H. ILLIG.

APPARATUS FOR ELECTRO-OSMOSIS.

APPLICATION FILED JAN. 4, 1913.

1,174,946.

Patented Mar. 7, 1916.

2 SHEETS—SHEET 1.

Fig. 1.

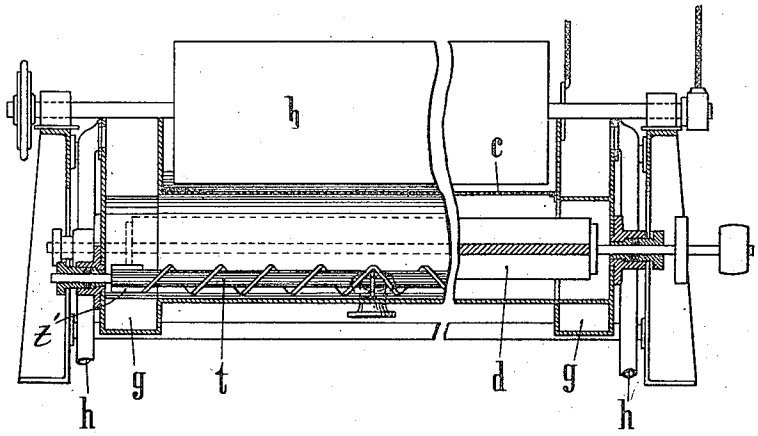
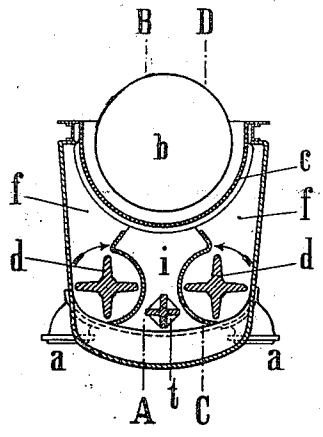


Fig. 2.



Witnesses.
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2 SHEETS—SHEET 2.

Fig. 3.

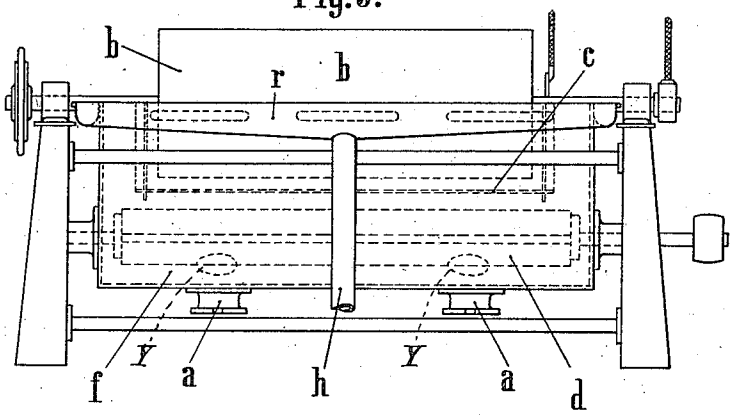


Fig. 4.

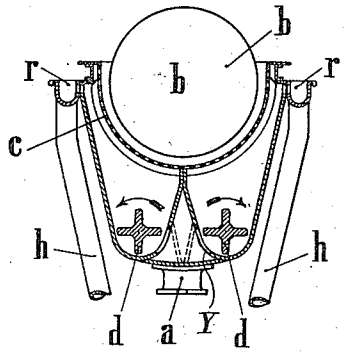
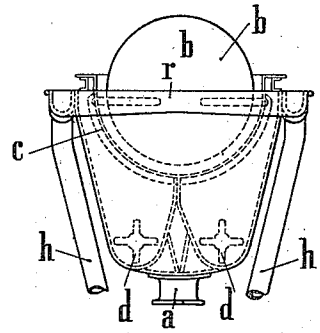


Fig. 5.



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APPARATUS FOR ELECTRO-OSMOSIS.

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To all whom it may concern:

Be it known that I, HANS ILLIG, a subject of the German Emperor, residing at Frankfort-on-the-Main, Germany, have invented certain new and useful Improvements in Apparatus for Electro-Osmosis, of which the following is a specification.

Heretofore it has been proposed to separate the finely divided particles of clay, kaolin, etc., by means of electro-osmosis in machines somewhat similar to the structures described herein. Certain of the proposed machines have had a horizontally disposed cylindrical anode adapted to rotate within a complementarily formed cathode spaced therefrom and adapted to have directed thereagainst a suitable suspension which is acted upon by a horizontally disposed vane substantially parallel to the anode which is rotated to direct the suspension to the cathode. After the suspension has reached the cathode, the particles in suspension become charged and migrate toward the cylindrical anode where they collect and are deposited and can be removed therefrom by any suitable scrapers, several of which are in use. The chamber for containing the suspension in said proposed machines comprises generally a tank with no means for preventing the mixing of fresh solution with impoverished solution and the lack of such a means unfavorably influences the operation of the machines.

The present invention aims to overcome this disadvantage by providing suitable baffle plates or walls for defining a compartment within which the impoverished suspension may be confined and from which said impoverished suspension may flow to a suitable exhaust. The streams of incoming and outgoing suspension are separated by means of these baffle plates or walls in such a way that the two streams cannot collide with each other. The electro-osmotic action takes place between the cathode and the anode and the effect of such action upon the particles in suspension is substantially the same as that described in connection with machines which have already been proposed and no claim is made in this application to the method for precipitating or otherwise collecting the finely divided particles of clay, kaolin, etc., upon the anode, this invention being restricted to the apparatus for carrying out the process.

In the drawings some examples of suitable apparatus are illustrated, Figure 1 showing a sectional elevation of one form, the left hand portion of Fig. 1 being a fragmental vertical section on line A, B of Fig. 2, while the right hand portion is a fragmental vertical section on line C, D of Fig. 2, Fig. 2 a central transverse section through Fig. 1, Fig. 3 an elevation of another form, Fig. 4 a cross section of Fig. 3 and Fig. 5 an end elevation of Fig. 3.

Referring to Figs. 1 and 2, the working space is subdivided into three chambers which are apparent in the cross section Fig. 2. Through the supply pipes *a*, *a* the suspension flows to the two chambers *f*, *f* in which shafts carrying vanes *d*, *d* rotate and drive the suspension toward the anode *b* through the perforated cathode *c*. The suspension impoverished at the anode *b* by the osmotic separation and those particles which do not settle on the anode, or are repelled by the cathode, flow away through the middle chamber *i*. While the chambers *f*, *f* are not connected with the two auxiliary chambers *g*, *g*, the chamber *i* is so connected to the said auxiliary chambers, the auxiliary chambers being also connected with the discharge pipes *h*, *h*. In order that in the middle chamber *i* there may be no settlement of separated particles and a satisfactory flow toward the auxiliary chambers may be attained, there is a shaft carrying vanes *t* in the middle chamber and this is advantageously constructed to act as a worm conveyer. The ends of the shaft *t* which extend into the auxiliary chambers *g* may carry stirrers to prevent deposition of precipitate on the bottoms of the auxiliary chambers. Fig. 1 shows a worm *t*, one end of which is right-hand, while the other end is left-hand so that as said worm is rotated the foreign matter and other deposits located in the bottom of the compartment *i* together with the impoverished suspension will be moved toward the ends of the machine so as to enter the auxiliary chambers *g*. It will be understood in the operation of this device that materials collect in the bottom of the compartment *i* and the purpose of making the bottom of the auxiliary

compartments *g* below the bottom of the principal part of the machine is that these deposits of foreign matter, etc., will drop to the bottom of the chambers *g* and thus be out of a position where they might interfere with the worm *t*.

In Figs. 3 to 5, the auxiliary chambers are omitted and the object of the invention is achieved by introducing the suspension to be supplied to the machine from below, while the discharge is from the upper part of the vat along the sides and the ends, at which there are discharge gutters or the like. The fresh suspension flowing in at *a* is engaged by the vanes *d*, *d* and propelled through the cathode *c* toward the anode *b*. At the sides and ends of the vat are discharge gutters *r* into which the impoverished suspension and the impurities separated by the cathode, flow. They are discharged through the pipes *h*, *h*. When two vanes are used the vat is preferably divided by a longitudinal partition, whereby the desired direction of flow of liquid is provided.

Openings *m* may be employed to allow the suspension to pass from the supply *a* to the compartments containing the vanes *d*.

Having thus described the invention, what is claimed is:

1. An apparatus for electro-osmosis comprising a horizontally disposed cylindrical anode, a parti-cylindrical cathode adjacent thereto, a housing upon which said anode and cathode are mounted, vanes rotatably mounted within the housing and having the axes thereof substantially parallel to the axis of the anode, and an auxiliary chamber located on one end of the housing communicating with the first named housing, said vanes being located below the cathode and projecting into the auxiliary chamber.

2. An apparatus for electro-osmosis containing electrodes situated opposite one to another, two inner chambers, through which the suspension is supplied, means defining an auxiliary chamber, into which the suspension is conducted away and a chamber situated between the said inner chambers and conducting the suspension from the inner chambers to the auxiliary chamber.

3. An apparatus for electro-osmosis containing electrodes situated opposite one to another, two inner chambers, through which the suspension is supplied, and means defining an auxiliary chamber into which the suspension is conducted away, a chamber situated between the said inner chambers serving to conduct the suspension from the inner chambers to the auxiliary chamber and a shaft carrying vanes in the middle chamber adapted to convey the suspension toward the auxiliary chamber device.

4. An apparatus for electro-osmosis comprising a housing, a horizontally disposed cylindrical anode rotatably mounted upon the housing, a parti-cylindrical cathode spaced from the anode and secured to the housing below said anode, rotatably mounted vanes, the axis of each of which extends substantially parallel to the axis of the anode, said vanes being below the cathode, and an auxiliary chamber located at one end of the housing, the vanes extending into said auxiliary chamber.

5. An apparatus for electro-osmosis comprising a housing, a horizontally disposed cylindrical anode rotatably mounted upon the housing, a parti-cylindrical cathode secured to the housing and spaced from the anode, vanes rotatably mounted in the bottom of the housing below the cathode and anode having the axes thereof substantially parallel to the axis of the anode, an auxiliary chamber at one end of the housing communicating with said housing and having the bottom thereof lower than the bottom of the housing, the vanes extending into the auxiliary chamber.

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

HANS ILLIG.

Witnesses:
JEAN GRUND,
CARL GRUND.