(No Model.) 3 Sheets—Sheet 1.

E. RAMSAY.

COAL AND MINERAL WASHER.

No. 528,803. Patented Nov. 6, 1894.

Fig. 1.

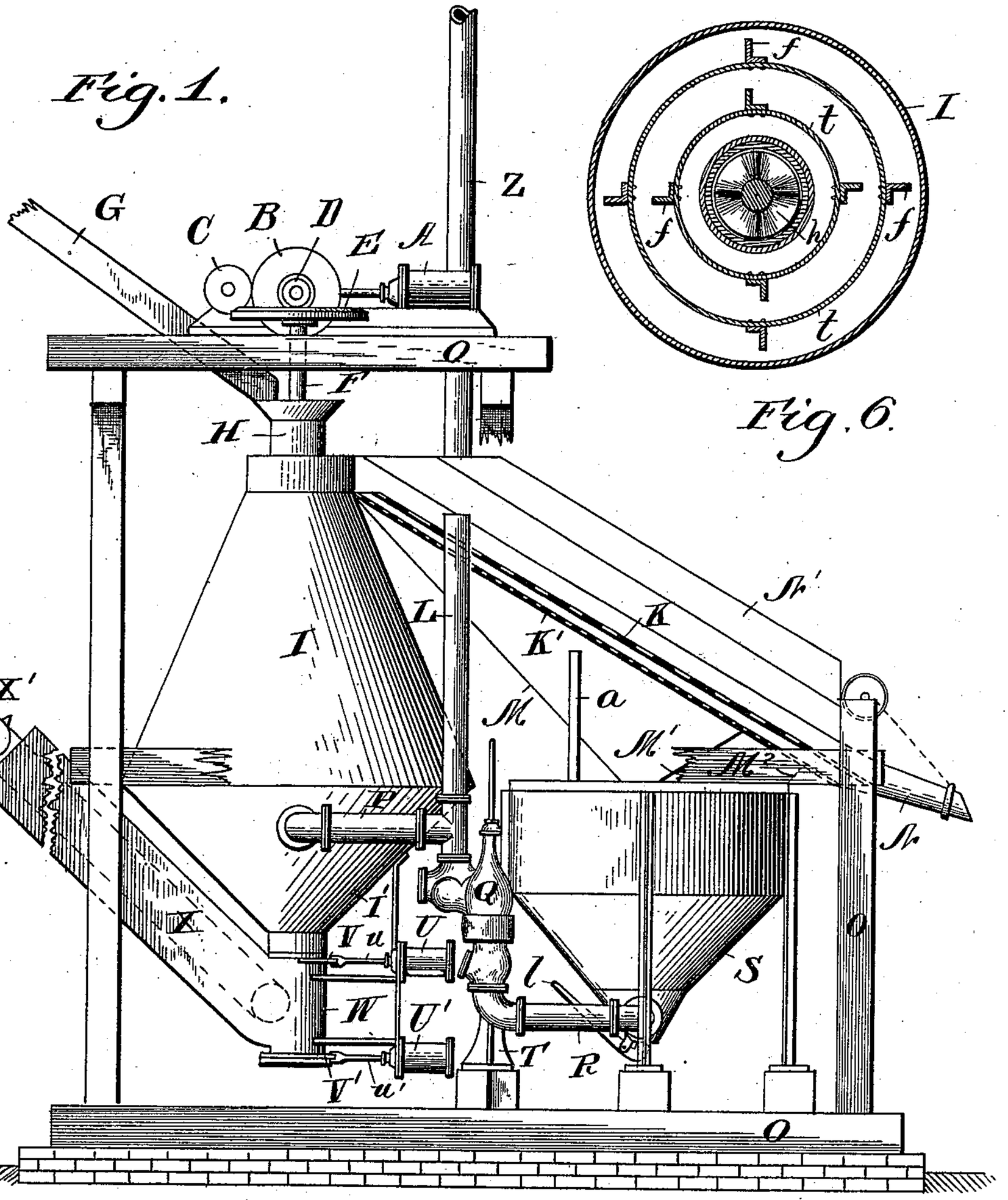

Fig. 6.

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Fig. 3.

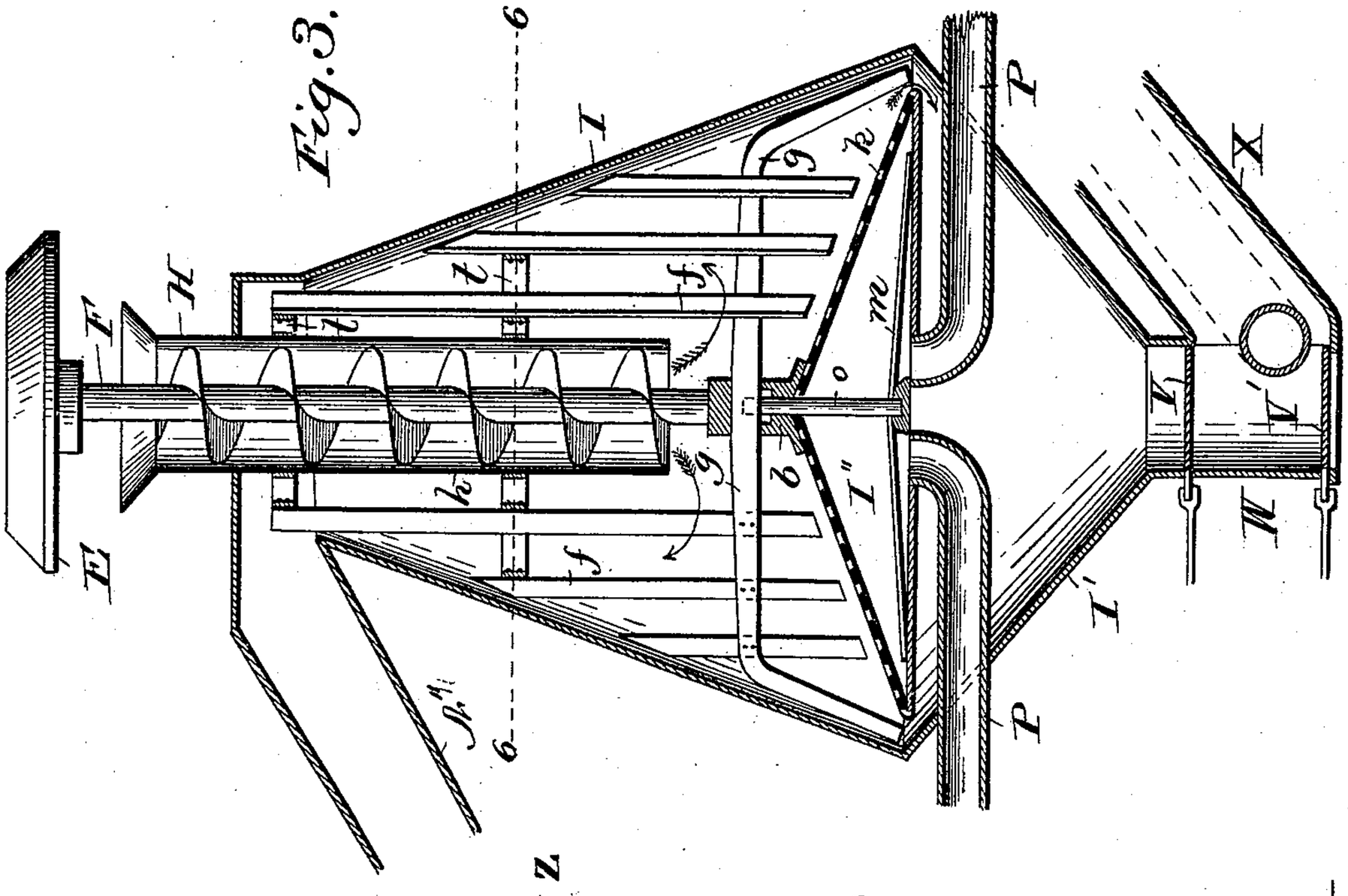

Fig. 2.

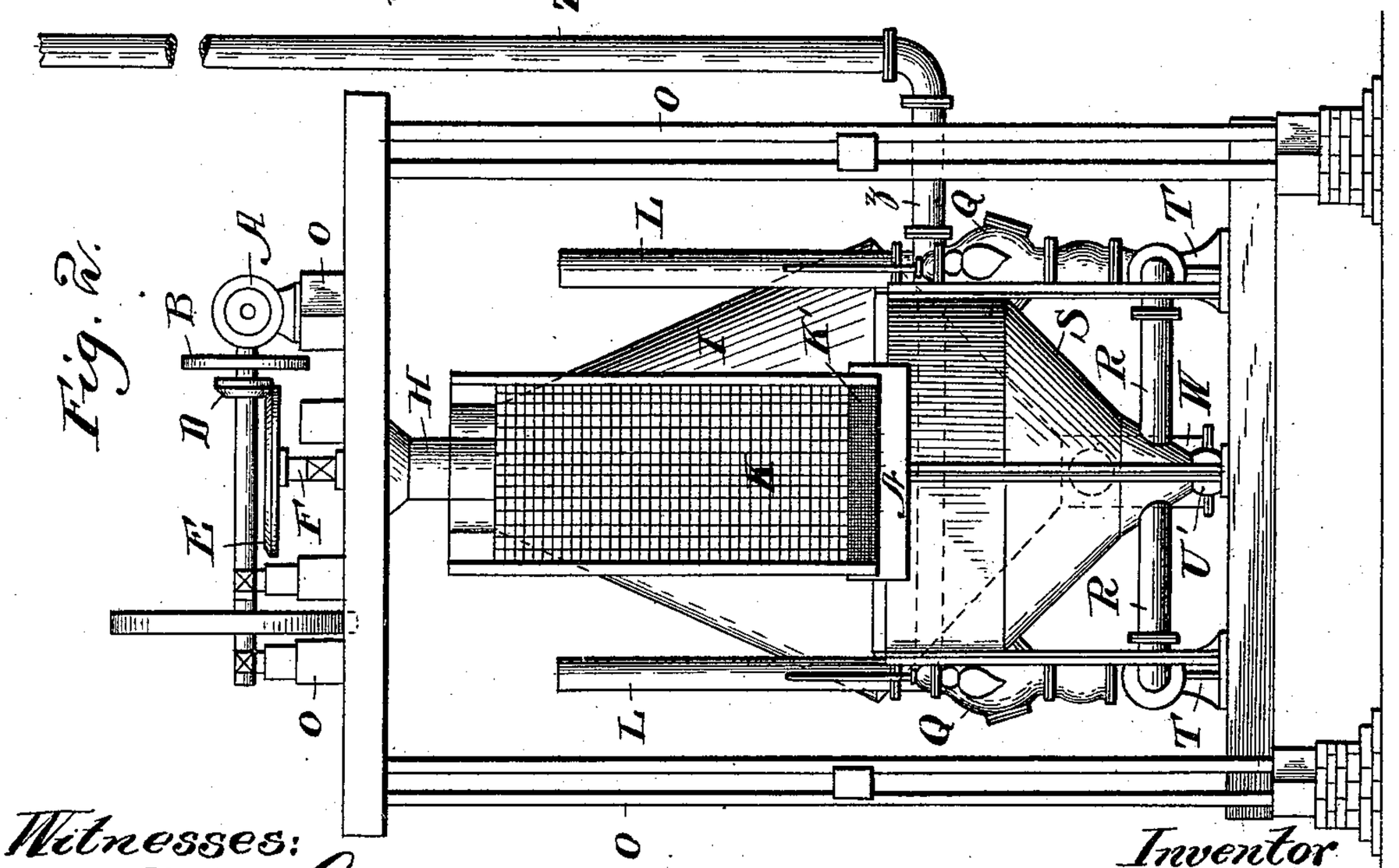

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Fig. 4.

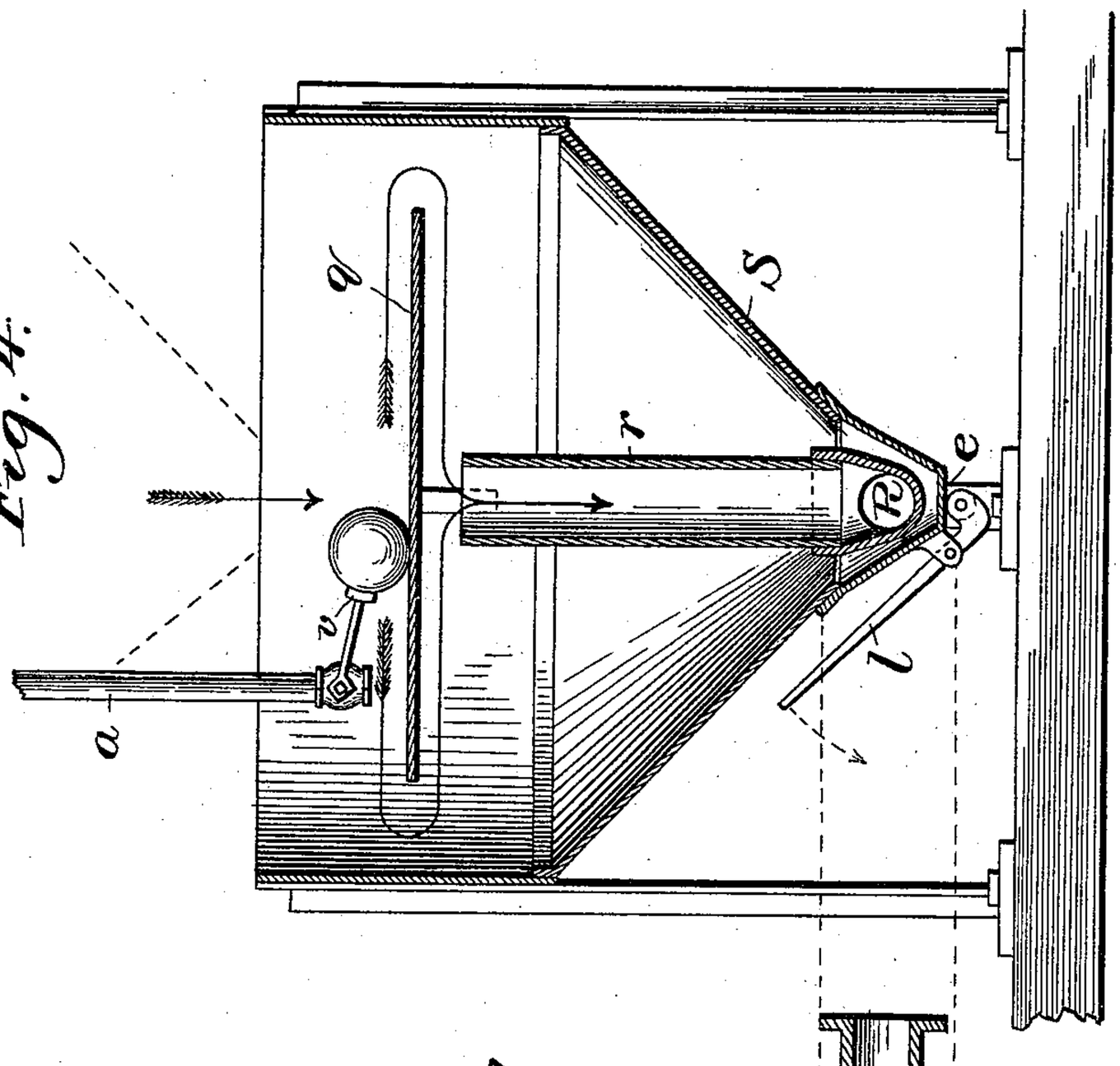
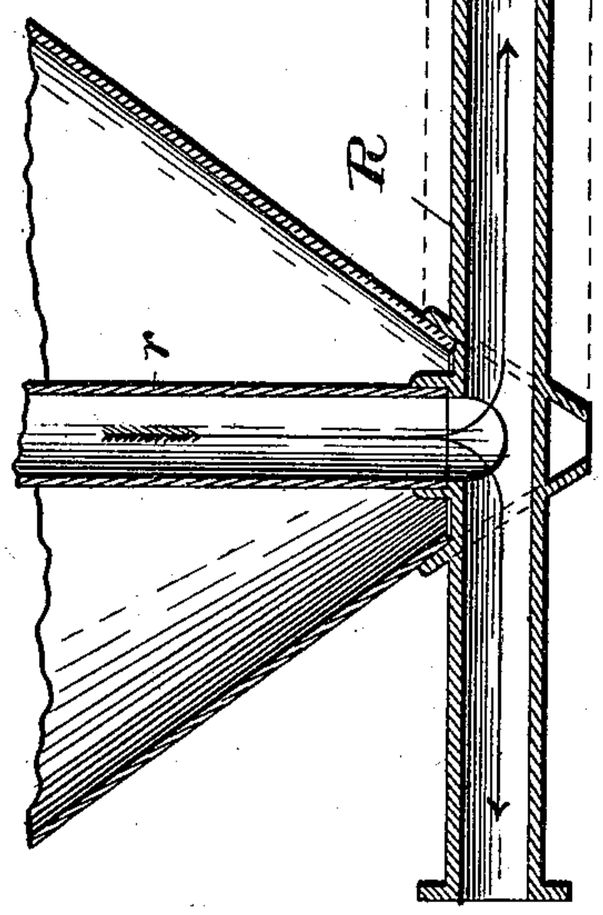


Fig. 5.



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UNITED STATES PATENT OFFICE.

ERSKINE RAMSAY, OF PRATT MINES, ALABAMA.

COAL AND MINERAL WASHER.

SPECIFICATION forming part of Letters Patent No. 528,803, dated November 6, 1894.

Application filed February 17, 1894. Serial No. 500,530. (No model.)

To all whom it may concern:

Be it known that I, ERSKINE RAMSAY, a citizen of the United States, residing at Pratt Mines, county of Jefferson, Alabama, have invented certain new and useful Improvements in Coal and Mineral Washers, of which the following is a specification.

My invention relates to coal and mineral washers and its objects are to provide a washer in which the material may be economically and expeditiously washed in one continuous operation; to provide means for conveying away the separated, heavier ingredients and means for clearing the chamber in which the said ingredients are deposited when for any cause the elevating or conveying mechanism attached thereto is stopped or broken; to secure an automatic replenishing of the supply of fresh water to take the place of that absorbed in the washing process; to provide improved chutes over which the coal is discharged; and to provide means whereby the water pipes leading to the washer may be kept automatically clear of obstruction; and in general to provide an efficient washing machine in which the force of an ascending current of water, force of gravity and centrifugal force are used to perform the operation of washing.

With these objects in view my invention consists in the construction hereinafter described and claimed.

In the drawings: Figure 1, is a side elevation of the apparatus. Fig. 2, is an end elevation of the same. Fig. 3, is a longitudinal vertical section of the washer chamber, the coal conveyer being shown in elevation, part of its casing removed. Fig. 4, is a vertical section of the water tank and fine mineral washer. Fig. 5, is a detailed sectional view of the bottom of said tank. Fig. 6, is a cross section on the lines 6—6, Fig. 3.

Referring now to the drawings, in which the same reference letters designate the same parts throughout the different views, I, designates the washer proper which is a chamber or casing of metal of frusto-conoidal shape, provided with a coal discharge, N″, at the top. A water chamber, I″, is supported by suitable metal brackets between the washing chamber, I, and the conical settling chamber or space for impurities, I′, and the latter chamber is formed with a cylindrical extension, W, into which the slate or other heavy impurities gravitate, and from which they are removed by suitable bucket elevating or conveying apparatus, X′, working in a pipe or casing, X, provided at its upper end with a discharge chute, Y. This conveyer pipe extends above the coal discharge to prevent the waste of water from the washer.

G, designates the feed chute or trough by which the material is conveyed to the washer.

The water chamber, I″, is a conical chamber having a perforated top, *k*, through which water, supplied through the pipes, P, opening into the bottom of said chamber, may freely pass upwardly into the washer, I.

The feeding device for coal or other material consists preferably of the cylindrical casing, H, extending centrally within, and terminating near the bottom of the washer, I, provided with a worm feed or screw conveyer formed of the helical flange, *h*, secured to the stirrer shaft, F. This stirrer shaft carries at its lower end, just above the step bearing, *b*, on top of the water chamber, I, two or more stirrer arms, *g*, bent downwardly at the outer ends to which arms are attached the vertically arranged stirrers, *f*, braced by the flat annular bar braces, *t*, the inner ones of which form collars journaled upon the outside of the casing, H. The annular braces, *t*, should preferably be braced by suitable metallic braces for securing a more stable construction. Connected to the main shaft, F, by a smaller counter shaft, *o*, are sludge stirrer arms, *m*, which prevent the accumulation of sludge within the water chamber. The shaft, F, may be rotated by any suitable motor through any convenient gearing or connections, but I preferably use the steam engine, A, mounted upon the top frame, O, of the apparatus, transmitting motion to said shaft by means of the spur gears, B, C, and the bevel gears, D, E. The elevating mechanism, X′, may also be operated from the crank shaft of the engine by a chain or other belt, as desired, this means not being shown as it will be understood readily and forms no part of my invention.

The bottom of the slate chamber, W, is provided with two sliding gate valves, V, V′, at

the top and bottom thereof that are operated by suitable power cylinders, U, U′ in which pressure—air, steam or water—is normally maintained on both sides of their pistons, whose rods, *u*, *u′*, are connected to the said valves. When the conveyer, X′, is stopped for any cause and it is desired to remove the slate from the chamber, W, the pressure in the cylinders is shut off from the ends toward which the pistons are to move to open or close the valves. To effect this operation the cylinders are of course provided with passages in each end connected, by suitable pipes having proper valves therein, to the source of power, in this case to the steam pipe which supplies steam to the main engine, A. I find that by employing these power cylinders for this purpose the valves are readily and quickly opened which is not the case when levers are used for the purpose.

The conveyer for removing the slate is so speeded as to discharge the slate only so fast as it becomes separated from the coal by the washer, for if it were removed faster some portion of the coal might likewise be removed with it. To accomplish this I allow the slate chamber to be always partially full.

N″, indicates one form of coal discharge chute consisting of a metal casing which I employ preferably when the coal is to be delivered to any ordinary settling tank, from which it is elevated by any suitable elevating mechanism, and carried to the point desired; but I preferably employ the chute, N′, Fig. 1, having two sides and provided with a bottom, K, with comparatively large perforations through which the finer coal and sludge may pass onto a thinner screen, K′, with finer perforations in the same, the sludge or fine minerals, as pyrites, passing through both screens by way of the chutes, M, M′, M″, whose upper ends are secured to the chute and whose lower ends lead into the central portion of the sludge or fine mineral washer and water supply tank, S, open at the top formed of upper cylindrical and lower conical portions. The lower end of the chute, N′, is provided with a hinged trough or chute, N, over which the washed coal from both the screens may pass to cars, bins, &c. In practice it is found that the employment of these two screens with the perforations of different sizes reduces the cost of renewals of the said screen to a minimum; for where one screen is used the perforations must be very small, say one-twelfth of an inch, in order that only the finest minerals may pass through them and hence it is impossible to use plates of much thickness for these screens; and they consequently wear out very quickly when all the coal passes over them. By placing a screen with larger perforations above the finer this upper screen can be made of thicker plates for carrying the most of the coal, while the lower screen carries only the very finest, both discharging over the chute, N.

The tank, S, as ordinarily constructed is designed to act merely as a receptacle to catch the water from drying screens or settling tanks from which the pumps derive their supply of water for the washer; and in practice it is found that the fine sediment, such as pyrites and slate, settles on the bottom until it gradually acquires a height above the discharge pipe, into which some of it slides, clogging up the pumps to such a degree as to prevent their operation. To overcome this defect I construct this tank as shown in Figs. 4 and 5, where *q*, designates a circular deflecting plate supported near the normal level of water in the tank, just above the discharge pipe, *r*, which projects centrally within the tank. The bottom of the tank is provided with an upwardly opening disk valve, *e*, operated by the lever, *l*, for removing the sediment which settles therein. The central discharge pipe, *r*, is connected to the pump supply or suction pipes, R, just above this valve, as shown in Figs. 4 and 5. The pipes, R, are supported upon the stools, T, forming part of the elbows joined to the pumps. This arrangement separates the fine sediment in the following way: The water being caused to flow over the edges of the plate, as indicated by the long arrows, it carries with it the fine sediment which, as the current is compelled to flow inwardly toward the pipe, *r*, attached to the suction of the pumps, as described above, gradually gravitates into the settling space for impurities, because of the fact that their specific gravity is greater than that of water and clean coal. Some of the impurities will thus be thrown off by their momentum when rounding the deflecting plate.

The relative diameter of the deflecting plate to that of the tank is governed by the amount of sediment it is desired to remove. As the water contains some fine coal not intended to be removed, this diameter should not be too large; while on the other hand if the diameter is too small then the current of water would be so rapid that it would carry with it the specifically heavier sediment as well as the fine coal. This matter properly regulated enables the separation of the impurities to any degree of perfection.

Some of the water is necessarily absorbed by the coal discharged from the washer, and to automatically replenish the supply of fresh water I provide the fresh water pipe, *a*, with a ball float, *v*, which is adapted to open the valve in said pipe as the level of the water in the tank, S, falls below the point at which it is desirable to maintain it, in order to keep a sufficient supply therein for use in the washer. When the water rises again the float rises with it and closes the valve in the pipe, *a*.

By the use of the sludge washer I am enabled to rid the water of the pyrites and slate, and thus reduce to a minimum the wear usually resulting from the friction of these ingredients in the pumps, pipes, and the other parts of the washer. By this means the life of these parts is prolonged and the cost of renewals consequently diminished.

In many washers now in general use, the water to be supplied to the washer chamber is stored by pumps in a cistern or reservoir located some distance above the washer, the head of water being fixed in such cases, and it frequently happens that sediment will collect in the washer supply pipes and prevent sufficient water from passing to the washer, thus necessitating the taking down of the pipes to clean them, and stopping the operation of the apparatus. I overcome this defect by dispensing entirely with this fixed reservoir, and connecting the pumps directly with the supply pipes, P, of the washer and connecting these pipes with a stand pipe, Z, as shown in Fig. 2, extending a considerable distance above the washer, say eighty feet. This pipe, Z, is attached to the cross pipe, *z*, which connects the two discharges of the pumps, Q, the supply pipes, P, and the air chambers, L, as shown in Figs. 1 and 2. By this construction a normal head of say twenty-five feet will be maintained in the stand pipe but the moment the supply pipes leading to the washer become clogged by sediment the pumps will force the water up to a greater head in the pipe until it is sufficient to force the obstructions out of the said supply pipes through the washer chamber, at which time the normal head will again be resumed. This action is thus automatic, avoiding the necessity of stopping the apparatus; and furthermore in my arrangement the water does not have to be pumped against a greater head than is absolutely necessary to do the work; whereas in the case of a fixed head, in order to keep the pipes moderately clear the cistern will have to be elevated to such a height as to greatly increase the normal work of the pumps. The stand pipe, it will be seen, acts somewhat upon the principle of the air chamber on the discharge of a pump, since the water contained in the said pipe ascends and descends at each pulsation of the pump, by which the supply of water to the bottom of the washer is made regular.

The operation of the washer proper may be now briefly described, that of the other parts being clear from the foregoing description. Coal being fed into the washer through the top of the worm feed shell or casing, as the shaft, F, rotates the coal will be carried downward by the worm feed, and as it is discharged from the lower end of the feed shell it comes in contact with the upward current of water from the water chamber, I″, which current together with the revolving motion imparted by the stirrers, causes the coal to move upward, in the direction indicated by the arrows; and the slate owing to its greater specific gravity and to centrifugal force is moved gradually to the slate discharge where it passes downward into the slate chamber to the conveyer by which it is removed, the bent stirrer arms, *g*, keeping the slate from clogging up in the slate discharge from the washer. After the coal reaches the top of the washer it is discharged in either of the two modes hereinbefore described; the water passing with it to the water chamber to be returned therefrom by the pumps to the washer chamber proper for use again.

It will be seen that by making the washer larger at the bottom than the top the least current of water is at the bottom and the greatest at the top, from which it follows that the slate or heavier material will be more readily separated without remaining in a state of suspension with the coal, and in addition, this construction gives a greater centrifugal force at the bottom of the washer, thus making the separation of the slate from the coal more rapid and thorough, thereby preventing the slate from being pulverized by attrition and passing out at the discharge with the coal.

While I prefer to feed the coal downwardly through the central positive feed, my washer can still operate with the coal fed into the annular space around the central shell, the discharge in this case being upwardly through the feed shell. This operation can be readily effected by reversing the engine which gives the reverse motion to the worm feed; and of course the feed and discharge chutes would be shifted, as will be readily understood.

While I have shown two pumps for supplying the washer it is to be understood that one or more may be used for this purpose as found desirable.

I claim as my invention—

1. The combination with the outer conical casing having its small end at the top and provided with the coal discharge near the top, of the supply shell, the revolving shaft therein carrying a feeding device for the material to be washed, the water chamber in the bottom of said conical casing provided with inlets for a water supply and outlets for discharging the water into the washer upwardly, with means for agitating the material wtthin the washer, substantially as described.

2. In a coal or mineral washer, an upper casing having a discharge near the top, a bottom casing joined to said casing, provided with an outlet at the lower portion thereof, a water chamber located between the two casings and communicating at its upper side with the upper casing and its lower side with a water supply, a central feed shell, with a revolving shaft therein provided with a worm feed, and a series of stirrer arms secured to said shaft and journaled upon the feed shell above the water chamber, substantially as described.

3. In a coal and mineral washer the combination with the upper conical casing constituting the washer proper, the lower conical casing forming a waste chamber, the said chambers united at their bases, of a conical water chamber between the two communicating with the upper casing through its conical surface, and at its base with a water supply,

said chamber forming with the sides of the casings an annular discharge opening into the waste chamber, with means for feeding the coal or mineral into the washer, substantially as described.

4. In a coal and mineral washer, the washer chamber having its bottom end larger than its top end, provided with a discharge for the washed material at the said smaller end, in combination with a water supply pipe or pipes opening upwardly through the bottom end, means for agitating the material within the chamber, and means for feeding the said material to the chamber, substantially as described.

5. In a coal and mineral washer an upper washing chamber or casing, having the discharge near the top, a lower waste chamber, an intermediate water chamber forming an annular discharge between the two, a conveyer or elevator for conveying the material from the lower waste chamber to a desired point above the discharge for coal, mechanism for feeding the coal downwardly into the upper chamber, with agitators or stirrers operating in said chamber, whereby the coal may be washed by water forced upwardly through the water chamber into the washer while the heavier material gradually descends to the waste chamber, and to the conveyer, substantially as described.

6. In a coal and mineral washer, the combination with the chamber or casing, I, the casing, W, intermediate water chamber, I″, and provided with a water supply, the feed shell, H, the revolving shaft, F, having the worm feed, *h*, the stirrers in the washer chamber, and the sludge stirrer in the water chamber, with the elevator, X′, substantially as described.

7. In a coal and mineral washer, the combination with the washer chamber, the pumps having their discharge pipes connected with the supply pipes of the washer, of the stand pipe attached to and communicating with the said supply pipes, substantially as and for the purposes set forth.

8. In a fine mineral washer or settler, the combination with the tank having the discharge pipe extending upwardly within the same, of the flat deflecting plate supported above the pipe over which the water and sludge are compelled to flow outwardly, and then inwardly below the plate toward the discharge pipe, whereby some of the impurities are thrown off by their momentum as the current is deflected around the edges of the plate and the rest deposited as the current flows inward to the discharge pipe, and means for automatically maintaining the water level in the tank normally above the deflecting plate, substantially as described.

9. The combination with the casing forming the supply tank, *s*, of the discharge pipe, *r*, projecting upwardly within said tank and forming an annular settling space for impurities, the flat deflecting plate above said discharge pipe, over which plate the water and sludge are compelled to pass outwardly to the edge and then inwardly toward the discharge pipe, whereby some of the impurities are thrown off by their momentum as they round the edges of the plate and the rest are deposited as the current flows inward to the discharge pipe, and a valved outlet at the bottom of the tank for removing the impurities, substantially as described.

10. In a coal and mineral washer, the combination with the washer chamber provided with suitable supply and discharge chutes, and pumping mechanism for supplying water to said chamber, of a tank located under the discharge chute of said washer into which the water and fine mineral from said washer are centrally discharged, a fresh water supply pipe provided with a float valve at the water level in said tank, a discharge pipe projecting centrally within said tank and connected to the pumping mechanism, substantially as described.

11. The combination in a fine mineral washer or settler, of the tank, the central discharge pipe extending upwardly therein, the deflecting plate supported above said discharge pipe over which plate the water and sludge are compelled to pass outwardly to the edge thereof and flow inwardly below the same to the discharge pipe, whereby the heavier ingredients are thrown off by momentum as they round the edges of the plate, a fresh water pipe opening into the tank above the plate and provided with an automatically operated valve to maintain the water level normally above the plate, and a valved outlet at the bottom of the tank, substantially as and for the purpose set forth.

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

ERSKINE RAMSAY.

Witnesses:
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D. M. B. HASSLER.