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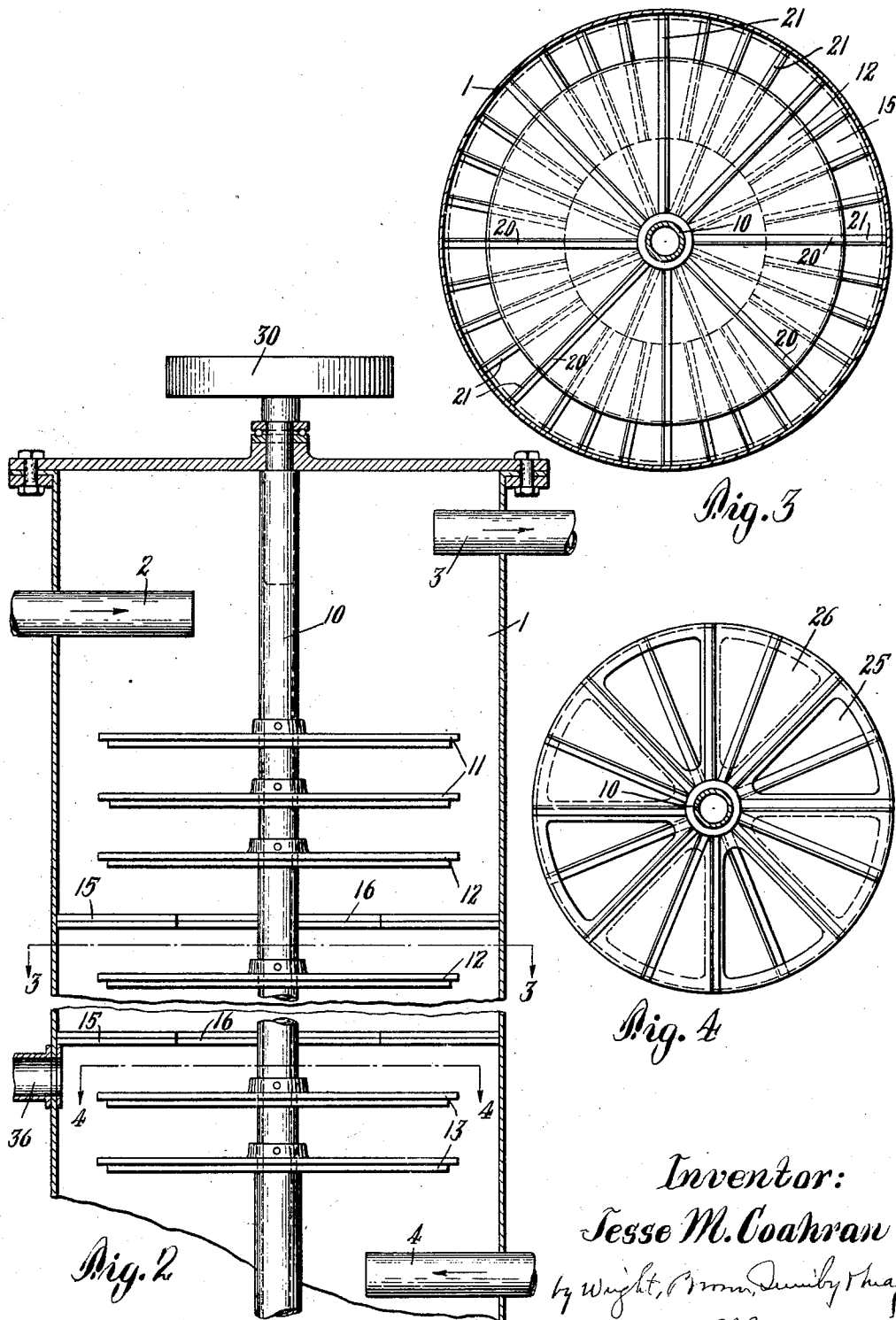
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EXTRACTOR COLUMN HAVING A LIQUID LEVEL REGULATOR

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UNITED STATES PATENT OFFICE

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EXTRACTOR COLUMN HAVING A LIQUID LEVEL REGULATOR

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In my application for Patent Serial No. 3,797 filed January 21, 1925, for apparatus for extracting chemicals from liquors is shown and described a countercurrent flow apparatus in which a relatively heavy liquor containing chemicals which it is desired to extract therefrom is caused to flow downwardly through a column, while a relatively light fluid solvent for the chemicals is caused to pass up through the column in intimate contact with the descending liquor. In carrying out the process for which this apparatus was designed, it is important to maintain a pool of substantially fresh solvent in the lower part of the column, through which pool the nearly extracted liquor flows in diffused condition before it is withdrawn. In order, however, that no solvent shall be withdrawn with the extracted or exhausted liquor, it is necessary to maintain the extracted liquor in a pool beneath and supporting the pool of solvent, the plane of demarcation between the extracted liquor and the solvent being maintained at a point substantially above the spent liquor outlet. When acetic acid is being extracted from pyroligneous acid liquor by a solvent such as ether, the plane of demarcation between the extracted liquor and the solvent pools may be seen by the use of a sight glass communicating with the interior of the column above and below this plane, and the level of this plane may be kept within reasonable limits of that desired by careful and frequent manipulation of the spent liquor outlet valve. In other cases, however, it might be difficult to determine this level by sight and at best this hand method requires the full attention of an attendant and is attended with the constant liability of the level becoming so high as to unnecessarily diminish the size of the solvent pool, impairing the efficiency of extraction, or so low as to cause loss of solvent with the spent liquor. Moreover, the flow of spent liquor when regulated by hand is more or less irregular which acts to impair the general efficiency of the continuous process.

The present invention, therefore, has for its object to provide a device which will maintain this plane between the two liquids close

to the desired level automatically and without regard as to whether or not it is readily determinable by sight. To this end a float weighted to maintain a constant level relative to this plane and subjected to the buoyant action of the liquid in the column is arranged to control the spent liquor outlet valve so as to shut the valve as the plane descends and to open the valve as the plane rises. By a suitable proportioning of the parts, therefore, this plane may be maintained substantially at a constant level.

For a more complete understanding of this invention, reference may be had to the accompanying drawings in which

Figure 1 is a fragmentary vertical section through the column showing the level control device applied thereto.

Figure 2 is a fragmentary section of the column showing portions not disclosed in Figure 1.

Figures 3 and 4 are detail sections on lines 3—3 and 4—4, respectively, of Figure 2.

Referring to these figures, 1 indicates a column having near its upper end a heavy liquid inlet 2 and above this a light liquid outlet 3. Near the lower end of the column is a light liquid inlet 4 and below this is a heavy liquid outlet 5. The heavy liquid inlets and outlets are for the passage of the liquor from which the chemicals are to be extracted and the light liquid inlet and outlet for the relatively light solvent. Extending axially through the column is shown a shaft 10 having fixed thereto between the heavy liquor inlet and the light liquor inlet, three sets of stirring or agitator members indicated, respectively, at 11, 12 and 13. Alternately arranged with each of the agitators 12 the series of which extend the greater part of the length of the column are fixed baffle plates 15 extending inwardly from the wall of the column, each having a central opening 16 through which the shaft 10 passes, this opening being somewhat larger than the shaft so as to permit the restricted passage of the light liquid upwardly and the heavy liquid downwardly about the shaft. Each of the agitators 12 is formed as a flat disk having a plurality of ribs 20 radially arranged thereon and co-

operating with similarly radially arranged ribs 21 on the stationary baffles 15. There are no stationary baffles adjacent to and between the stirrers 11 and 13 and as shown in Figure 4 these stirrers 11 and 13 are formed with alternate open and solid portions 25 and 26, the open portions of one stirrer being arranged in vertical alinement with the closed portions 26 of the adjacent stirrer. The central series of agitators 12 is intended to thoroughly mix the descending heavy liquor and the ascending light solvent at the intermediate portion of the length of the column, while the stirrers 11 are intended to diffuse the ascending solvent liquor through a pool of substantially fresh heavy liquid at the upper portion of the column, and the stirrers 13 are intended in like manner to diffuse the descending nearly extracted heavy liquor through a relatively large pool of substantially fresh solvent maintained in the lower portion of the column. After passing through this pool of substantially fresh solvent, the solvent being supplied thereto through the inlet 4, the heavy spent liquor is allowed to collect in the bottom of the column and is drawn off through the outlet 5.

The extreme upper and lower portions of the column are free from agitators of any description so as to permit the heavy and light liquids to separate by gravity so that the light liquid may be drawn off with its chemical content removed from the heavy liquor through the outlet 3 without being contaminated by the heavy liquor entering through the inlet 2 and so that the heavy spent liquor may be drawn out through the outlet 5 without carrying therewith solvent introduced through the inlet 4. The shaft 10 may be rotated in any suitable manner, as by means of the pulley 30 at its upper end. This portion of the apparatus may be the same as that disclosed in my application hereinbefore referred to.

The plane of demarcation between the spent heavy liquor and the pool of substantially fresh solvent superposed thereon should be slightly below the inlet for the solvent at 4 or about at the line *a-a* of Figure 1. In order to maintain the level at this point, a controlling device has been devised. This device comprises a casing 35, the lower end of which communicates with the lower end of the column as through the heavy liquor outlet 5, and the upper portion of which communicates through the pipe 36 with the column just beneath the lowest stationary baffle (see Figure 2). The lower end of the casing 35 is closed off by means of a valve plate 37 having a central opening 38 therethrough surmounted by an annular valve seat 39 substantially concentric to the opening 38 but of an internal diameter somewhat larger than this opening. On the lower side of the valve plate 37 is the heavy liquid outlet 40. Slid-

able through the opening 38 of the valve plate is the valve member 41. This comprises a tube provided with a considerable number of radially extending openings 42 through its wall, and surmounted by an imperforate cap plate 43 which when the valve is in its lowest position rests on the upper face of the valve seat member 39 and completely closes the outlet 40. As the valve is raised, more and more of the perforations 42 are brought above the valve plate 37 so as to permit an increasing quantity of the heavy liquid to escape therethrough into the valve tube and pass out through the outlet 40. By placing the openings 42 radially the valve is substantially balanced in so far as any effect of the flow of liquid therethrough is concerned, at least until such time as the disk 43 is very near to its closed position. This valve is connected by means of a rod 44 at its lower end adjustably threaded into the disk 43 and having a loop 45 at its upper end to a depending portion 46 of a float 47. This float is preferably formed hollow and is provided with guiding lugs 48 to guide it for vertical movement within the casing 35, while permitting the passage of liquid therewith. At its upper end it is provided with a filling opening at 50 which may be closed by a suitable plug so that any suitable weighting material, such as a liquid or granular material, may be poured into its interior until the weight of the float is such as to cause it and the valve to tend to assume a position with substantially the lower half of the float immersed in the heavy liquid and the upper half immersed in the light solvent. When weighted in this manner, if the plane of demarcation between the liquid descends, the float and the valve descend therewith, closing the valve somewhat so as to diminish the escape of spent liquor, while if the level of the plane of demarcation rises the float also rises, opening the valve wider and permitting a more rapid escape of the spent liquor. The upper end of the casing 35 is shown as closed off by a cover member 55 through which is threaded an abutment rod 56 which should be so adjusted that the float contacts therewith, so that its upward movement is stopped before the lower end of the valve tube is raised clear of the valve plate 37.

This device, it will be seen, acts to regulate the level of the plane of demarcation between the heavy and light liquids within relatively close limits and in actual operation effects a substantially steady flow of spent liquor, thus adding to the general efficiency of the continuous process which this apparatus is designed to carry out.

Ordinarily there is no occasion for using an automatic means for controlling the level of the liquids at the upper end of the column between the heavy liquid inlet and light liquid outlet, this level being determined large-

ly by the proportions of the two liquids and the speed of the rotor. These factors once adjusted, the upper level seems to take care of itself, consequently no regulator for this upper level has been shown herein.

Having thus described an embodiment of this invention, it should be evident to those skilled in the art that various changes and modifications might be made therein without departing from its spirit or scope as defined by the appended claims.

I claim:

1. The combination with a column having a heavy liquid inlet adjacent to its top, a light liquid inlet adjacent to its bottom, a light liquid outlet above the heavy liquid inlet, a heavy liquid outlet below the light liquid inlet, and means between said liquid inlets for producing intimate contact between liquids introduced through said inlets, of a chamber in communication with said column above and below said light liquid inlet, a discharge port at the lower end of said chamber, a valve in said port, a float in said chamber arranged to float partly submerged in the heavy liquid and the remainder in the light liquid, and operative connections between said float and valve for maintaining a plane of demarcation between said light and heavy liquids between said light liquid inlet and said heavy liquid outlet.

2. In combination with a column having a heavy liquid inlet adjacent to its top, a light liquid inlet adjacent to its bottom, a light liquid outlet above the heavy liquid inlet and a heavy liquid outlet below said light liquid inlet, means between said light and heavy liquid inlets for mixing the liquids while permitting them to separate out by gravity at the end portions of said column into distinct layers, a chamber in communication with said column above and below said light liquid inlet, a float in said chamber weighted to float partly submerged in each liquid and substantially at the level therebetween in said column, and means controlled by said float to maintain said level substantially constant between said heavy liquid outlet and said light liquid inlet.

3. In combination, a column having separate liquid inlets and outlets adjacent to its upper and lower ends, agitating means between said upper and lower inlets and outlets, the upper and lower portions of said column between the inlets and outlets of said portions being free from agitating means to permit liquids of different specific gravities in said column to separate out by gravity into distinct layers, and means controlled by the level between said liquids at the lower end of said column for controlling the escape of liquid through said lower outlet to maintain said level substantially constant between said lower inlet and outlet.

4. An extractor comprising a column, a

liquid inlet and an outlet at the upper portion of said column, a liquid inlet and an outlet at the lower portion of said column, means between said upper and lower portions for producing intimate contact between said liquids in said column, the lower portion of said column forming a substantially unobstructed chamber with which said lower inlet and outlet communicate at different levels, and means for maintaining a plane of demarcation between liquids of different specific gravity in said chamber at a level between said lower inlet and outlet.

In testimony whereof I have affixed my signature.

JESSE M. COAHRAN.

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