No. 689,166. Patented Dec. 17, 1901.

J. E. COLEMAN.

MINING APPARATUS.

(Application filed July 26, 1900.)

(No Model.)

7 Sheets—Sheet 1.

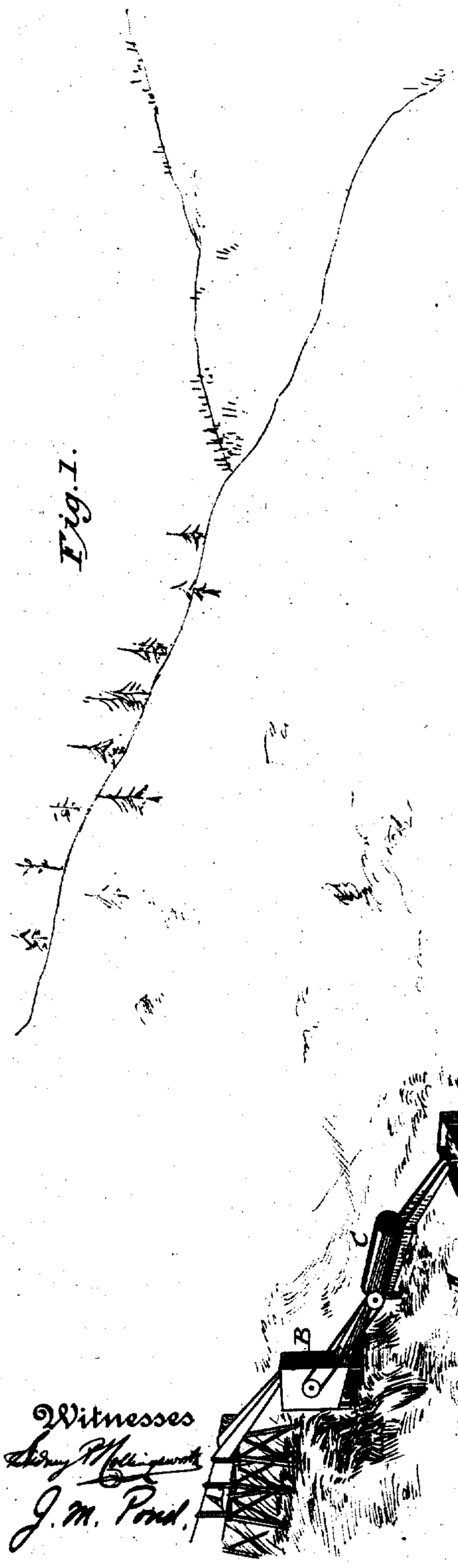
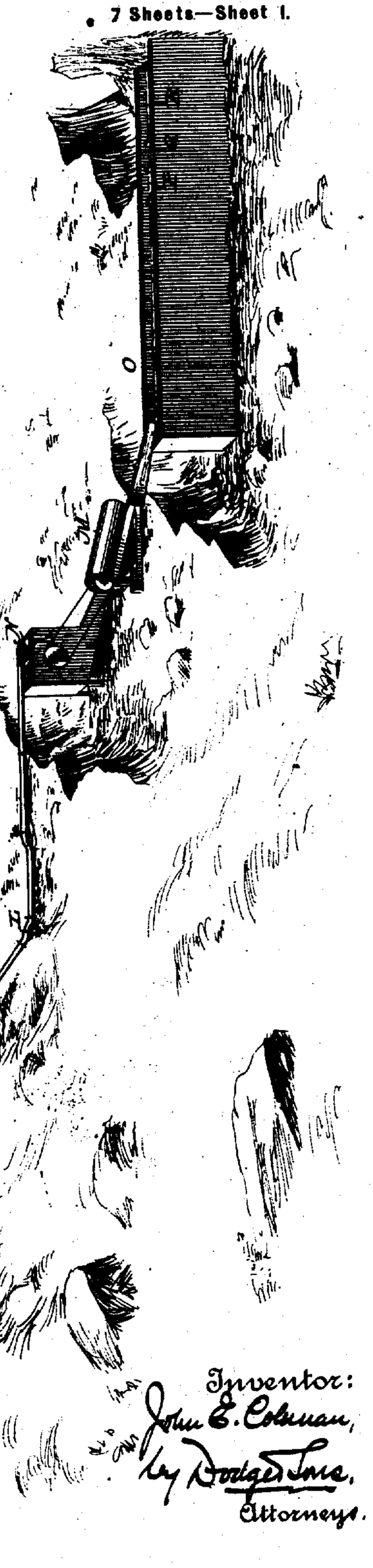


Fig. 1.



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(No Model.) 7 Sheets—Sheet 2.

Fig. 2.

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7 Sheets—Sheet 3.

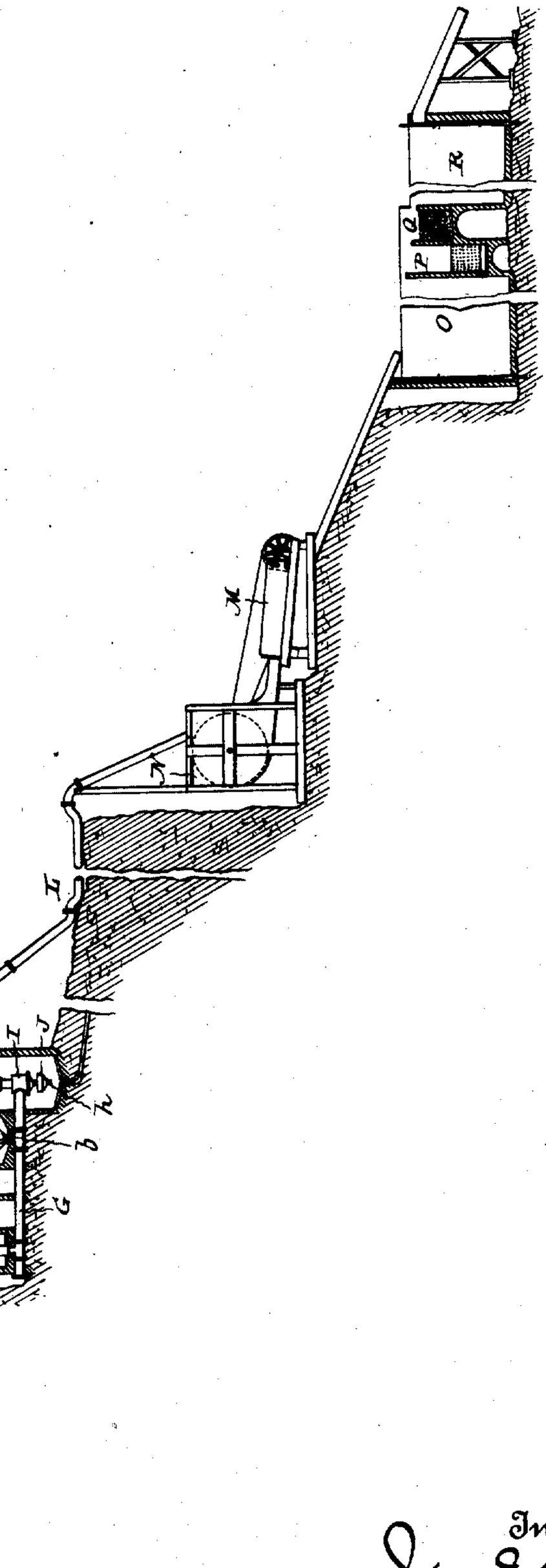

Fig. 3.

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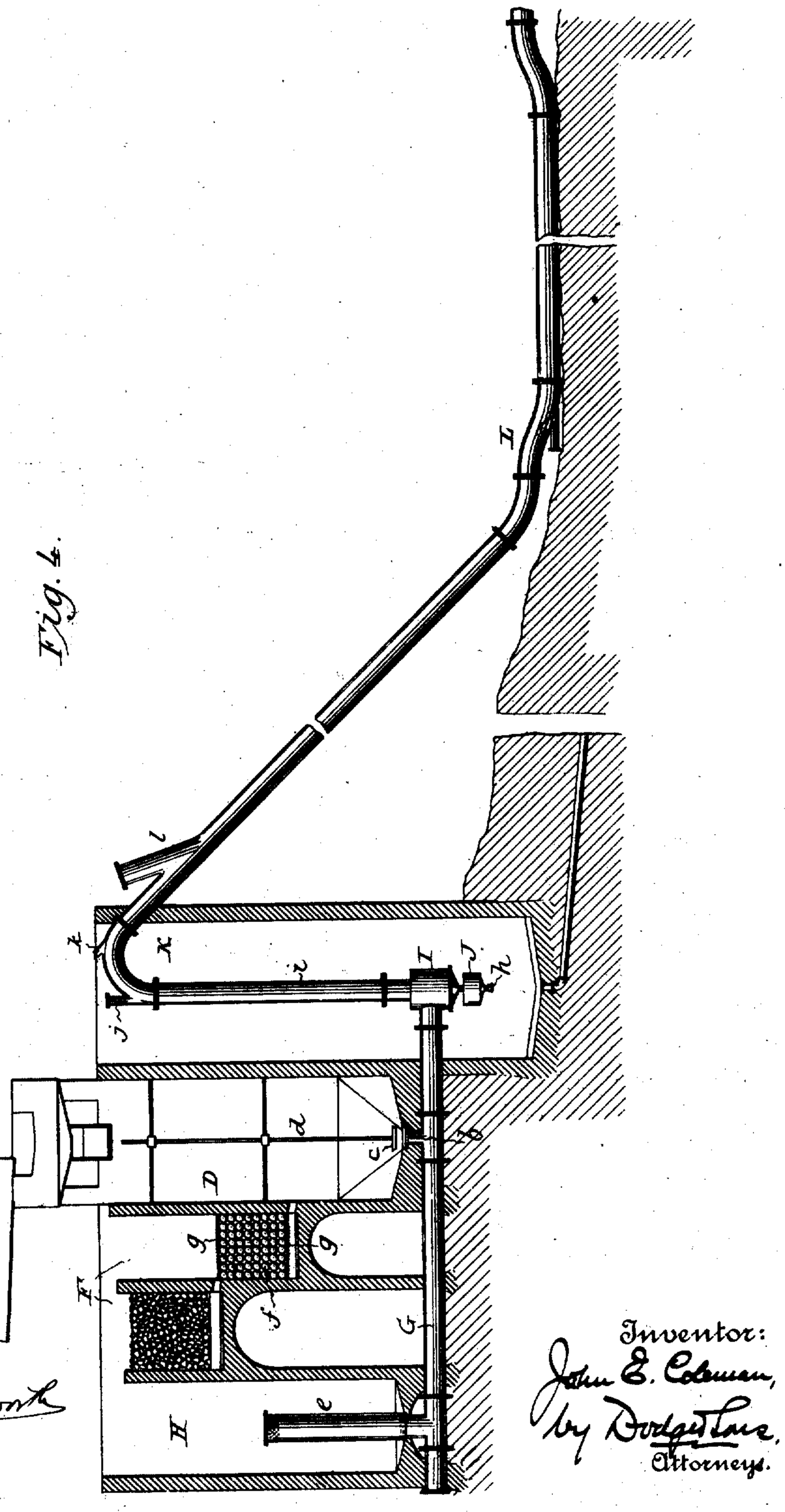
Fig. 4.



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7 Sheets—Sheet 5.

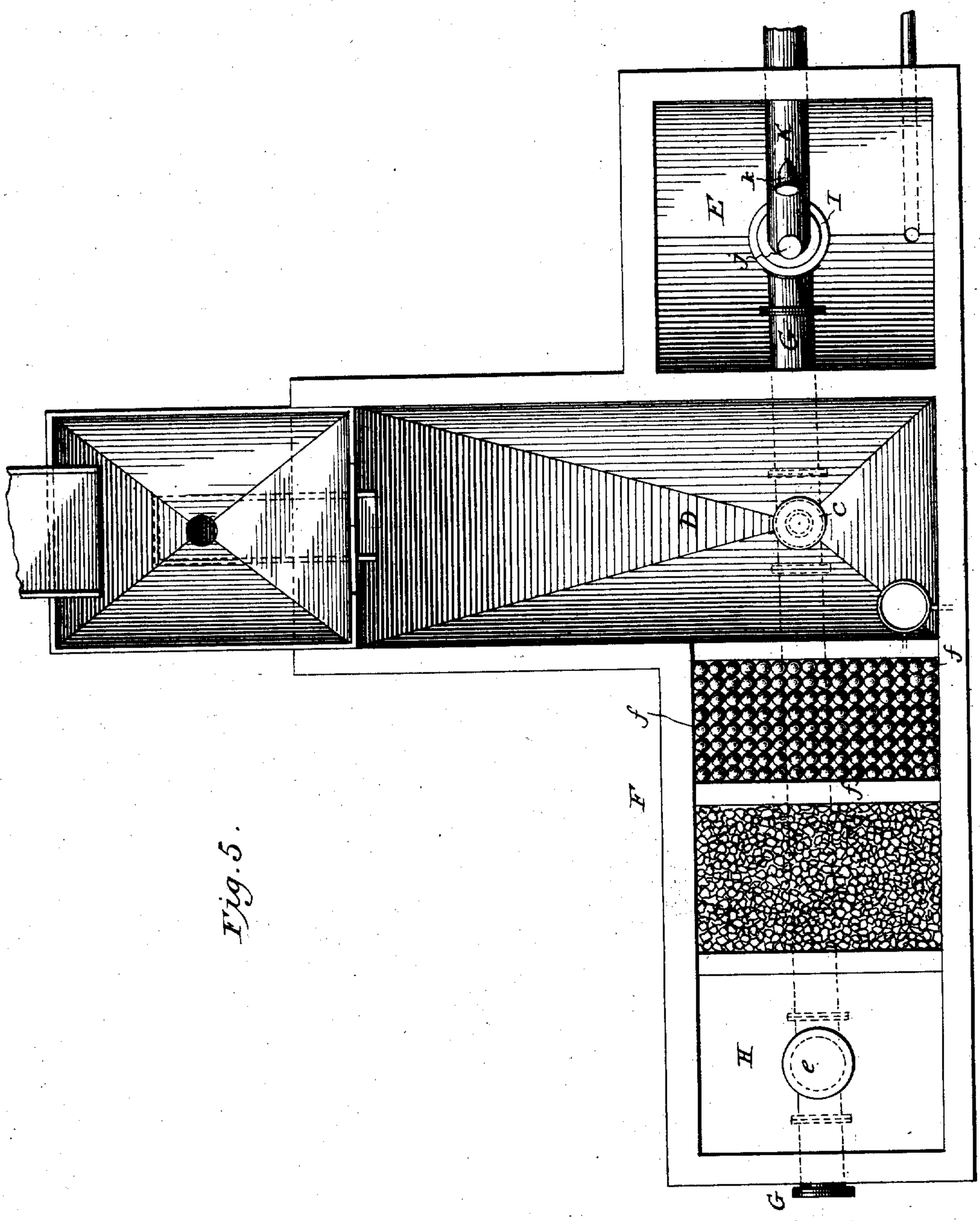

Fig. 5.

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(Application filed July 26, 1900.)

(No Model.)

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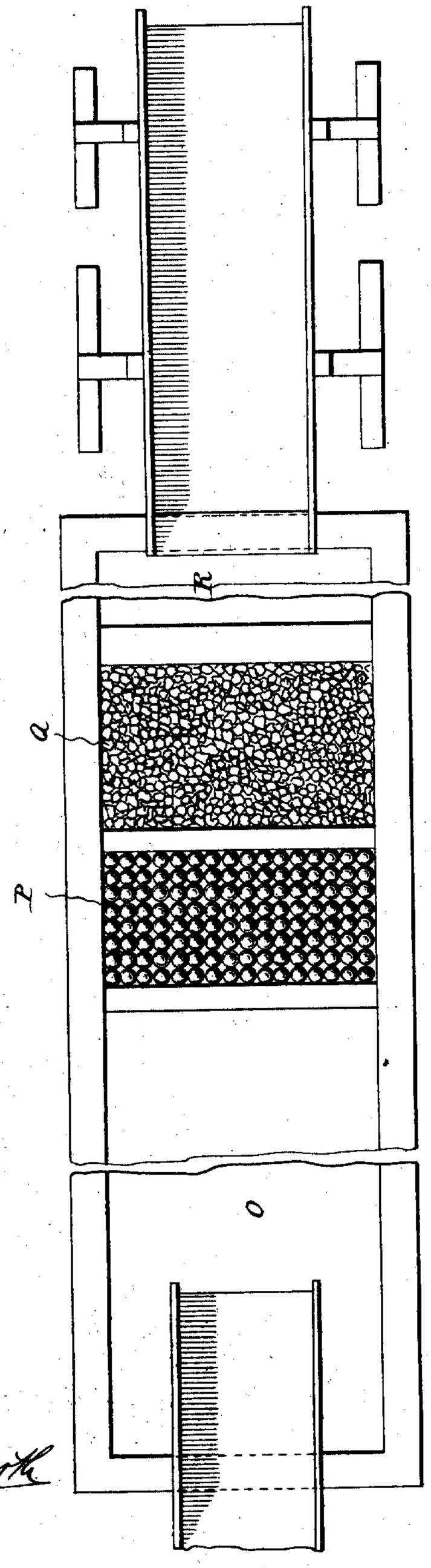
Fig. 6.



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(Application filed July 26, 1900.)

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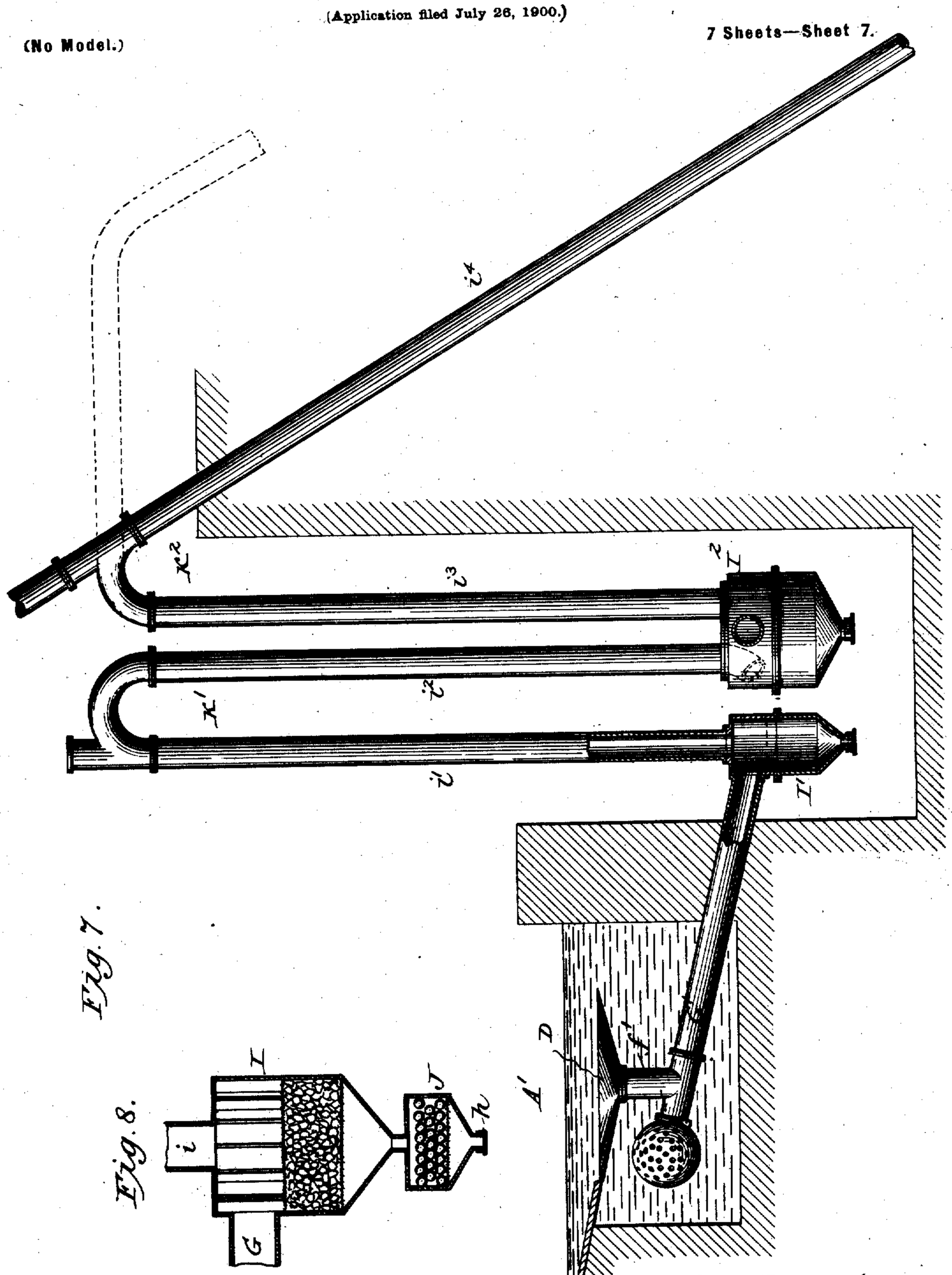

Fig. 7.

Fig. 8.

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UNITED STATES PATENT OFFICE.

JOHN E. COLEMAN, OF SPOKANE, WASHINGTON.

MINING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 689,166, dated December 17, 1901.

Application filed July 26, 1900. Serial No. 24,907. (No model.)

To all whom it may concern:

Be it known that I, JOHN E. COLEMAN, a citizen of the United States, residing at Spokane, in the county of Spokane and State of Washington, have invented certain new and useful Improvements in Mining Apparatus, of which the following is a specification.

This invention pertains to placer-mining and to the separation of gold, platinum, and other precious or valuable metals from sand, gravel, and other bodies through utilizing in a novel manner their differences in specific gravity.

The invention is particularly designed to dispense in many situations with the costly hydraulic system essential to ordinary placer-mining, though it may be used in connection therewith to very considerable advantage.

Many of the richest deposits are found in the beds of streams, and these have been but little worked, owing to lack of any well-considered and efficient plan for handling the deposits. For such beds this novel system is peculiarly adapted.

The underlying feature or principle of the system is the employment of the siphon action for lifting and carrying away all matters of less specific gravity than the metals designed to be saved, whereby a separation is made far more delicate and exact than can be produced by any other means of which I am aware.

The invention is susceptible of embodiment in apparatus of quite variant forms, and some of these different forms will be represented in the drawings and described herein; but it is to be understood that many other forms may be made without at all departing from the spirit of my invention. It is further to be understood that this present application pertains primarily to and is designed to cover the apparatus as distinguished from the art or method which is embodied in a separate application of even date herewith, filed in my name and designated by Serial No. 24,908, wholly independent of specific apparatus.

In the accompanying drawings, Figure 1 is a view in the nature of a perspective or bird's-eye view of a plant for carrying out my invention; Fig. 2, a similar view with the pipes carried underground to prevent freezing and to permit the apparatus to be used through winter weather in northern latitudes; Fig. 3, a vertical sectional view with the parts divided or broken at intervals to permit them to be placed within the prescribed limits of a patent drawing; Figs. 4, 5, and 6, sectional and top plan views of portions of said apparatus; Fig. 7, another vertical sectional elevation showing a double-siphon apparatus with two collecting-chambers and designed to effect a second and closer separation than can be done by the single apparatus; Fig. 8, a view illustrating a modification.

In establishing a plant of this character it is desirable to select a location where there is a running stream with a reasonable fall, and if the fall be somewhat rapid it will conduce to cheapness of construction and efficiency of operation, particularly in shortening the piping required and in rendering the plant as a whole compact and easy of supervision. Having located the deposit, whether the same be sand, gravel, or the like, requiring to be thrown down from a hillside, as in ordinary hydraulic mining, or a deposit in the bed of a stream caused by the action of the elements during long periods of time, provision is made for delivering the metal bearing sand, gravel, or earth into a hopper, whence it passes either directly or through intermediate screening and separating devices to the siphon apparatus.

Describing first the embodiment of the apparatus represented in Figs. 1, 2, 3, and 4, A represents a sluiceway into which sand, gravel, or other gold or metal bearing material is delivered in any convenient way, together with water sufficient to cause it to flow and to fill the interstices or places between particles and produce a solid column in the pipes of the apparatus. By preference this sluice delivers to a bucket-wheel B, in the nature of an overshot water-wheel, which being rotated by the material discharged upon it gives motion through suitable gearing to a rotary screen, drum, or sieve C, by which boulders and large bodies are removed. The finer material which passes through the meshes or perforations of the sieve or screen is delivered into a lower chute *a* and finds its way eventually either with or without intermediate separation into a hopper or chamber D, which is located between

the siphon-containing chamber E and filtering-chambers F. These several chambers may be constructed in the form of a strong stone or wooden structure wholly or partially above the surface of the ground and suitably partitioned, as in Fig. 1, or they may be below the surface, as in Fig. 2. As shown in Figs. 3 and 4, the chamber D has a pyramidal or hopper bottom, the several sides of which all slope toward a common outlet *b*. This outlet, which is made in the form of an elbow or vertical branch of a horizontal pipe G, is provided with a valve or closure *c*, having a rod *d*, which extends to and above the top of chamber D to permit its adjustment and control from such point. It may be provided with a screw-stem, lever, or any usual means of adjustment and locking. The purpose of this outlet and valve or closure is to determine the outflow of material from the hopper or chamber D into the pipe G, either permitting free and unrestricted flow to the outlet or reducing the flow in greater or less degree and compelling the contents of the chamber to find their way to any desired extent upward through filtering-chambers F to a settling-chamber H, whence the material may flow through a suitable outlet *e* into the pipe G. As seen in Figs. 3 and 4, the pipe G when the structure is built above ground may extend outside of the chamber, so as to receive directly through its outer end the material to be treated or a portion thereof. Ordinarily the discharge from chamber D will be mainly through the outlet *b*, and only the lighter and finer stuff containing float-gold or minutely-divided valuable metals will pass through the filtering apparatus.

The filtering-chambers F, which communicate with each other and one of which opens directly into chamber D, are provided with suitable filtering substances designed to gather and hold such matters as are worth saving. The chamber immediately adjoining chamber D is preferably provided with a number of balls *f*, of or plated with copper, which may in turn be plated with silver and which will preferably be amalgamated. These balls will be held between screens *g*, of wire, or between grids or other suitable supports admitting of a free passage of the water, sand, &c., but precluding escape of the balls. The second filtering-chamber has its bottom at about the level of the top of the first filtering-chamber and will be charged with charcoal or similar substance held between screens or other foraminous bodies, whereby the charcoal is prevented from being displaced. The amalgamated balls, for which of course bodies of other form may be substituted, serve to gather the fine float-gold to a very considerable extent; but such particles as pass between the balls and escape above them will be largely caught and held by the charcoal of the next filter. The walls separating chamber D from the adjoining filtering-chamber, the first from the second filtering-chamber, and the second filtering-chamber from the settling-chamber are made progressively lower, so that the material shall always flow in proper direction from each to the next. Chamber E contains the separating or collecting drum proper, I, which may advantageously be made of cylindrical form with a hopper-bottom and a central outlet at the apex of the hopper-bottom opening into a lower depositing-chamber J, which in turn has a hopper-bottom and an outlet *h*, provided with suitable closure. The drum I is advisably of considerably larger diameter than the pipe G and is furnished with an upwardly-extending neck of the same diameter as said pipe G, though the shape and the proportions of the chamber may vary. The pipe G may connect with the drum radially or tangentially, according as it is desired to simply deliver the material into the chamber subject to the natural tendency of a moving liquid column to take on a rotary motion or to give to said column powerful and constant rotation in one direction. In the drawings the radial arrangement is shown, and in practice this will ordinarily be adopted, for the reason that a more effective separation will take place in the absence of undue agitation than is possible where the motion is very strong. This statement, however, is subject to the qualification that where the particles are of considerable size and where by reason of differences in specific gravity the rotary motion will tend to throw the heavier particles outward against the walls of the drum or chamber the tangential arrangement, producing the strong whirling action, may and frequently will be found advantageous.

Connecting with the upper end of the neck of drum or cylinder I is a vertical pipe *i*, constituting the uptake or shorter leg of a siphon K, the longer or discharge leg of which must of course descend to a lower level than the receiving or intake leg or to a lower level than the point at which pipe G opens into said drum or cylinder I. The strength of the siphoning action, or, in other words, the force with which the column of water with its contained sand, gravel, &c., will flow upward through the shorter leg of the siphon, will of course depend upon the relative elevation of the intake and delivery ends of the siphon, subject to some variation or influence from the friction of the moving column in the pipe. This will depend upon the length of the pipe, its diameter, and similar considerations, which are well understood by hydraulic engineers. By properly relating these levels or by providing the delivery end with an adjustable section, whereby the outlet-level may be varied at will within reasonable limits, any desired strength or force of flow may be given the current up to the limit possible in siphonic action.

In Figs. 3 and 4 I have represented a siphon as constructed with a curved connecting-section between the uptake and discharge legs, said curved section being provided with

capped necks *j* and *k*, designed to permit the insertion of rods, brushes, or other devices for clearing or cleaning the siphon when required. The descending leg is likewise further provided, preferably, with a Y *l*, suitably capped or covered, through which may be introduced a stream of water for the purpose of starting the siphon in action. It will be found expedient also to make sections of the piping with necks in line with the bore similar to the necks *j k* for the purpose of facilitating the clearing of the pipe. This may readily be done by making such pipe-sections of curved form, as indicated at L in Figs. 3 and 4.

The material entering the drum or cylinder I will under most circumstances take on a rotary movement, even though the inlet-pipe be arranged radially, but this movement may be suppressed or lessened by placing in said chamber between suitable screens or grids heavy bodies—such as stone, balls of iron or of lead, or the like—or a like effect may be attained by forming internal ribs or wings in the chamber to resist or impede the rotary movement of the water.

The material carried by the discharge-leg of the siphon will consist of water, sand, gravel, earth, &c.; but particles of gold, platinum, and like heavy metals will not, if the strength of current be properly adjusted or regulated, be carried upward through the siphon. These will be gradually deposited in the chamber I, and when the latter is provided will find their way into the lower chamber J, from which they may be withdrawn from time to time. It is found, however, in the practical working of this apparatus that occasionally particles of even the heavier metals are carried upward in the siphon and discharged through the outlet thereof, and it is consequently advantageous to rework this discharged material or to subject it to screening, sifting, filtering, or amalgamation, or any of these treatments. With this object in view I propose to employ when necessary a second rotary screen M, turned by a wheel N through suitable gearing or belting after the manner of screen C and wheel B, the wheel here represented being, however, of the overshot type. The screenings or finer material passing through the meshes of this second screen, with water, are delivered by a trough into a settling-chamber O, whence they pass upward through filtering-chambers P Q to a second settling-chamber R, from which the water overflows to the bed of the stream or to any convenient delivery-point. From time to time the material settling in the chambers O and R and that deposited in the filtering-chambers is taken out and panned or otherwise treated to separate the metal held therein from the slime and worthless matters, and the like treatment is given to the deposits in the chambers D, F, and H. The material discharged from the siphon, either with or without previous screening, settling, filtering, &c., may be passed through a washer or riffle.

In the practical carrying out of my invention I prefer to adopt the form of apparatus represented in Fig. 7, in which a double siphon is employed, the first delivering to the second and the second discharging either into the stream at a lower level or delivering to other apparatus to further treat the discharged material. In this figure, A′ represents a basin, sink, or depression in which is placed a supply-pipe G′, having a feed opening or inlet *f′*, communicating with a supply-hopper D′, into which the sand, gravel, or earth is delivered by any convenient means, the end of the supply-pipe G′ being open at one side of the hopper to permit ingress of water from the sink or basin in the quantity necessary to properly mix and mingle with the sand, gravel, &c., to form a vehicle or carrying body therefor. I′ indicates the drum or cylinder of the separator with which pipe G′ communicates and which may be formed or furnished with a lower collecting-chamber, as in Figs. 3 and 4. This, however, is not represented in Fig. 7, which shows instead a relatively deep chamber I′, with the inlet-pipe G′ opening into the same near its top. The uptake-leg *i′* of the siphon K′ communicates with the cylinder or drum, as under the construction previously described, and is connected by an arching pipe or section at its upper end with the descending leg i^2, which in turn opens into the top of a second drum or cylinder I^2, which may be at the same level as chamber I′ or above or below the latter, as found expedient. It is preferred to have the pipe i^2 enter chamber I^2 from the top, and it will be found advantageous to deflect slightly or turn to one side the delivery end of said pipe where it enters into the end of chamber I^2. This will result in setting up a whirling action, which in the relatively large chamber I^2 will be found advantageous. I do not, however, mean to limit myself to this arrangement of the pipe. From the top of the cylinder or drum I^2 a third pipe i^3, constituting the uptake or shorter leg of a second siphon K^2, is carried upward a suitable height and connected by an arching section with the descending leg i^4, the delivery end of which must of course pass to a level sufficiently below that of chambers I′ I^2 to effect a proper fall of water and consequent siphonic action through the pipes *i′* i^2 i^3 i^4. The chambers I′ and I^2 may be constructed in the same manner as in Fig. 7 or varied therefrom as occasion may require, provided the general construction and mode of operation be retained. The appliances for operating upon the material discharged from the siphon being exactly the same as in the preceding figure need not be further described herein.

As stated at the outset, the leading feature of the invention is the employment of the siphon principle through suitably-constructed

apparatus to the separation of worthless from valuable material. In this connection it is proper to state that a clear distinction is to be observed between lifting the worthless material of a body containing valuable material, on the one hand, and carrying the entire mass forward in a stream and depending upon the greater specific gravity of the valuable particles to cause them to fall and be deposited in pockets, riffles, or receptacles along the way, on the other hand. By the lifting action of the siphon here described I am enabled to make a most perfect and delicate separation and to determine with the utmost nicety the point at which such separation shall be effected—that is to say, the specific gravity which shall resist and overcome the siphonic action, on the one hand, and which, on the other hand, shall permit it. Practical operation of the system upon a commercial scale has demonstrated the capability of the apparatus to effect a separation where the metal—platinum—was present in a state of such exceeding high division as to present the appearance to the naked eye of a powder and to be recoverable by no other known means.

While the apparatus above described is designed primarily for recovery of rare or precious metals, it will be seen that it may be employed for effecting separation of other substances.

In Figs. 3 and 4 I have shown the section L in the form of a trap produced by dropping a section of the pipe *l* below the level of the portions at each end thereof. This section should be of capacity equal to or slightly in excess of that of the vertical leg of the siphon. Its purpose is to enable the siphon after being once charged to be started with a small body of water and to prevent air from working back into the siphon. No claim is made to this feature *per se*, the same being common in siphons.

Having thus described my invention, what I claim is—

1. In apparatus for recovering rare or precious metals and the like, the combination of a chamber or vessel adapted to receive metal-bearing sand, gravel, earth or the like, and water; and a siphon communicating with said chamber or vessel above the intake and having its outlet or delivery end at such level relatively to the intake as to cause a lifting by unaided siphonic action of all particles or bodies of less than predetermined specific gravity, and thereby to effect a separation of particles or bodies in said chamber according to their relative specific gravity.

2. In an apparatus for recovering rare or precious metals and the like, a chamber or drum having an inlet at one side for the introduction of a fluid mass bearing the materials to be treated; and a siphon opening from the upper part of said chamber and adapted to draw water from said chamber and to lift with it the lighter matters contained within said chamber, while leaving behind those of greater specific gravity, the chamber being without other normally open outlet.

3. In apparatus for recovering rare or precious metals and the like, the combination of a separating chamber drum or cylinder, a lateral inlet-pipe provided with openings for the admission of water; a hopper arranged to deliver sand, gravel, earth, &c., into said pipe; and a siphon communicating with the upper part of the separating drum or chamber, whereby it is adapted to produce unaided the travel of a stream or current of water through the apparatus, while permitting particles of great specific gravity to settle below the level of the inlet, substantially as and for the purpose set forth.

4. In an apparatus for separating rare or precious metals and the like from base matters, the combination of a receiving-chamber; a filtering-chamber communicating therewith; a pipe or conduit adapted to be placed in communication at will with the receiving-chamber or the filtering-chamber, or with both in greater or less degree; a separating chamber or drum arranged to receive the material carried through said pipe; and a siphon communicating with the upper part of the separating-chamber and serving to create by the siphonic action, a current through the receiving-chamber, and to carry off all matters of less than a predetermined specific gravity.

5. In an apparatus for separating bodies of different specific gravities, the combination of a separating drum or chamber; an inlet or supply pipe opening into the same above its bottom; a siphon opening from the upper part of said chamber and constituting the only outlet therefrom; a screen or sieve for treating the material delivered from the siphon; and a wheel or motor connected with and serving to operate the sieve or screen and located in position to receive the discharge from the siphon, whereby it is adapted to be operated by said discharge.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN E. COLEMAN.

Witnesses:
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