

Jan. 20, 1931.

T. KÄLLE

1,789,386

PROCESS AND APPARATUS FOR AUTOMATICALLY REGULATING OR INDICATING  
THE CONCENTRATION OF MATERIALS SUSPENDED IN LIQUIDS

Filed March 1, 1929

*Fig. 1.*

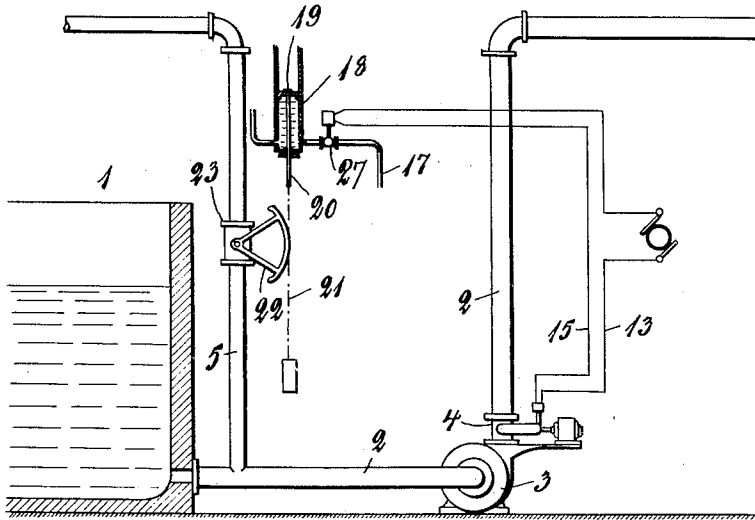
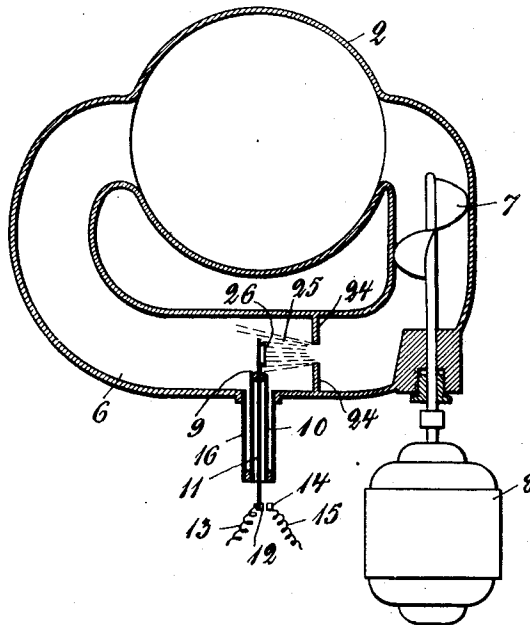


*Fig. 2.*



J. Kalle  
INVENTOR

By: Marks & Clark  
ATTYS.

## UNITED STATES PATENT OFFICE

TORSTEN KÄLLE, OF SAFFLE, SWEDEN

## PROCESS AND APPARATUS FOR AUTOMATICALLY REGULATING OR INDICATING THE CONCENTRATION OF MATERIALS SUSPENDED IN LIQUIDS

Application filed March 1, 1929, Serial No. 343,810, and in Sweden March 3, 1928.

In the devices hitherto known for regulating the concentration of wet cellulosic material for example, either a test portion or the entire mass has been taken out and caused to act upon an impulse member. This withdrawal must be effected at the end of the pipe through which the material is delivered, because the pressure in the preceding portions of the pipe and in the neighbourhood of the pumping apparatus that causes the material to travel along the pipe is so high that if an outlet aperture for the removal of a test portion were to be provided there it would be liable to be choked owing to the accumulation of material.

Under such circumstances also the water of dilution has been supplied on the delivery side of the pump, as a result of which, however, a sufficiently homogeneous mixture has not been obtainable. Since, however, the pump that pumps the material is an exceedingly effective mixing device for water and cellulosic material, attempts have been made to introduce the water of dilution on the suction side of the pump and to take samples directly upon the delivery side. This, however, has not hitherto been successful, on account of the fact that the distance between the point of supply for the water of dilution and the impulse member is too great to enable regulation to be effected in a sufficiently rapid manner and without oscillation.

The present invention relates to a process and a device for regulating or indicating the concentration of liquids with suspended material. It is intended to enable the water of dilution to be introduced directly upon the suction side of the pump or the like and impulses to be taken out directly after the pump on the delivery side thereof, and independently of how high and how far the material is then being transported by the pump.

The invention is based upon the following principle, wet paper pulp being assumed as an example. If a pipe is branched off from the pulp pipe on the pressure side of the pump and a portion of the pulp is conveyed by this pipe under the action of a propeller or other suitable member which may impart to the pulp a uniform motion through the

branch pipe and also a rotary motion in the pipe, it will be found that according as the concentration of the pulp is less or greater, and the friction produced thereby is correspondingly less or greater, the rotary movement of the pulp is more or less energetic and protracted. The higher the concentration, the more rapidly does the rotary movement of the pulp diminish, and conversely the smaller the concentration of the pulp the more energetic does the rotary movement become and the longer does the pulp continue its rotary movement during its passage through the branch tube. The relationship is the same if the pump is employed for the feeding, and in the main pipe, on the delivery side of the pump, a member such as a screw thread is inserted, which can impart to the pulp an energetic rotary movement.

The higher the concentration of the material delivered through the branch pipe, the higher will also be the impulsive force of the material upon an impulse member or checking member introduced into the branch pipe. Upon these conditions is based the possibility according to the present invention of regulating the concentration. If the concentration of the material is so low that the difference between the impulsive effects within a certain range of concentration is too small to produce a sufficiently great deflection of the impulse member, the energetic rotary movement occurring at the said concentration can be utilized in the case of the present regulating device. This can be done by effecting, in front of the impulse member, a throttling of the branch pipe so that through the throttled passage a conical jet of the material is passed. The structure of this jet is then dependent upon the velocity of rotation and accordingly upon the concentration of the material in such a manner that the greater the speed of rotation the more does the jet spread out and the smaller is the portion of the jet which strikes against the impulse member and conversely, the lower the speed of rotation, the more the jet becomes concentrated in passing the constriction and the greater will be the portion thereof which strikes against the impulse member, and con-

sequently the greater will be the force acting upon the impulse member. The placing of the impulse member and that of the constricting device in relation to the position of the screw propeller or the like must be capable of being regulated according to the various ranges of concentration of the material.

Some constructional forms of a device according to the invention are illustrated in the accompanying drawings wherein

Figures 1 and 2 show one constructional form. Fig. 1 showing the general arrangement and method of working of the device, while Fig. 2 shows on a larger scale a cross section through the impulse device.

In Fig. 1, 1 denotes a tank for the material of varying concentration, 2 an outlet pipe therefrom, 3 a centrifugal pump inserted in the pipe 2, and 4 the impulse device, which, as will be seen, is inserted directly upon the delivery side of the pump. The pipe 2 is continued on the other side of the pump to the point where the material is used, a paper machine for example, at which the material is to have a constant concentration. 5 denotes a pipe for water of dilution which enters on the suction side of the pump 3.

According to Fig. 2, a branch pipe 6 leaves the pipe 2, and in the pipe 6, near the inlet end, is arranged a screw propeller 7, which is driven by an electric motor 8. A rather small quantity of material passing through the pipe line 2 is accordingly set in motion by the propeller and constrained to pass through the branch pipe 6. It is then returned into the pipe 2. Under these circumstances the material is moved past an impulse member 9, which according to Fig. 2, consists of a resilient tube 10, in which is arranged a metallic rod 11, which projects a little way out of the tube 10 at the end of the pipe 6 that opens into the said tube, while its opposite end also projects out a little way, and is here provided with a contact 12 and connected with an electric conductor 13. The rod 11 is so arranged that when actuated, it co-operates by the pressure of the material with another contact 14, which is inserted in an electric conductor 15. The conductors 13 and 15 are portions of a circuit which is accordingly interrupted or closed when the contacts are out of contact and in contact with one another respectively. The tube 10 is secured by one end to a non-resilient tube 16. If the pressure of the material acts upon the end of the tube 10 and of the rod 11 that enter the branch pipe 6, a bending thereof occurs in the direction of movement of the material, which has the result that the end of the rod 11 provided with the contact 12 moves against the contact 14, and, if the deflection is sufficient, closes the circuit. When the contacts 12 and 14 are brought into contact with one another owing to the concen-

tration of the material being too high, a valve 27 fitted into the discharge pipe 17 of the servo-motor 18 is closed by the electric current. By this means the piston 19 in the servo-motor is raised, in which case a weight-loaded wire 21 connected with the piston rod 20 ascends and displaces a controlling segment 22, which actuates a valve 23 in the diluting water pipe, so that the valve 23 opens and admits diluting water into the material which is too thick. When the concentration of the material has been sufficiently reduced the tube 10 and the metal rod 11 return to their initial position and the circuit 13—15 is interrupted. The members described are then actuated in the opposite direction, so that the valve 23 is throttled again.

In those ranges where the concentration of the material is low, the difference in the impulsive effect upon the rod 11 for variations within the said ranges is insufficient to produce the required effect upon the metal rod 11 to close the circuit. In such cases it is always possible to bring about a sufficient impulse for this purpose by arranging a throttling device in the branch pipe 6 in front of the metal rod 11. This throttling device is constructed according to the drawing as a throttling flange 24. Since the material, at the concentration in question, is set into comparatively energetic rotary movement, and maintains this movement, the result is produced by this throttling device that the material is forced through in the form of a jet 25, the force of which varies according to the speed of rotation. If the rotation is rapid, which is the case when the concentration of the material is rather low, the jet spreads out so that only a rather small portion thereof strikes against an impact disc 26 on the metal rod 11, thereby producing a rather small deflection of the opposite end of the rod 11. At a lower speed of rotation of the material, which corresponds to a higher concentration thereof, the jet is more concentrated. A more powerful impact action occurs upon the disc 26. By this means a closure of the circuit at 13—15 is produced, with the result indicated above.

The invention is of course not limited to the constructional forms shown, as the various members thereof may be modified. Thus for example it is not necessary to employ a screw for setting the material in circulating and rotating motion. It would be possible for example to set it in continuous motion by means of a pump and to employ a separate member for bringing about the rotary movement, such as a fixed screw thread for example. Thus according to Fig. 1, the pump 3 may be employed as an impelling member if upon the pressure side thereof a fixed screw thread or the like is inserted in the pipe 2. In this case no branch pipe need be used. Similarly some member other

than the member 10, 11, shown by way of example, may be employed for receiving the impact effect.

I claim:

5 1. A process for automatically regulating the concentration of substances suspended in liquids, consisting in imparting to the material to be regulated a forward rotary movement, and constraining the material while  
10 so moving to actuate an impulse member, by direct impact action in the case of higher concentrations or by an impact action brought about by the rotary movement in the case of lower concentrations, the impulse member, when sufficiently actuated, setting in operation a member which effects the desired regulation of the concentration of the material.

2. A process for automatically regulating or indicating the concentration of substances  
20 suspended in liquids as claimed in claim 1, in the case where the material is of such low concentration that the difference in the impact action for various concentrations within a certain range of concentration is not sufficient to produce a sufficient deflection of the impulse member, characterized by the feature  
25 that the material set in rotation, by means of a throttling device inserted in front of the impulse member, is converted into a conical jet, which at higher concentrations and slower speeds of rotation occasioned thereby is more strongly concentrated and can accordingly exert a more powerful impact action upon the impulse members than at lower concentrations, when the speed of rotation of the material is greater and the jet is more spread out and accordingly only a portion thereof acts upon the impulse member.

3. Apparatus for automatically regulating the concentration of substances suspended in liquids, comprising a main conduit for conveying the material to the place of consumption, a pump device in said conduit, a branch pipe from said main conduit on the  
45 pressure side of said pump, means for imparting a rotary motion to the material and feeding it forward through said branch pipe, an impulse member located in said branch pipe in front of said means, means controlled by said impulse member for regulating the supply of a diluting liquid to the material in the main conduit and a supply conduit for such diluting liquid opening into the main conduit on the suction side of the pump.

55 4. Apparatus for automatically regulating the concentration of substances suspended in liquids, comprising a main conduit for conveying the material to the place of consumption, a pump in said conduit, a branch  
60 pipe directed from said conduit on the pressure side of the pump and opening into the main conduit at another point on said pressure side, a continuously rotating conveyer screw at the inlet end of said branch pipe for feeding part of the material from the

main conduit through the branch pipe and simultaneously imparting a rotary movement to the same, an impulse member located in the branch pipe in front of the conveyer screw, means controlled by said impulse member for regulating the supply of a diluting liquid in conformity with the momentary impact action on the impulse member, which depends on the concentration of the material, and a conduit for such diluting liquid opening into the main conduit on the suction side of the pump.

5. In an apparatus according to claim 4, the provision of a throttling member in the branch pipe between the conveyer screw and the impulse member, said throttling member being adapted to convert the current of material into a jet, which at higher concentrations and consequent lower speed of rotation of the material becomes more compact thereby exerting a higher impact action on the impulse member than at lower concentrations of the material and consequent higher speed of rotation during greater spread of the jet causing a feebler impact action on the impulse member.

6. Apparatus according to claim 4, wherein the impulse member comprises a rigid tube attached to the branch pipe and opening into the same, a resilient tube located within said rigid tube and extending with its inner closed end for a distance into the branch pipe, a metal rod extending through said resilient tube, its inner end extending beyond the resilient tube a further distance into the branch pipe, while its opposite end extends for a distance beyond the outer end of the resilient tube, a contact of an electric circuit being located at a distance from the last mentioned end of the metal rod, so that, when sufficient impact action is exerted on the inner end of the metal rod by the material in the branch pipe, the outer free end of said rod is moved thereby closing the electrical circuit and putting into operation the members used for regulating the supply of diluting liquid to the material conveyed through the main conduit.

In testimony whereof I have affixed my signature hereunto.

TORSTEN KÄLLE.