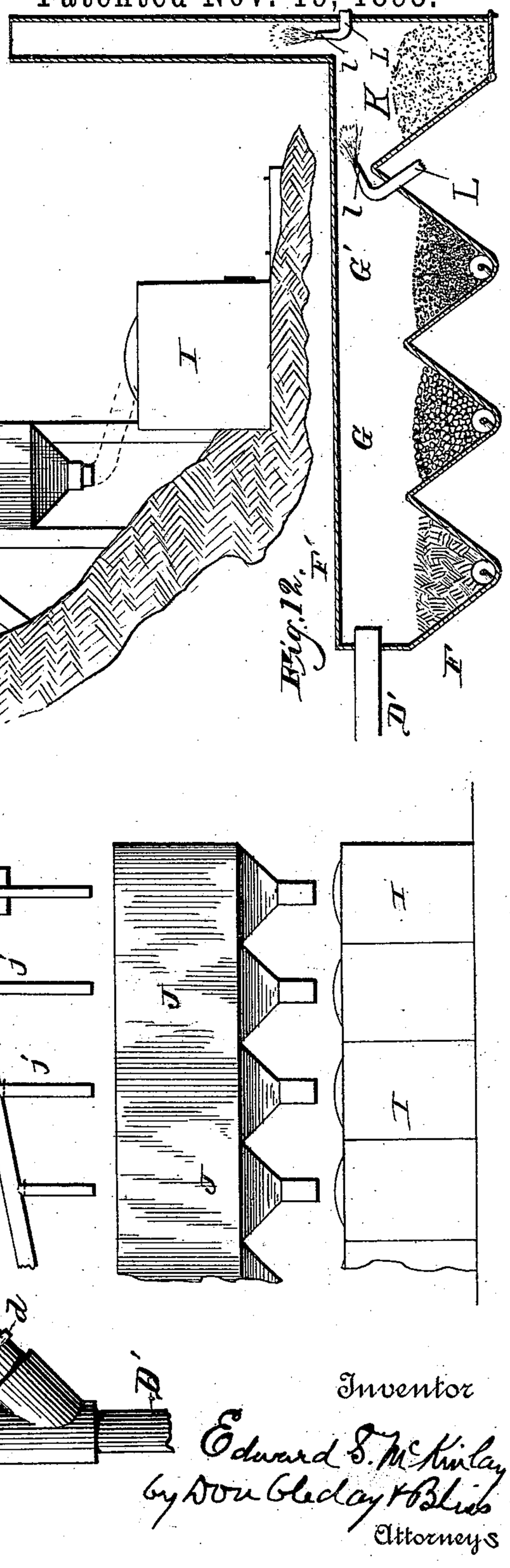

Fig. 12.

Fig. 3.

Fig. 4.

Fig. 11.

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UNITED STATES PATENT OFFICE.

EDWARD S. McKINLAY, OF DENVER, COLORADO.

APPARATUS FOR AND ART OF TRANSPORTING COAL.

SPECIFICATION forming part of Letters Patent No. 550,051, dated November 19, 1895.

Application filed May 28, 1891. Renewed April 23, 1895. Serial No. 546,919. (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 Apparatus for and Art of Transporting Coal, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to a method of transporting the cuttings produced in mining coal from the place where they are formed to the outside of the mine and disposing of them properly in relation to the screens, ovens, &c. It relates, also, to an improved apparatus by which such transportation can be effected.

In the drawings I have shown some of the parts of one form of apparatus which can be used in carrying out the invention.

Figure 1 is a plan view showing a part of such apparatus. Fig. 2 is a section on the line *x x*, Fig. 1. Fig. 3 is a section of a tunnel, showing my apparatus in operation. Fig. 4 shows the coke-ovens and the communicating ducts. Fig. 5 illustrates the manner of supporting the feed and exhaust ducts. Fig. 6 shows in detail the connections between the ducts. Fig. 7 shows in elevation one form of tunneling-machine which may be advantageously used with my apparatus. Fig. 8 is a plan view of the same. Fig. 9 is a cross-section on line *y y*, Fig. 7. Fig. 10 is a plan view of the crushing-rolls. Fig. 11 shows the dampers in the branch ducts, and Fig. 12 shows the arrangement of parts which may be used when there is a single bin at the end of the duct.

A represents a coal-cutting machine, which for some of the purposes of the present invention may be of any of the now well-known sorts. I prefer to employ one substantially such as is shown, it being one of that class used for driving tunnels or headings. It has a set of vertically-revolving cutters, which are secured to a cross-head or arms that are carried by a revolving shaft, said cutters being so arranged as to attack the whole face of the material being operated on. Said cutters are shown at *a a* and the cutter-carrier is indicated by $a' a^2$. It is unnecessary here to describe the details of a cutting-machine of this sort, as they are well known to those familiar with mining machinery.

Cutters of the character referred to reduce the material in advance of the machine to a pulverulent mass, or a mass of comparatively small particles. This mass will contain particles of different materials, according to the formation or constitution of the veins that are attacked.

In almost all cases the veins of comparatively pure coal alternate with veins of slate or other rock and veins of sulphur formation. These materials differ in their specific gravities, and one of the objects of my apparatus and method of working is to utilize this difference in specific gravity readily in effecting a separation of one from the other. The cuttings drop from the face of the material attacked and tend to accumulate at the center of the bottom of the tunnel. From that place I pick them up by one or the other of several methods. In Figs. 7 and 8 elevating arms or plates B are shown, these being carried by the cutter-arms a'. They are so constructed that the material which is scooped up by them at their outer ends slides or falls toward the center of the axis of the apparatus. It drops thence into a receptacle C. With this receptacle there communicates a duct D, which is preferably secured to the framework of the machine A, so as to advance and recede with it.

As some of the cuttings may be somewhat large, I use a conveyer N, which picks them up and drops them on a chute O, which guides them to a pair of crushing-rolls P P. (See Fig. 10.) The rolls are driven by pinions *p p* and sprocket-wheel Q and chain *q*.

D′ is a stationary duct formed of pipes or wooden trunks and extending from a point as near the machine as is practicable, outward along the entries to the outside of the mine.

D^2 is a flexible connecting-duct united to that at D and to that at D′. There may be more or less variation in these respects without departing from the matters which are essential. The duct may be more nearly continuous up to the face of the heading and may be at the side of the machine instead of under the center; but the central position is the better, as it allows more ample room at the sides of the machine for the movements of operatives.

E indicates, more or less conventionally, an air-compressing apparatus preferably situ-

ated, as usual, at or outside of the mouth of the mine. From this there extend in one or more ducts E′ to carry the compressed air. From this duct E′ the air can be taken at any desired place for actuating the engines of machines such as that at A. I utilize this duct and its compressed air, also, for the purpose of withdrawing the cuttings for the reduced material above referred to.

E^2 E^2 are pipes placed at intervals along the duct D′, they communicating with that and with the compressed-air duct E′. As shown, these pipes E^2 terminate in nozzles *e*, which may be of any of the forms now well known for delivering air or steam in such way that can be utilized as a direct propelling agent. I provide each pipe E^2 with a valve, so that the force of the air delivered through its nozzle *e* can be accurately regulated, or so that it can be shut off entirely. The method of operating, as concerns these parts, will be described more fully below.

D^3 represents a branch duct analogous to that at D′, it, in fact, communicating therewith at a suitable point. It extends to another part of the mine, wherein it is adapted to play a part similar to that of the said duct D′. Preferably at various points valves or dampers *d* are inserted, so that those parts of the ducts which are not in use can be shut off from those that are.

At F there is a receptacle. It may be formed by merely enlarging the pipe; but I prefer to make it of the form of a bin or hopper having a suitably narrow throat at *f* at the bottom of the duct D′. The adjacent blast-nozzles are arranged and adjusted in relation to it so that the undesirable materials, which are of a specific gravity greater than that of the coal, will drop through the said throat and be collected in the receptacle, the lighter and desirable coal particles being carried across the throat and propelled farther along the duct.

At G G′ additional receptacles are provided, one in advance of the other, these also having each a throat, as at *g g′*. Above each there is a screen, as at H H′, one being preferably of coarser mesh than the other.

I I indicate a series of coke-ovens. Adjacent to each there is a bin or receptacle J, and with these the duct D′ communicates, there being passages *j j′*; or a single bin can be used at the terminus of the duct.

M is a dust-collector of any of the ordinary sorts, and is interposed in the duct D′ in the rear of the receptacle G G′.

There should be a valve or damper for each of the throats *f*, *g*, *g′*, and *j*, so that they can be closed or adjusted, as desired.

A bin at the terminus of the duct is shown at K in Fig. 12.

L indicates a pipe terminating in one or more nozzles *l l*, these parts being adapted to receive a stream of water or steam and form therewith a spray of such nature as to arrest solid particles carried by an air-current and cause them to settle while the air escapes.

The mode of operation of an apparatus such as has been above described is as follows: The cutting-machine A being at work, large quantities of reduced material are delivered to the withdrawing ducts D D^2 D′, and at this time the valves which control the jets of air in the duct D′ are properly adjusted, so that the air picks up the material and drives it forcibly along said duct outward. The air exhausted from the engines on machine A can be used either alone or to assist in discharging the cuttings from the receptacle C and duct D. The number of the jet-nozzles *e* and the force of the jets are such that the material is prevented from accumulating at any particular place, and is driven from section to section to the duct. When it reaches the throat *f* of receptacle F, the heavier particles, such as those of slate or any metaliferous material, will drop through said throat. The lighter and more nearly pure carbon particles will pass over the said throat until they reach the screens at H H′, one or more. The coarsest particles will be arrested by the screen H and will drop through the throat *g* into receptacle G. Those of intermediate size will be arrested by screen H′ and will be deposited in receptacle G′. The finest particles of the material will continue along the duct until they reach a place of ultimate deposit, as the bins J and K, where they are either allowed to settle unassisted or are removed from the air by a spray of water or steam or other suitable means. In Fig. 12 I have shown a mechanism of well-known form for accomplishing this result. Slack coal—that is, finely-reduced coal material of the sort I herein provide—is largely employed in the manufacture of coke, it in fact being preferred by many manufacturers, and when coal is taken out in lumps or large masses it is pulverized or reduced before being introduced into the ovens. By following the method herein described of getting the coal out and delivering, I obviate all necessity of any supplemental pulverizing. I attain, also, other important ends, both in the mining of the coal and in the transporting of it to the ovens or places of deposit. Among them are these: I obviate all the labor and expense of laying the ordinary track to support cars, a duct, such as at D′, herein provided for, being of less expense and more easily put up and taken down than such track. The duct can be supported along the side of the tunnel, and is therefore out of the way of the tunneling-machine when it is being drawn back in the tunnel, as it must be frequently. The ordinary track is a serious obstacle to the necessary movements of the machine. Again, the saving in the expense incident to the use of a number of mules and the drivers is obvious.

There are of course many modifications which can be made as concerns the apparatus. Thus, instead of using exclusively air jets or blasts for driving the coal, suction de-

vices can be employed either entirely or in conjunction with the blast-jets.

I am aware of the fact that use has been made of, first, machines adapted to cut cylindrical tunnels, and, second, of pneumatic apparatus (comprising tubes or ducts and air-forcing mechanism) for conveying from one point to another various materials—such as grain, cotton, and numerous others—and I do not claim, broadly, either of such mechanisms; but I am the first to have provided means for carrying out the mode herein set forth of cutting and reducing coal and delivering it to ovens or equivalent receptacles, the material being constantly, practically, in motion from the time it is dislodged from its natural bed to the time it is deposited in the oven or outside receptacles, so that the whole operation is conducted with the utmost economy and speed, the cutting and delivering to the air-duct being simultaneous with the conveying to the mouth of the mine.

What I claim is—

1. The herein described improvement in the art of getting out coal which consists in cutting the coal from its natural bed initially in masses of reduced particles, immediately withdrawing the said particles from the cutting machine simultaneously with the cutting action through a duct extending to the mouth of the mine by a series of air jets at different points along said duct and acting successively on said material therein, substantially as set forth.

2. The herein described improvement in the art of getting out coal which consists in cutting the coal from its natural bed in masses of reduced particles delivering it to an inclosed duct at a point in proximity to the cutting devices and transporting them to the mouth of the mine through said duct by currents of air and over a gravity separating mechanism whereby the slate and sulphur are removed from the coal while the latter is under the action of the air, substantially as set forth.

3. The combination of the coal cutting apparatus, the duct extending from said apparatus to the mouth of the mine, means for delivering the cuttings to said air ducts simultaneously with the cutting action and the continuously acting air forcing devices which force currents of air through the said duct, whereby the cutting and outward transporting of the coal are effected by a continuous operation, substantially as set forth.

4. The combination of the coal cutting devices adapted to form masses of reduced particles, the scrapers or scoops, the power mechanism which actuates simultaneously the coal cutting devices and the scrapers or scoops the receptacle behind said scrapers or scoops, the duct extending from said receptacle to the mouth of the mine, and the air forcing mechanism adapted to drive currents of air through the said duct continuously and simultaneously with the cutting action, substantially as set forth.

5. A system of apparatus for getting out coal, transporting and coking it and comprising a cutting apparatus adapted to relatively pulverize the coal as it is taken from its natural bed, a receptacle or series of receptacles adapted to deliver material to the ovens, a duct extending from said cutting devices out to said receptacles and comprising a gravity separator and a dust collector and an air forcing mechanism adapted to force currents of air through said duct, whereby the pulverized coal is forced along said duct past the gravity separator and the collector to the said receptacles, substantially as set forth.

6. A system of apparatus for getting out coal comprising a cutting mechanism, an air compressing mechanism outside the mine, an ingoing duct for supplying compressed air to the said cutting mechanism, a duct for withdrawing the cuttings from the mine and a series of separate air ducts extending from said ingoing duct to said withdrawing duct, whereby a high pressure can be maintained in the withdrawing duct, substantially as set forth.

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

EDWARD S. McKINLAY.

Witnesses:

LEROY F. TENNEY,

GEO. K. TENNEY.