May 19, 1931. W. BAENSCH 1,806,381

AGITATING DEVICE

Filed July 11, 1928

Fig. 1

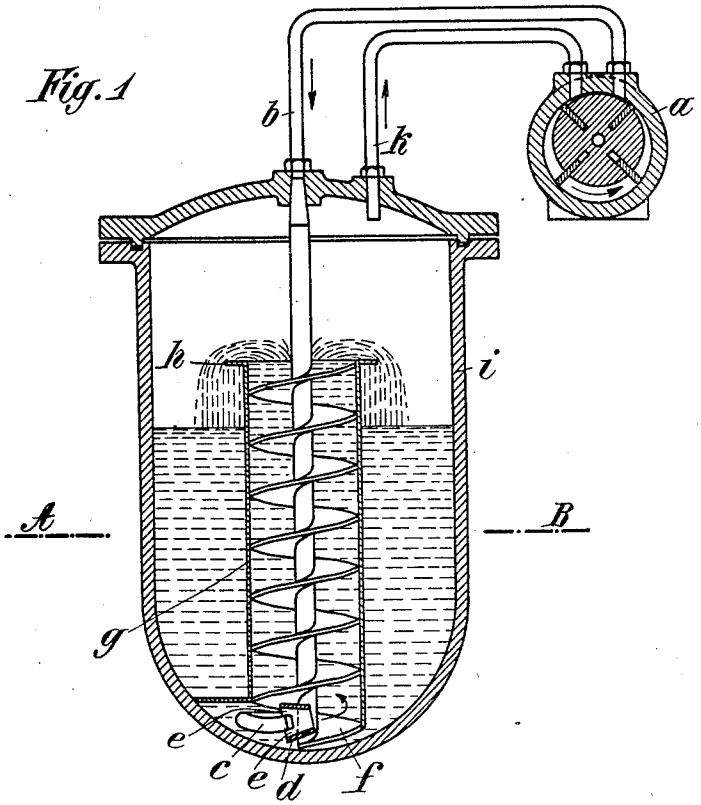
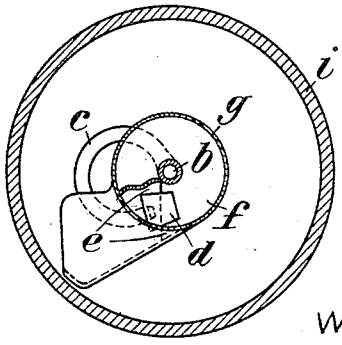


Fig. 2



Inventor:

Walter Baensch

By Emil Bönnebycke

Attorney

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UNITED STATES PATENT OFFICE

WALTER BAENSCH, OF BERLIN, GERMANY, ASSIGNOR TO SCHERING-KAHLBAUM A. G., OF BERLIN, GERMANY

AGITATING DEVICE

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My invention relates to an agitating device which is particularly intended to be used in hydrogenizing liquids.

The agitating devices and mixing apparatus hitherto used in hydrogenizing liquids suffer from many drawbacks, as well-known. Either only an insufficient mixing of the liquid and gas is attained, or the devices are of a too complicated construction or require too much power and difficult attendance. Propeller agitating devices e. g. which in themselves have a satisfying mixing effect must have a driving shaft that must be lubricated, the lubricant very easily penetrating into the hydrogenizing receptacle and contaminating the catalyzer. Furthermore, nozzles, spraying pipes, and mammoth pumps are used for this purpose, the jets of which, however, either do not take with them the catalyzer to a sufficient extent or circulate too small a quantity of liquid only in the time unit, despite high gas consumption. Appliances of this type further suffer from the drawback of the gas taking the shortest possible path to the surface of the liquid. Even when the liquid is pumped off from the hydrogenizing receptacle and supplied to it again, the circulation in the receptacle is not satisfying, this method besides requiring a very complicated arrangement and a great number of places to be tightened.

Now my invention has for its object to obviate these disadvantages of the known agitating devices.

In order to permit my invention to be more easily understood, a number of preferred embodiments of the subject-matter is illustrated in the drawings which accompanies and forms part of this specification. In the drawings

Figure 1 is a vertical section through an agitating device comprising my new screw pump agitator,

Fig. 2 shows the section on line 2—2 of Figure 1,

Fig. 3 is a vertical section of a modified construction,

Fig. 4 is a vertical section of a further modified form, and

Fig. 5 is a vertical section of a still further form of the invention.

The gas current supplied by a circulating pump *a* flows through the pipe *b* to a nozzle *c*. In escaping from the latter, the gas current acts as an injector jet and drives the liquid and the catalyzer mud through an annular nozzle *d* arranged around the nozzle *c*. The liquid jet escaping from the annular nozzle *d* further sucks liquid through the space denoted by *e* which is formed due to the fact that the nozzle system is located in part within the first thread of the screw *f*, which covers the space *e* on top and bottom, while it is confined laterally by the gas supply pipe *b* and the shell *g* that surrounds the screw *f*. The powerful liquid current thus produced which takes with it not only the catalyzer mud, but also metal chips and other small particles, now rises within the screw while quickly rotating around the axis of the latter along the comparatively long path through the threads of the screw. When arriving on the top, the liquid together with the particles taken with it flows over the edge *h* of the shell *g* down to the surface of the charging liquid in the receptacle *i*, while the gas that is not consumed by the chemical process separates and is sucked away by the circulating pump *a* from the upper portion of receptacle *i* through the pipe *k*. In this manner a hydrogenization takes place not only within the threads of the screw, but also still while the liquid is descending as described.

Instead of being formed by a sheet metal strip wound with a small angle of pitch, and a cylindrical shell surrounding it, the screw *f* may also be formed by a correspondingly narrow coiled pipe *n*, Fig. 3. The described small pitch screw affords the advantage of the surface on which the catalyzer is distributed allowing it to be made extraordinarily large. The object of my invention may further be obtained by nozzles of other design. Finally, the screw may comprise a plurality of threads each equipped with a nozzle system.

When it is intended to operate with very small gas quantities, then no notable quantity of liquid would be conveyed through the

screw if the latter be arranged vertically, as illustrated, as the gas then would rise in bubbles through the screw threads. For these purposes the screw may therefore be arranged in an inclined or horizontal position, Fig. 4, so that so-called air locks are formed in the individual threads. With pump installations these air locks are a drawback, in the described apparatus, however, they prevent the gas bubbles from rising directly. The agitating device then delivers the liquid intermittently.

When very heavy or very light catalyzers are made use of, then the case may happen that these catalyzers easily separate from the liquid surrounding the agitating screw. In this case it will be of advantage to return the liquid that leaves the screw, through another screw along a long narrow way and at a great velocity.

Furthermore it is not necessary under all circumstances that the screw is arranged within a cylindrical shell. It may on the contrary extend along the wall of the receptacle like a winding staircase *m*, Fig. 5, whereby a very long way is obtained. The outer shell is thus dispensed with, while an inner shell *o* has to be provided to separate the liquid in the screw from that in the receptacle.

Furthermore, the possibility may be provided of causing the gas to rise more quickly than the liquid, by allowing the gas to enter the next higher thread of the screw through perforations provided in the sheet metal strip or the shell of the screw. This will be suitable, when large quantities of the gas should be used at the same time as a cooling means, since in hydrogenizing processes sometimes a very high heat is developed.

The quantity of gas required for the mixing process provokes in certain cases an undesired cooling of the liquid. When this is not admissible, the gas current supplied through pipe *b* may be caused to suck-in warm gas from the gas space of the receptacle in the manner of a steam jet air suction apparatus, the gas mixture thus obtained then being supplied to the nozzle *c*. In this manner, besides, a larger quantity of gas is available than that fed by the gas pump.

Owing to the rotary motion of the liquid current around the axis of the screw centrifugal forces arise by which in certain cases the catalyzer would be thrown out. This drawback can be avoided by providing a screw of oval cross section instead of a circular one.

When a tapering or hemispheroidal liquid receptacle should be favorable for any purpose aimed at according to my invention, the agitating device can be adapted to a receptacle of this configuration. In such a case the diameter of the screw may increase conically while the pitch of the individual threads is so chosen, that a uniform streaming velocity is obtained.

When special problems are to be realized, the idea of my invention can be so developed farther, that besides the indicated main function secondary functions still may be obtained. The shell *g* may e. g. be fitted with agitating vanes and the whole system set in rotary motion, eventually in a direction opposite to that of the screw. The essence of my invention may further be transmitted to a pump, if frictional losses are of no importance.

What I claim and desire to secure by Letters Patent, is:

1. An apparatus for mixing gas and liquid, comprising a receptacle having a liquid therein, a rising pipe in said receptacle which is open at the top and at the bottom and extends above the liquid level in said receptacle, a fixed helical conveyor in said rising pipe, a pipe for supplying gas under pressure to the lower end of said rising pipe, and an injector nozzle at the lower end of said conveyor surrounding the lower end of said gas supply pipe and opening into said conveyor.

2. An apparatus for mixing gas and liquid, comprising a receptacle having a liquid therein, a rising pipe in said receptacle which is open at the top and at the bottom and extends above the liquid level in said receptacle, a fixed helical conveyor in said rising pipe, a pump having a suction pipe connected to the space above the liquid level in said receptacle, a delivery pipe extending into the lower end of said rising pipe, and an injector nozzle at the lower end of said conveyor surrounding the lower end of said delivery pipe and opening into said conveyor.

In testimony whereof I affix my signature.

WALTER BAENSCH.