

(No Model.)

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SEPARATOR AND CONCENTRATOR.

No. 603,319.

Patented May 3, 1898.

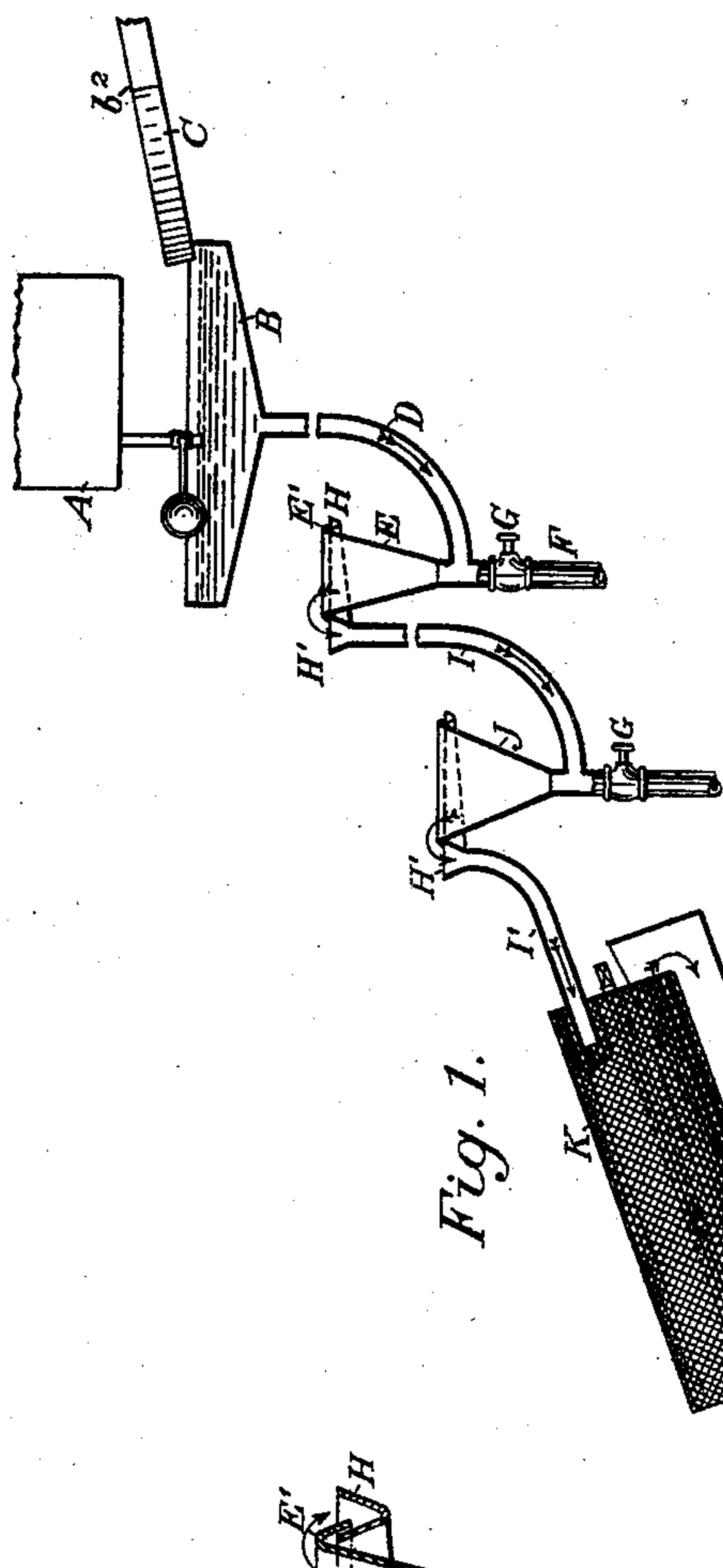


Fig. 1.

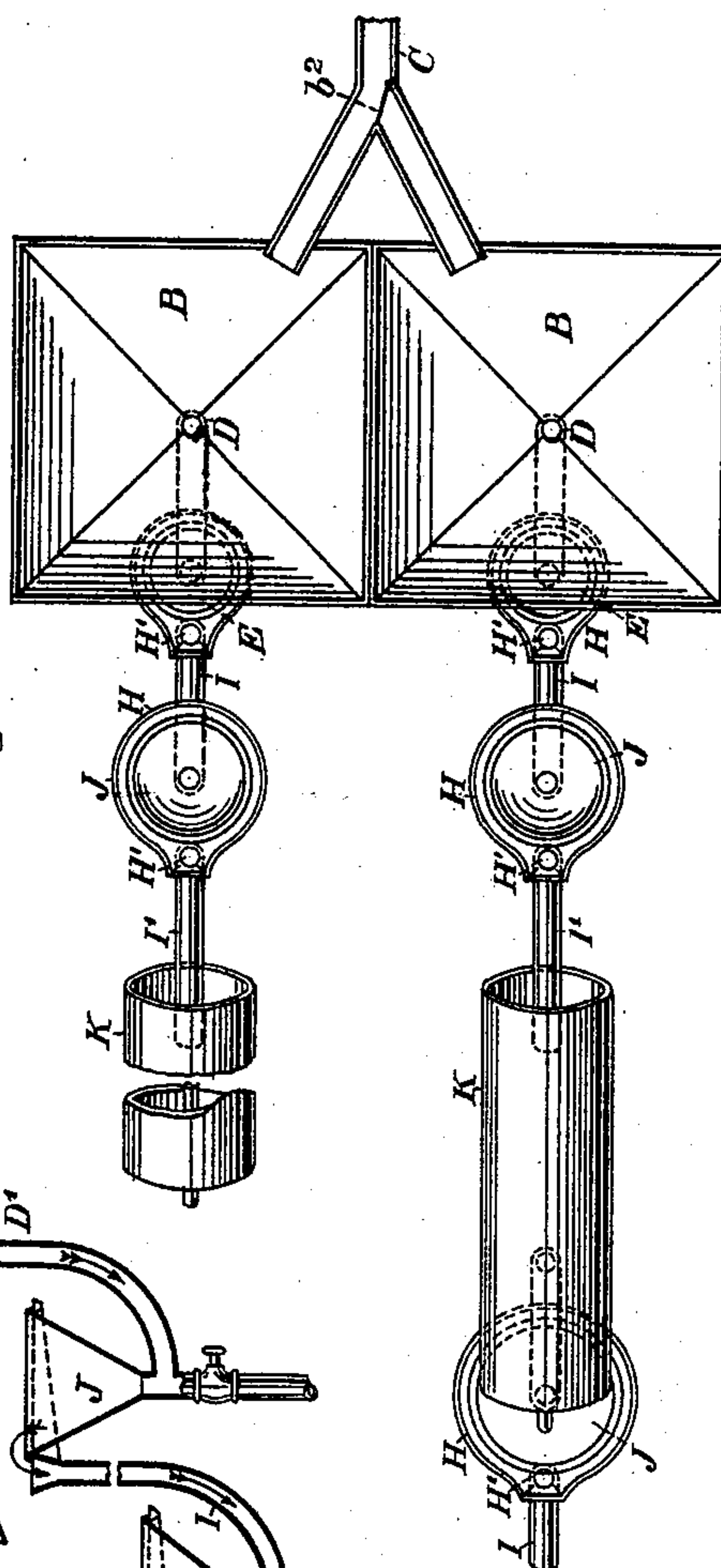


Fig. 2.

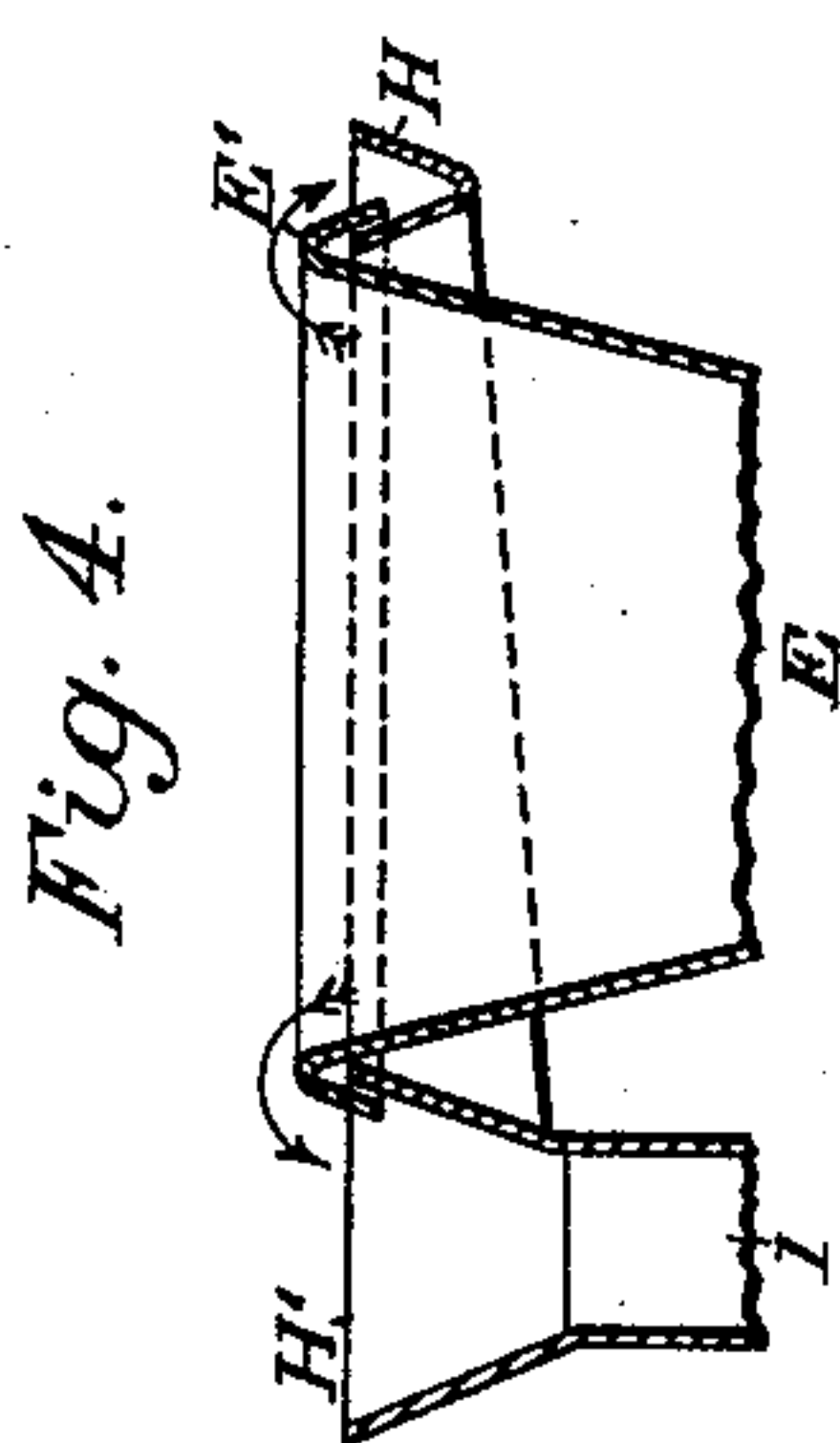


Fig. 4.

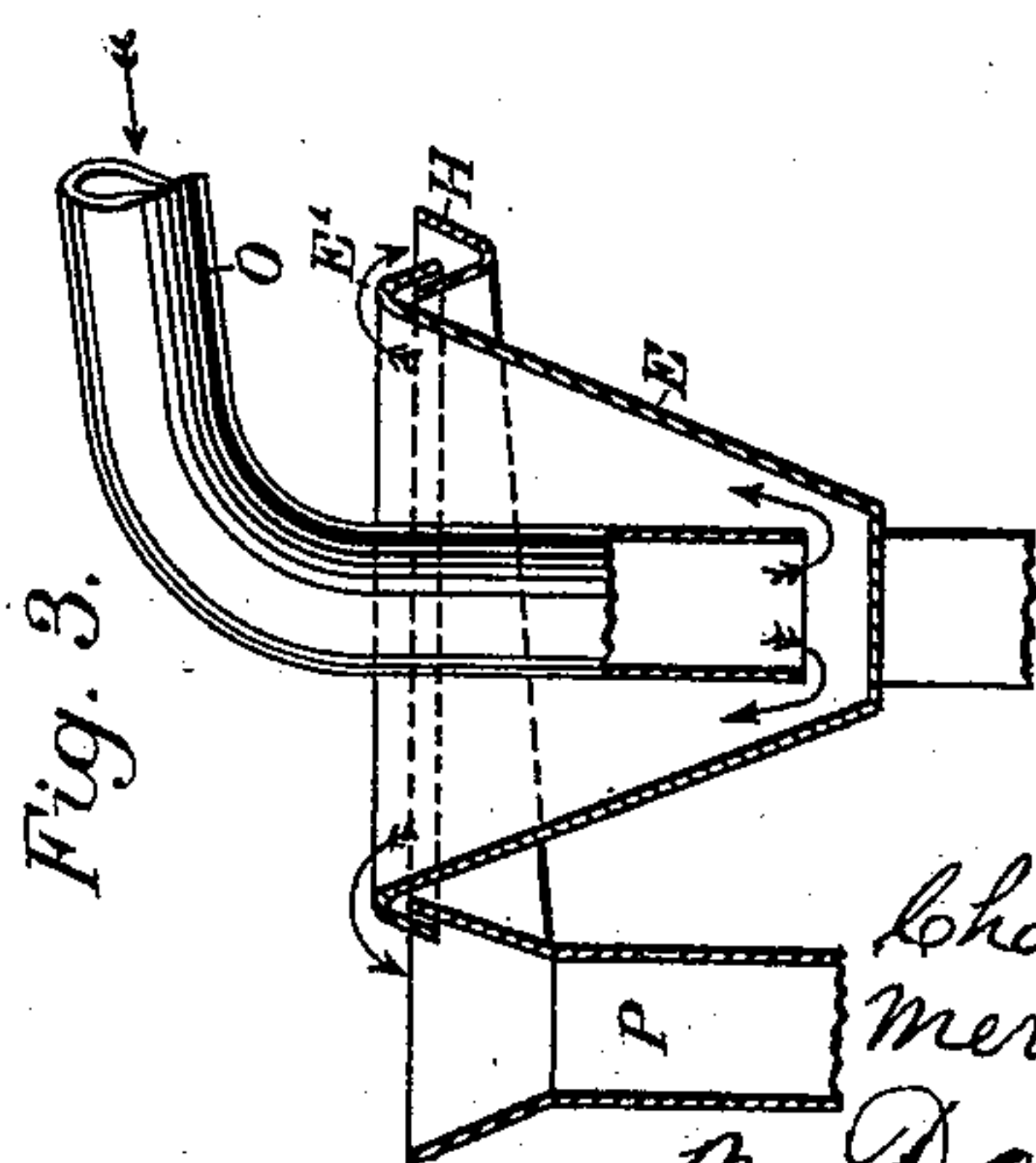


Fig. 3.

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## SEPARATOR AND CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 603,319, dated May 3, 1898.

Application filed June 4, 1897. Serial No. 639,436. (No model.)

*To all whom it may concern:*

Be it known that we, CHARLES E. CROWELL, residing at Stella, county of Shasta, and MERRITT F. GALE, residing in the city and county of San Francisco, State of California, citizens of the United States, have invented an Improvement in Separators and Concentrators; and we hereby declare the following to be a full, clear, and exact description of the same.

Our invention relates to improvements in that class of machines known as "ore washers" or "separators" for separating granular substances and minerals of different specific gravity by agitating them in a current of water while inclosed in a suitable receptacle; and the objects of our invention are to produce a simple, inexpensive, and easily-operated machine of this class. We accomplish these objects by means of the hereinafter-described apparatus by which the pulped or crushed ore can be perfectly separated and classified to any desired fineness.

In the accompanying drawings, Figure 1 is a side elevation and partial section. Fig. 2 is a plan and partial section. Fig. 3 is a modification. Fig. 4 is an enlarged section.

Our machine consists in the combination of a plurality of concentrators of similar construction, which may be used together or separately, as may be desired.

We will describe the single apparatus only, as such description will also suffice for the duplicate one.

A is the tank, provided with a ball-cock-controlled outlet-passage.

B B are receivers of any suitable size and description placed beneath the tank A, so that the water therefrom will flow into them and operate the ball-cocks, which control the supply of each. These receivers have pipes D leading from the bottom of each into the lower and smaller ends of converging hoppers E.

C is a sluice or passage through which the pulp is supplied to the receivers B B, and it is divided into branches C' C' with a hinged gate, turnable, so that the flow of the material into the receivers can be alternated to allow one set of the apparatus to be cleaned up while the other is in operation.

The cone-shaped hoppers E have down-

wardly-inclined lips or flanges E' around the upper periphery to discharge the overflow outwardly and away from the sides into surrounding inclined troughs H. The apex of each cone has connected with it a discharge-pipe F. The pipe D connects with the pipe F just below the apex of the hopper E or so as to discharge upwardly into the hopper. At a convenient distance below this connection the stop-cock G is placed in the discharge-pipe F.

Fitting around the top of the hopper E and underneath the lip E', so that the overflow from the hopper will pour into it, is the annular trough H, having a projection H', from the bottom of which extends the curved pipe I, which connects with another hopper or receptacle J, similar in all respects to the vessel E, except that its surface area is larger. The hopper J is also provided with an annular trough similar to the trough H and having a curved pipe similar to the pipe I, and so on in series as many as may be suitable or proper for the material to be worked, the upper surface of each hopper being on a level lower than its preceding one, so that there may be a regular fall between each member of the series and each member having a greater surface area than the one next above it. Between any two, preferably the last and last but one, of such series of hoppers or receptacles we place the rotary screen K, into which the pipe I', extending from the annular trough H', is projected at the upper end, the lower end being provided with a sluiceway M, extending over the last one of the series of hoppers into the waste-sluice of the apparatus. The rotary screen revolves in a casing K', at the lower end of which the bent pipe D' connects with the next lower hopper in the series, as before described with regard to the bent pipe D. From the annular trough, which is fitted to the last and lowest of the series of conical hoppers, instead of the bent pipe D, there projects the waste-sluiceway N, through which the slimes and tailings of the machine are discharged.

In lieu of the mixture of pulp and water being introduced into the conical hoppers from below it may be admitted from above by means of a pipe O, extending down cen-



trally inside of and to within a short distance of the bottom of the hopper and supported so that the discharge flows upwardly with expanding and decreasing force until it overflows at the top of the hopper, as before described. When this method is adopted, the projection II' from the annular trough H is extended horizontally until it reaches over the center of the next lower hopper, when it is connected with the pipe P, as stated, and so on through the series.

The method in which our improved separator and concentrator operates is as follows: When the material passing through the bent pipe D reaches the bottom of the first hopper, the heavier portion of it is retained there and the lighter portion is carried by the upward flow of the water with a gradually-decreasing speed to allow the heavier particles to settle, while the lighter portions flow over the lip of the hopper and into the surrounding annular trough, whence it passes along the connecting-passage into the next pipe, and so on through the series of hoppers, leaving in each a deposit of gradually-increasing fineness, which may be withdrawn by opening its appropriate stop-cock.

The object of increasing the surface area of the hoppers is to reduce the force of the flow of the water proportionately as the material becomes less coarse in consequence of the heavier portion having been left behind in the preceding hoppers.

When it is desired to have a direct vertical delivery of water into any of the hoppers, the pipe O or P may be used. By this means the force of the water is reduced, and it is adapted to treating the finer grades of pulp containing a lower percentage of slimes.

The rotary screens may be operated by any of the ordinary means used for similar purposes, and we have found them of great benefit in conjunction with the series of hoppers in saving the extremely-fine gold which would otherwise be carried with the tailings into the waste-slucie and lost.

Having thus described our invention, what

we claim as new, and desire to secure by Letters Patent, is—

An improved apparatus for separating and concentrating heavy valuable materials from lighter slimes, consisting of one or more series of hoppers situated one below the other so that the discharge from the uppermost will be delivered successively into the bottom of the next succeeding hopper, said hoppers being of gradually-increasing diameter and having upwardly-diverging sides, inclined overflow-directing lips surrounding the upper parts of the hoppers, annular troughs surrounding the hoppers into which the overflow-discharge is received and pipes connecting said troughs successively with the bottoms of the next succeeding hoppers whereby an upward flow at a gradually-decreasing rate takes place in each of the hoppers, inclined cylindrical rotary screens journaled intermediate between one or more of each series of hoppers adapted to receive the overflow from the next preceding hopper and deliver it into the following one, casings in which the screens rotate, having pipes leading therefrom to the next succeeding hopper, final discharge sluices, and preliminary water and pulp receivers with means for automatically regulating the water-supply, a pipe extending to said receiver with diverging branches leading to the two series of hoppers, and a gate at the junction of the branches whereby the supply is diverted alternately from one to the other series whenever the material collected in the discharge-pipe of the hoppers is to be removed.

In witness whereof we have hereto set our hands.

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