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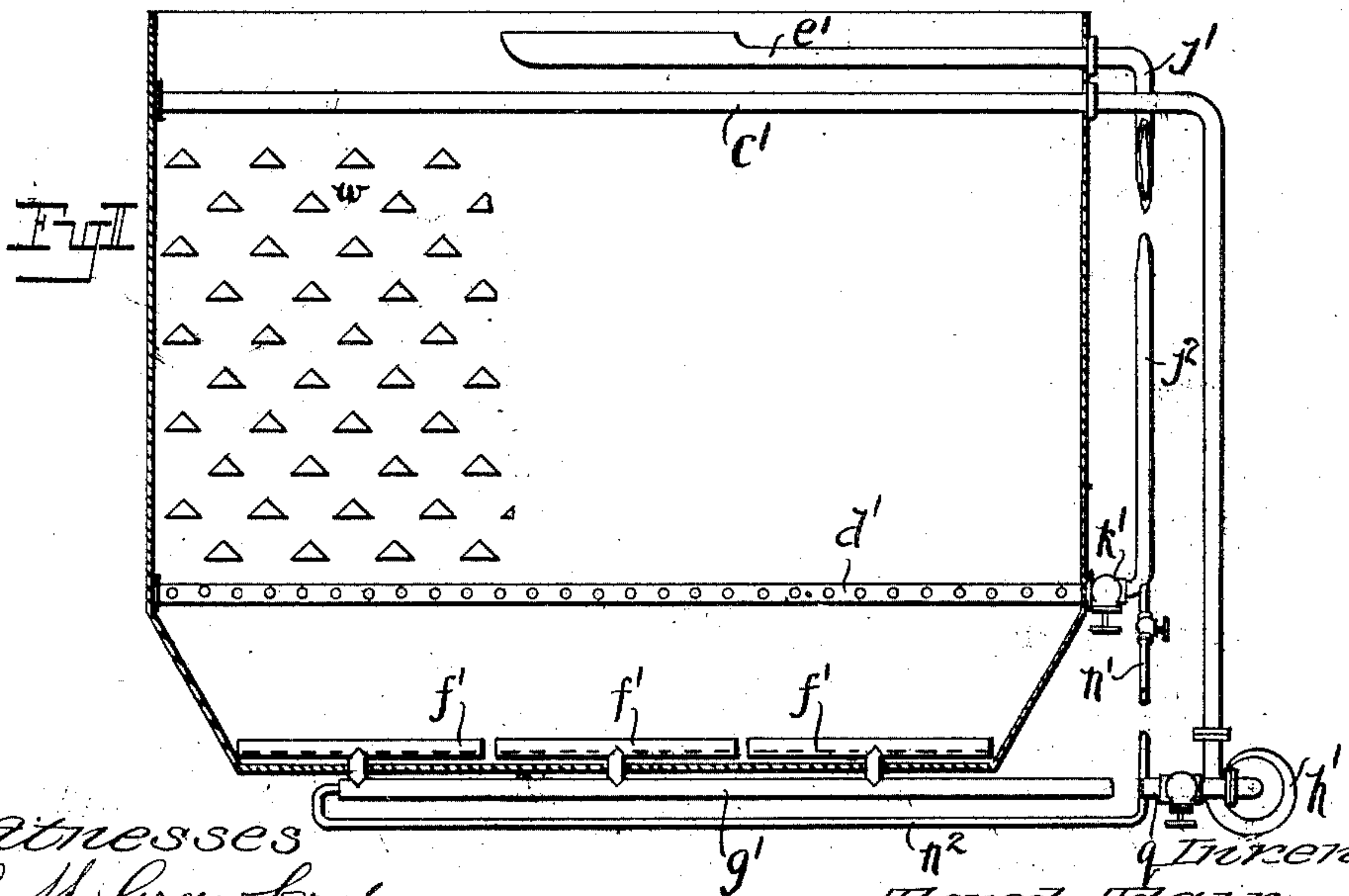
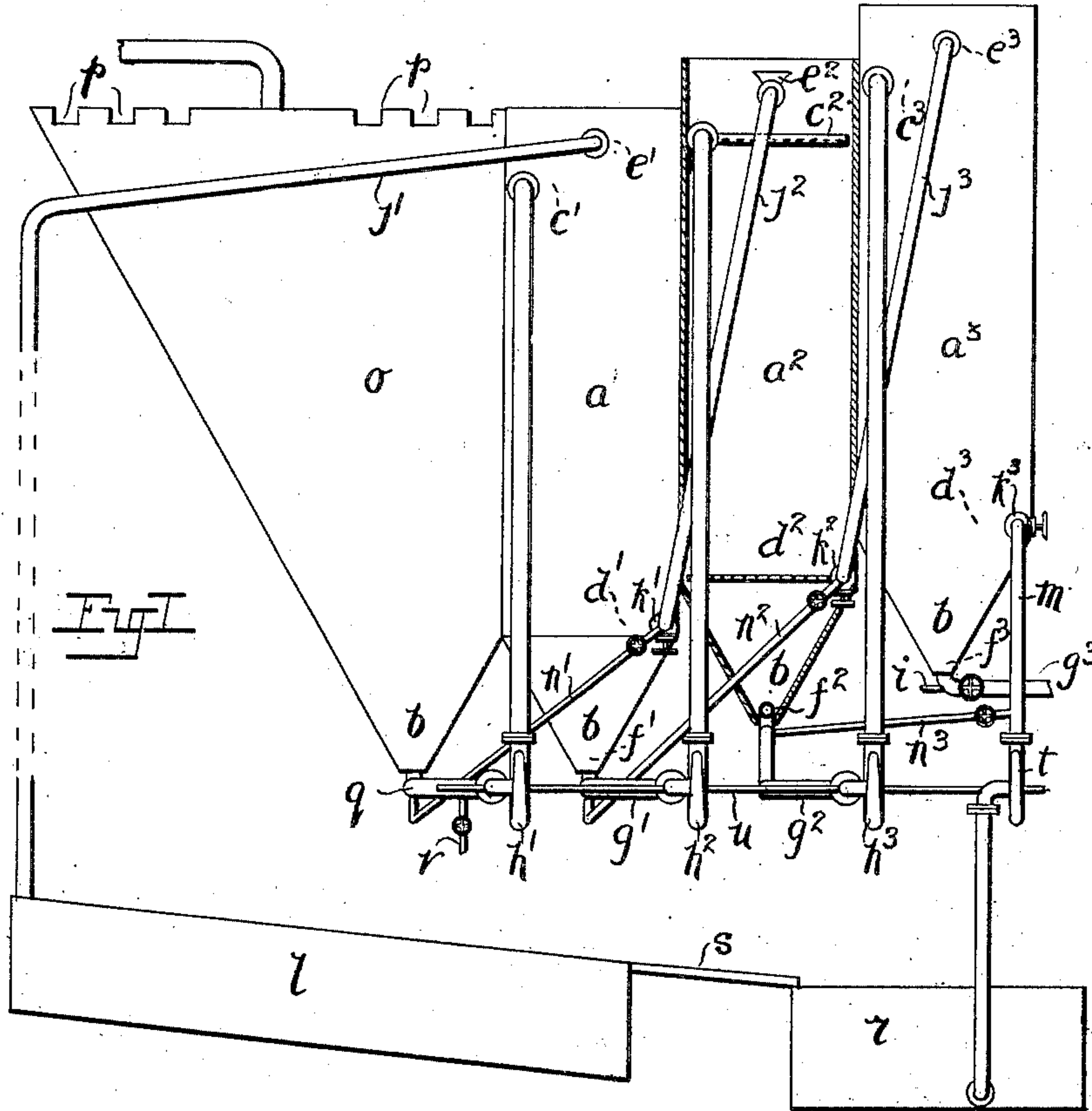
PATENTED JULY 28, 1908.

A. ADAIR.

TREATING COMMINUTED SOLIDS WITH LIQUIDS.

APPLICATION FILED JULY 5, 1907.

2 SHEETS—SHEET 1.



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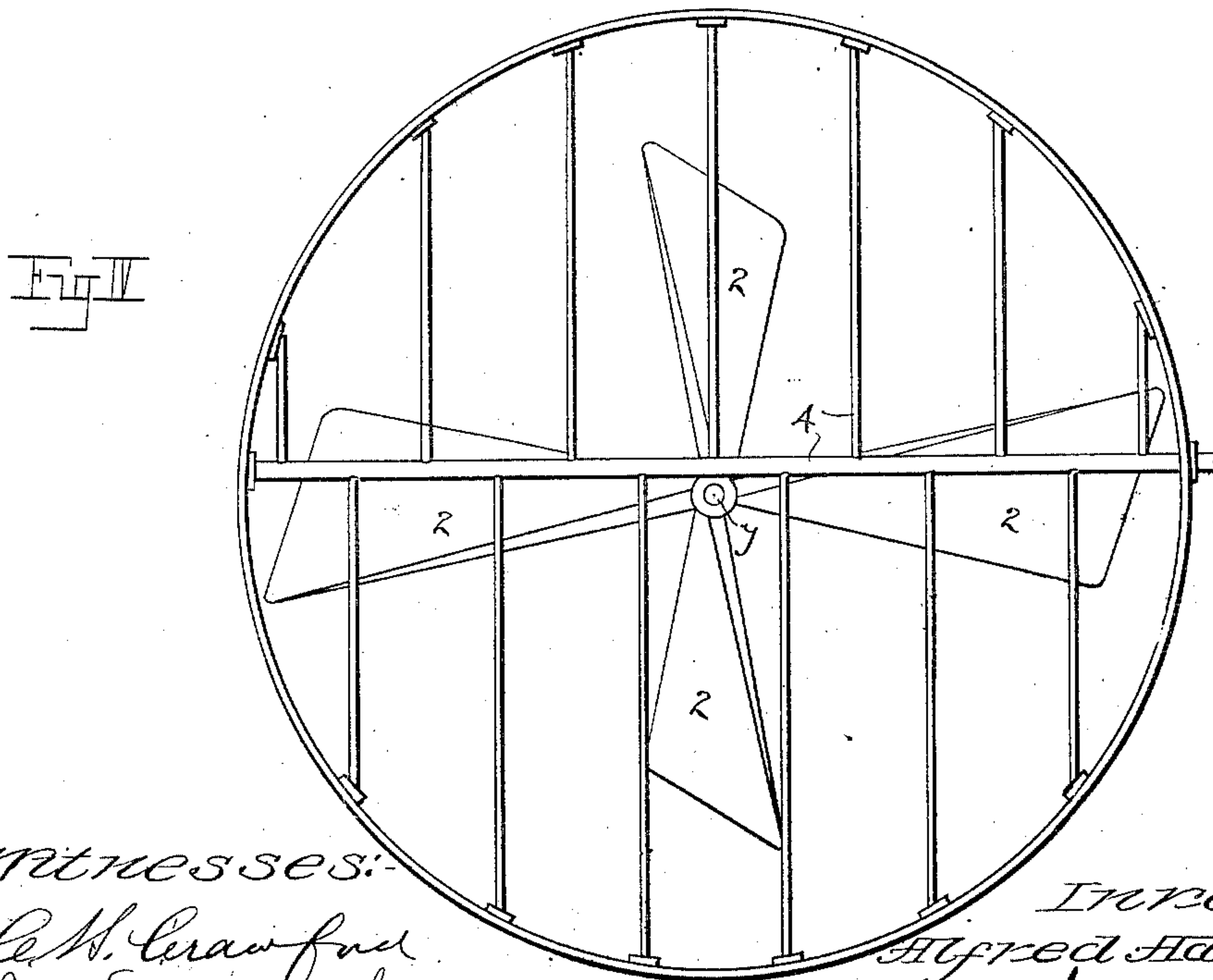
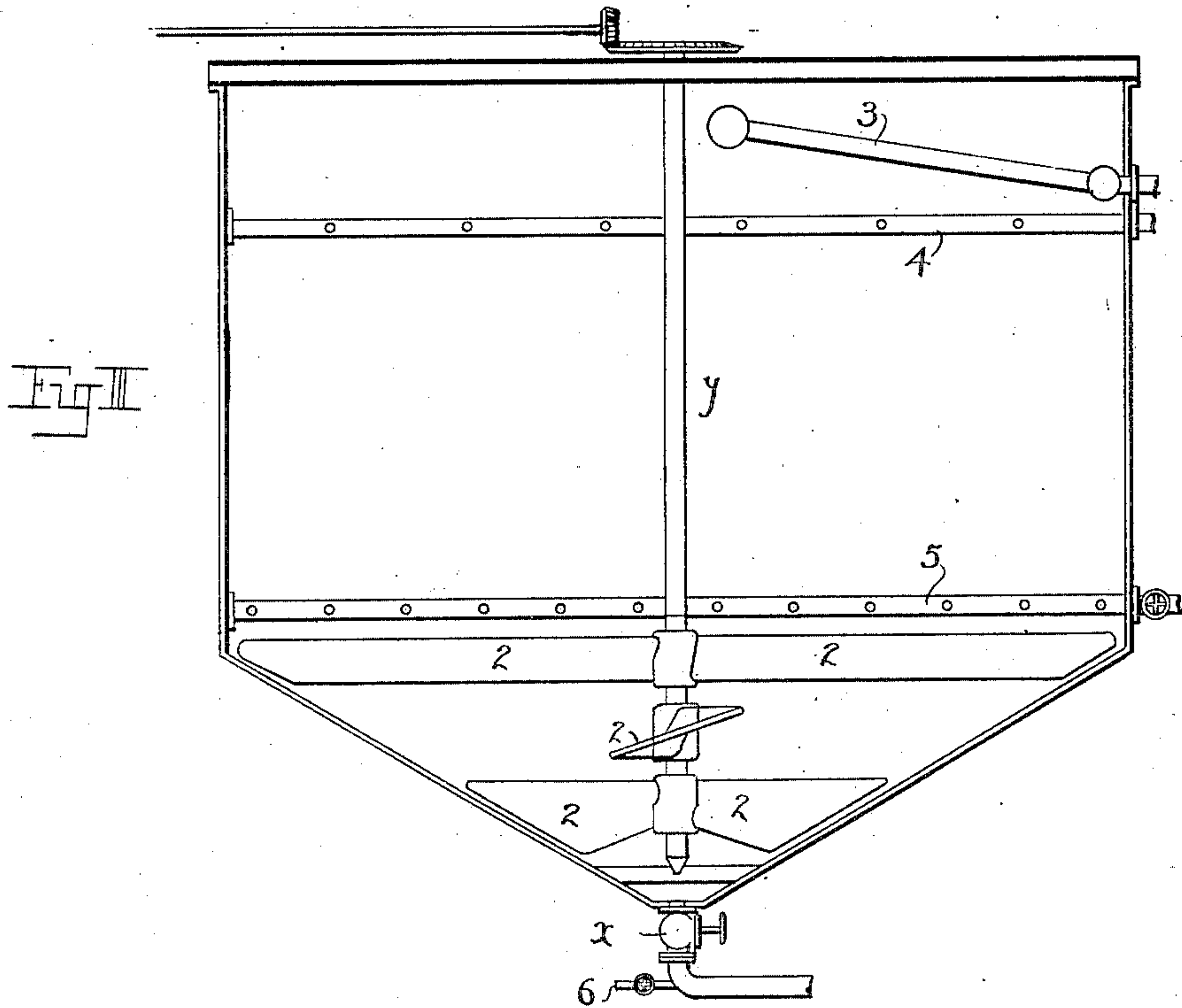
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

ALFRED ADAIR, OF JOHANNESBURG, TRANSVAAL.

TREATING COMMINUTED SOLIDS WITH LIQUIDS.

No. 894,417.

Specification of Letters Patent.

Patented July 28, 1908.

Application filed July 5, 1907. Serial No. 382,346.

To all whom it may concern:

Be it known that I, ALFRED ADAIR, a subject of the King of Great Britain, residing at 16A Overbeek street, Troyeville, Johannesburg, in the Colony of the Transvaal, have invented certain new and useful Improvements in Treating Comminuted Solids with Liquids, of which the following is a specification.

10 The present invention relates to the treatment with liquids of comminuted solid matter; as for example the treatment of fine auriferous sands and slimes by cyanid, for the purpose of dissolving the metallic constituents of the former; the treatment of other
15 comminuted metalliferous ores and products, by solvents, or the treatment of muds containing valuable salts, or the washing of ores, muds or chemical precipitates.

20 The purpose in view is to provide a process capable of continuous operation wherein the treatment is more efficient and rapid than heretofore and wherein the volume of liquid requisite for thorough treatment is minimized, so that in the case of solvents or washes
25 they are relatively more enriched in respect of their valuable contents.

According to the present process the comminuted solid is delivered as a thick pulp
30 into the upper regions of a body of liquid and is caused to gravitate downwardly through the same and re-collect as a thick pulp at the bottom of the liquid; while an upward current usually of low velocity is set up through
35 the liquid. The rate of flow and the manner of distributing the pulp and liquid respectively are such that clear liquid collects at the surface of the body of liquid and may be continuously withdrawn therefrom. The
40 treatment is usually carried out in a series of stages; the thickened pulp collected at the termination of the first stage being re-delivered to a second body of liquid through which it gravitates in the second stage of the process and so on. Furthermore, the stages are
45 coördinated in such manner that as the liquid passes through the several steps of the process from the last to the first it meets successively richer or less completely treated portions of the solid matter; in other words
50 the fresh liquid operates upon the most impoverished or fully treated solid, while the liquid about to be withdrawn is finally enriched by contact with the freshest and
55 therefore most amenable solids. A further feature of the invention is the agitation of

the pulp between each stage with liquid and its conveyance to the next stage thereby.

In the accompanying drawings is shown suitable apparatus for treating auriferous
60 fine sands or slimes with cyanid in accordance with the spirit of this invention: Figure I being a conventional elevation of the plant, the interior of one of the treatment vats being shown; and Fig. II a section at right angles
65 to the plane of Fig. I through the first of the treatment vats. Figs. III and IV illustrate an ordinary vat adapted for the purposes of the invention, the former being a sectional side view and the latter a plan. 70

Referring to Figs. I and II, there is included in the apparatus, a series of identical treatment vats a^1, a^2, a^3 , arranged one somewhat higher than the other from the first a^1
75 to the last a^3 . Each vat is preferably constructed with a pointed bottom b in order to facilitate the settlement and concentration of the slimes therein. The several vats are also provided with upper distributors c^1, c^2, c^3 for
80 slimes and lower distributors d^1, d^2, d^3 for solution, said distributors being adapted to distribute their feed uniformly over the whole area of each vat. Each vat is further provided with a decanting pipe, e^1, e^2, e^3 for
85 drawing off clear liquid at the surface.

f^1, f^2, f^3 indicate series of pulp collectors arranged in the pointed bottoms, each such series leading to a common eduction pipe, which latter are indicated by g^1, g^2 , and g^3 .

Pulp is supplied to the upper distributors
90 by pumps h^1, h^2 , and h^3 , each of said pumps except the first h^1 , drawing its supplies from the eduction pipe of the preceding vat. The eduction pipe g^3 of the last vat a^3 discharges to waste, the movement of the pulp being
95 assisted by a jet of water supplied through pipe i . Pump h^1 draws its supply from the settling tank hereafter mentioned.

Liquid passes from the decanters by the pipes j^1, j^2, j^3 . Of these j^2 and j^3 are connected respectively to the valves k^1 and k^2
100 controlling the feed to the lower distributors of the vats a^1 and a^2 . Pipe j^1 passes liquid to the precipitation boxes l ; while liquid is supplied to the last vat a^3 through valve k^3 and
105 the pipe m .

In order to assist movement of the slimes in the eduction pipes g^1, g^2 , and g^3 to the slimes pumps, liquid is supplied to such eduction pipes by small valve controlled pipes n^1, n^2 , and n^3 . The liquid is in each case drawn
110 from the feed to the vat to which the pulp

with which the liquid is mixed is about to be passed; for instance pipe n^3 conducts liquid from pipe m to eduction pipe g^2 from which pulp passes to vat a^3 and similarly pipe n^2 leads to eduction pipe g^1 .

o is a settling tank having notches p for conducting superfluous water to waste. Such settling tank is constructed with a pointed bottom, and, like the treatment vats, is provided with a slimes collector, and an eduction pipe g . As already mentioned the pump h^1 draws from said eduction pipe g , to which moreover pipe n^1 is arranged to pass liquid.

r is a sump to which impoverished solution is conducted from the precipitation boxes l by launder s , and t indicates a pump for passing solution from sump r to vat a^3 by way of the pipe m and valve k^3 already referred to. The several pumps h^1 , h^2 , h^3 , and t are shown as being driven off a single shaft u .

Although for the sake of convenience only three treatment vats are illustrated and described, it is to be understood that in practice their number may be varied as may appear desirable.

The plant described is operated in the following manner. The vats being preliminarily filled with solution, the slimes from the reduction plant, hydraulic classifiers or otherwise, are run continuously into the settling tank o , where the solid constituent settles and concentrates at the bottom, while the separated water runs off by way of the notches p . The settled slimes are now withdrawn by the pump h^1 , delivered to the upper distributor of vat a^1 and thereby caused to diffuse and gravitate through the mass of liquid therein. Settling at the bottom as a thick pulp comparatively free from solvent, the slimes are withdrawn from vat a^1 by the pump h^2 and delivered to the upper distributor of the vat a^2 ; and so on through the series, until they are discharged to waste through the pipe g^3 . Meanwhile fresh liquid is continuously supplied by the pump t to the lower distributor d^3 of the vat a^3 and rising up through the gravitating slimes collects in a clear state at the surface of the vat contents. A relatively smaller volume of fresh solvent is also passed by pump t through the pipe n^3 to the thick slimes which are about to be pumped to vat a^3 . The purpose of this is to thin such slimes sufficiently to enable them to be readily pumped, while avoiding the withdrawal with them of an undue quantity of gold-containing solution. A further purpose is to effect a thorough agitation of the slimes with solvent, between the stages, with the object of facilitating the extraction of the gold therefrom. The clear liquid collected in vat a^3 is withdrawn through the decanter e^3 and pipe j^3 , and the bulk of it is fed to the distributor d^2 of the preceding vat a^2 , wherein it rises and re-collects at the surface as clear liquid. The portion which is not fed to dis-

tributer d^2 is led on by pipe n^2 to the eduction pipe g^1 . Passing thus through the whole of the treatment vats the liquid is at last withdrawn by pipe j^1 and conducted to the extractor boxes l for the removal of its gold contents, being subsequently returned to the sump r to make the circuit again.

v is a feed pipe through which fresh cyanid may be introduced as required to replace that finally carried away with the discharged slimes or otherwise lost, the advantage of introducing it at such point being that a certain proportion of it is carried over with the enriched solution to the precipitation boxes and assists the operation of precipitation.

Where it is desirable to retard the motion of the solids in the liquid, as for example where sands are being treated, baffles w such as are shown on the left of Fig. II may be fitted in the vats, such baffles being preferably pointed at the top, to prevent accumulation of the solid matter upon them.

In applying the invention to existing cyanid treatment vats, of the usual circular type, as the vat floors are usually flat or insufficiently sloped to permit the ready discharge of the slimes collected at the bottom, means are provided as shown in Figs. III and IV to loosen the settled pulp from the bottom and pass it from the periphery to the center, where the outlet valve x is situated. Such means, as illustrated, consist in a central vertical shaft y revoluble by the spur wheels z and the driven shaft 1. Said shaft y carries propeller blades 2 shaped to fit closely to the bottom of the vat and so directed as to pass the pulp inwards and downwards. The other fittings of the vat are similar to those already described; 3 being the decantation pipe, 4 the upper and 5 the lower distributor and 6 the pipe for supplying fluid to the thick pulp.

It is important in carrying out the process in the most efficient manner to concentrate the slimes as much as possible at the termination of each stage in order that as little as possible of the treatment liquid may be carried back against the main flow between each stage. It will be seen that the liquid finally discharged with the impoverished slimes consists of substantially pure cyanid carrying an inappreciable amount of gold and therefore as a rule no final washing is required. Where desirable however a final wash of water or other liquid may be given in apparatus similar to the treatment vats already described, for the purpose of recovering the treatment liquid discharged with the residues.

It is evident that instead of arranging the vats in an ascending series as described, they may be arranged to descend, the solution being pumped and the pulp moving by gravity: or again the vats may be leveled and both solution and pulp may be pumped. It is how-

ever preferred to pump the pulp in order that it may be more completely agitated with solution between each stage.

It is to be understood that certain advantages of the invention may be attained by carrying out the treatment in one stage only, more particularly when the solids are readily amenable to the liquid. Thus, in such cases the process may be made continuous, the pulp after gravitating through the liquid being collected and drawn off in a concentrated condition separated to a large extent from the washing liquid, while the enriched solution may be continuously drawn off from above, free of pulp. It is evident however that the most perfect separation of valuable liquid from the pulp can be best effected by conducting the process in stages, as described, which method also enables the very desirable graduation of the freshness of the liquid in accordance with the impoverishment of the solid matter.

I claim as my invention:—

1. The process of treating comminuted solids with liquids, which consists in effecting the treatment in stages, each stage comprising the steps of distributing the solid matter as a concentrated pulp to the upper part of the body of liquid causing it to diffuse and gravitate through the same, re-collecting it as concentrated pulp below the liquid, distributing liquid in the lower part of the body of liquid so as to produce an upward current therein and collecting clear liquid at the surface; which consists further in supplying pulp collected at each stage as feed in the succeeding stage, supplying one portion of

the clear liquid collected at each stage as feed in the preceding stage and agitating the other portion of such liquid with the pulp about to be fed in such preceding stage, fresh pulp being supplied in the first stage, fresh liquid being supplied as feed in the last stage and fresh liquid being also agitated with the pulp about to be fed in the last stage.

2. A continuous process of treating comminuted solids with liquids, which consists in effecting the treatment in stages, each stage comprising the steps of distributing the solid matter as a concentrated pulp to the upper part of the body of liquid causing it to diffuse and gravitate through the same, re-collecting it as concentrated pulp below the liquid, distributing liquid in the lower part of the body of liquid so as to produce an upward current therein and collecting clear liquid at the surface; which consists further in supplying pulp collected at each stage as feed in the succeeding stage, supplying one portion of the clear liquid collected at each stage as feed in the preceding stage and agitating the other portion of such liquid with the pulp about to be fed in such preceding stage, fresh pulp being continuously supplied in the first stage, fresh liquid being continuously supplied as feed in the last stage and fresh liquid being also agitated with the pulp about to be fed in the last stage.

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

ALFRED ADAIR.

Witnesses:

ALFRED L. SPOOR,
WESLEY E. JOHN.