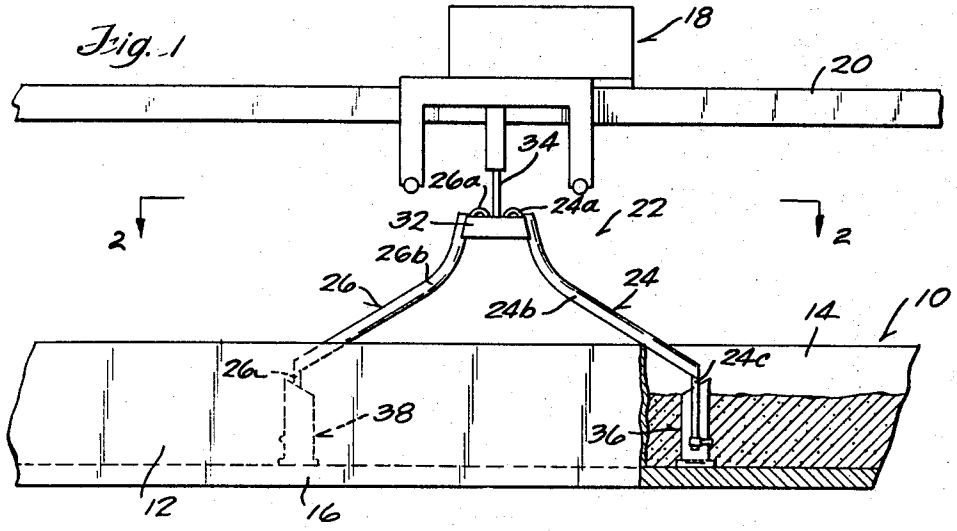
Nov. 4, 1969 M. C. THOMSON 3,476,364

STIRRING PADDLE ASSEMBLY FOR PROCESS VAT

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Fig. 1



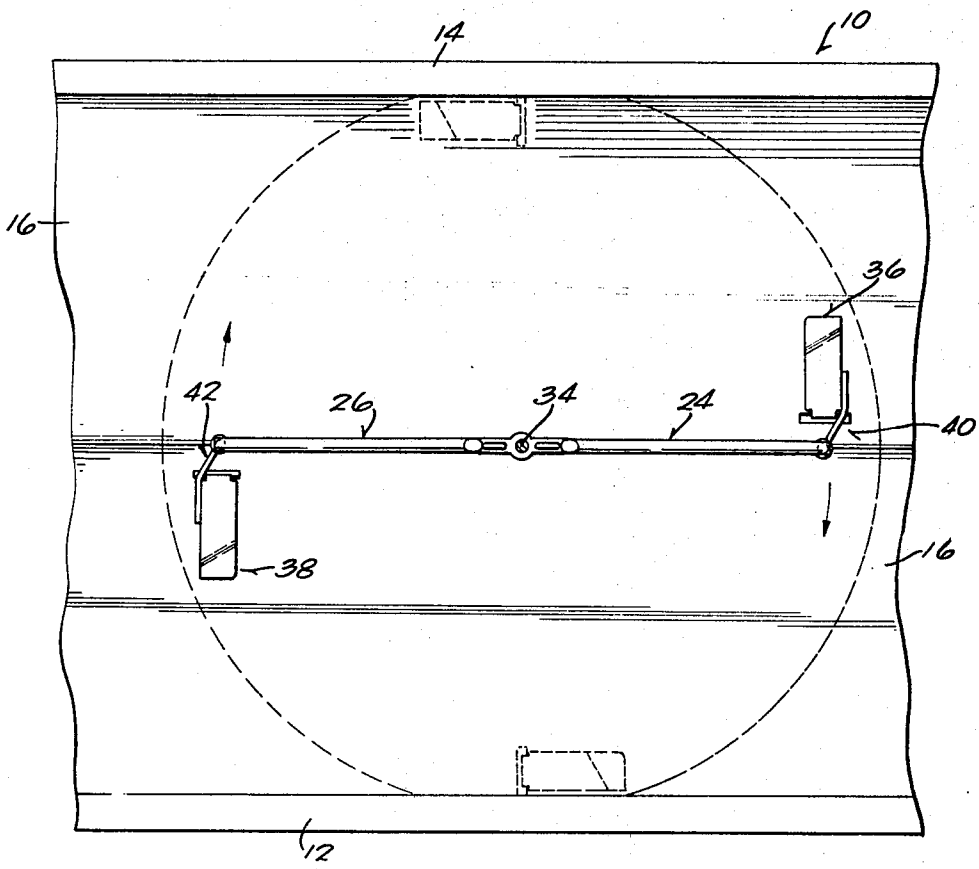


Fig. 2

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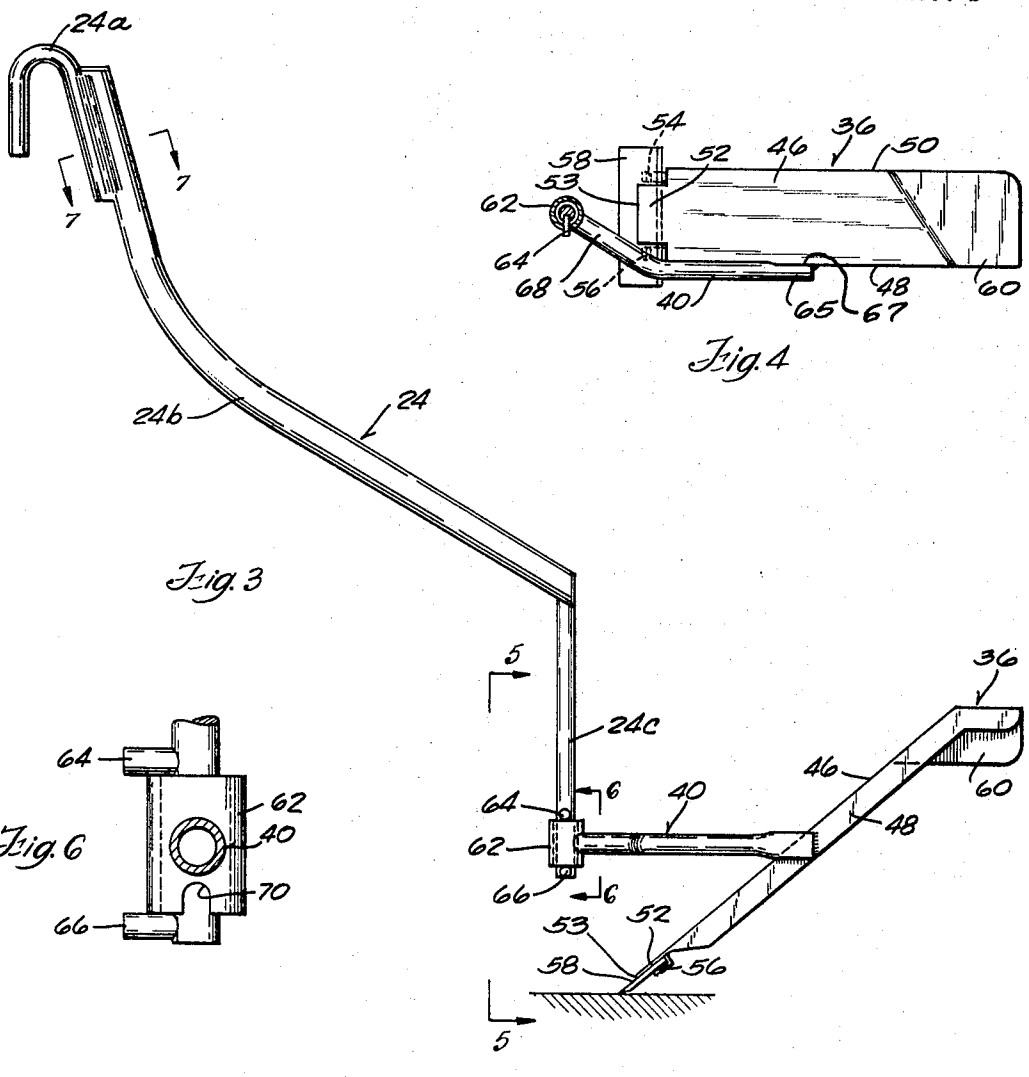


Fig. 3

Fig. 4

Fig. 6

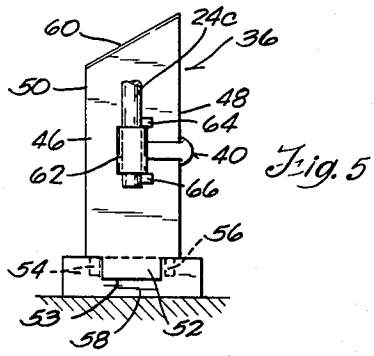


Fig. 5



Fig. 7

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3,476,364

STIRRING PADDLE ASSEMBLY FOR PROCESS VAT

Meredith C. Thomson, Oconomowoc, Wis., assignor to Stoelting Brothers Company, Kiel, Wis., a corporation of Wisconsin

Filed Feb. 16, 1968, Ser. No. 705,962
Int. Cl. B01f 7/20
U.S. Cl. 259—108 14 Claims

ABSTRACT OF THE DISCLOSURE

A stirring paddle assembly for a cheese processing vat is provided wherein a single stirring blade is connected to and trails each arm of the paddle assembly. The stirring blade has a substantial extension above the bottom wall of the vat so that it extends over a substantial portion of the vat depth and can extend through the entire depth of cheese product in the vat.

BACKGROUND OF INVENTION

Field of invention

This invention relates to stirring paddle assemblies of the type used, for example, in connection with the processing of cottage cheese.

Description of prior art

This invention will be discussed in connection with the process of making cottage cheese but it will be appreciated that problems encountered in cottage cheese making are also found in other cheese making processes or generally in processing products having liquid characteristics. Therefore, although the invention will be discussed in a cottage cheese making environment it is not necessarily limited to that environment.

Various steps in the process of making cottage cheese are carried out in a process vat, e.g. curd cooking, washing, creaming, etc. Stirring of the product medium is required during various steps in the process, for example the creaming step. It has been known to stir the creamed curd through the use of a traveling paddle assembly which moves through the process vat agitating the curd. Prior paddle assemblies have not been entirely satisfactory. Among the reasons for their not having been completely satisfactory is that they did not completely agitate the curd in the vat because the stirring blades had only a limited vertical extension through the curd depth. This resulted in relatively quiescent areas of curd and incomplete stirring of the curd. For the most part, such prior paddle assemblies were of the pusher type with the stirring blades being pushed through the curd. Pusher blade assemblies encounter such relatively large blade loads due to the pressure of curd thereon that the blades must be small, e.g. have a limited vertical extension, to prevent damage and/or jamming of the blade assembly against the vat wall. An improvement over these prior paddle assemblies is disclosed and claimed in the copending application of Meredith C. Thomson, Ser. No. 671,048, filed Sept. 27, 1967, entitled "Stirring Paddle Assembly for Process Vat" and assigned to the assignee of this application.

SUMMARY OF INVENTION

In accordance with this invention, a stirring paddle assembly is supported in a process vat from a movable carriage. The carriage is movable with respect to the vat and is adapted to move the paddle assembly through the product medium in the vat and to rotate the paddle assembly as it is moved through the product medium. A single stirring blade is connected to each arm of the stirring paddle assembly and is pulled through the product medium by the arm to which it is connected. Each stirring blade is of substantial length and engages the vat bottom wall of the vat and has a substantial extension above the vat bottom, extending from the vat bottom wall through a substantial portion of the depth of the vat so that the blade agitates all or a substantial part of the depth of curd in the vat. This arrangement achieves thorough stirring of the curd and with a relatively simplified construction.

DESCRIPTION OF DRAWINGS

FIG. 1 is a side elevation of a stirring paddle assembly, a portion of the stirring paddle assembly carriage and the process vat into which the paddle assembly extends;

FIG. 2 is a view taken generally along the line 2—2 of FIG. 1;

FIG. 3 is an enlarged view of one stirring paddle and arm assembly with the paddle assembly rotated 90° from its normal trailing position with respect to the paddle arm;

FIG. 4 is a top view of the stirring paddle;

FIG. 5 is a front view of the stirring paddle;

FIG. 6 is a section view taken generally along line 6—6 in FIG. 3; and

FIG. 7 is a section view taken generally along line 7—7 of FIG. 3.

DESCRIPTION OF PREFERRED EMBODIMENT

In the creaming step of cottage cheese making, a suitably prepared curd is pumped, or otherwise delivered, to a process vat **10**. The side walls **12** and **14** and bottom wall **16** of the vat are made of spaced inner and outer walls. With this arrangement the temperature of the curd can be controlled, in a conventional manner, by circulating a heating or cooling medium through the area between the inner and outer walls. For best results, the curd mixture (curd, cream, dressing etc.) is continuously stirred during the creaming step. To achieve this stirring, a carriage **18** is supported on and moves along rail **20**. Rail **20** extends longitudinally over the vat. The carriage, by means of a suitable drive system, is capable of traversing substantially the entire length of the vat by movement on the rail. Stirring paddle assembly **22** is suspended from carriage **18** and extends into vat **10**, the paddle assembly moving longitudinally through the vat with the carriage. The specific details of the carriage and the drive system are not necessary to a complete understanding of this invention and, for that reason, they have not been illustrated. Carriage **18** includes suitable mechanism for rotating the paddle assembly as it is moved through the vat and, since this mechanism can take any conventional form, its details have neither been illustrated nor will they be described. For example, the carriage drive and the paddle arm assembly drive can take the form of that disclosed and claimed in Patent 2,617,191 to Edgar W. Detjen and assigned to the assignee of this application.

Structurally, the paddle arm assembly includes two paddle arms **24** and **26** connected to hub **32** which is in turn connected through drive shaft assembly **34** to the drive in the carriage. Paddle arm **24** includes hook portion **24***a* engaging hub **32**, an angular portion **24***b* extending from the hook portion to a vertical portion **24***c* arranged generally parallel to the vat side walls. Similarly, the other paddle arm includes hook portions **26***a*, angular portion **26***b*, and vertical portion **26***c* extending parallel to the side walls.

The drive assembly in carriage **18** moves the paddle assembly longitudinally through the vat and, simultaneously with the longitudinal movement, rotates the paddle arms on shaft assembly **34** in the direction of the arrows in FIG. 2. The curd mixture is stirred by blades

36 and 38 connected to each of the paddle arms by connecting arms 40 and 42.

Reference will now be made to FIGS. 3 and 4 where stirring blade 36 and its connections to paddle arm 24 are more clearly illustrated, it being appreciated that the construction and connection of stirring blade 38 to its paddle arm are the same so that the description of one will suffice for both. Stirring blade 36 includes a body having a principal face 46 and turned side edges 48 and 50. Face 46 provides the primary curd contacting surface for stirring purposes. The lower end 52 of face 46 is flanked on both sides by tabs 54 and 56 formed integrally with but offset from the plane of face 46. Wiper 58 is positioned between end 52 and tabs 54 and 56 as shown. Tabs 54 and 56 have sufficient inherent resiliency and serve to clamp wiper 58 against face 46, if desired apertures may be provided in the wiper at the point of engagement of the tabs on the wiper to provide more positive engagement therebetween. Wiper 58 engages the bottom wall of the vat and is preferably made of a material having good sliding characteristics such as nylon or the like.

Rather than terminate abruptly at its upper end, face 46 preferably terminates in a rearwardly projecting extension 60, i.e. projecting away from the paddle arm or upstream with respect to direction of stirring blade movement through the curd. Moreover, extension 60 is preferably angled to one side, it being angled with respect to the plane of end edge 53 of face 46 so that it is not horizontal and will discharge any curd flowing into the extension to the side of the path of movement of the stirring blade. The extension and its particular orientation and relation with the principal blade face 46 is believed to enhance stirring of the curd as will be described more completely hereinafter.

Connecting arm 40 has a generally cylindrical collar 62 attached to one end thereof. Collar 62 fits over the lower end of vertical portion 24c of arm 24 and between vertically spaced pins 64 and 66 fixed to the arm. The inner diameter of the collar is substantially greater than the diameter of the paddle arm allowing for freedom of movement of the stirring blade assembly relative to the paddle arm in a vertical plane or, in other words, toward and away from the bottom vat wall. The collar is free on the arm so the stirring blade assembly is also free to rotate in a horizontal plane about the paddle arm.

The opposite end 65 of the connecting arm is flattened at 67 for engagement with edge 48 of the stirring blade, at which point the connecting arm can be suitably connected to the blade as by welding. It will be noted that connecting arm 40 includes an angular portion 68, this allows the stirring blade to trail the paddle arm in a position centered on the arm but with a connection which leaves face 46 of the blade unobstructed.

Collar 62 includes a notch 70 which faces toward the blade when the blade is in its operative position trailing the paddle arm. The notch provides clearance to permit the collar to slide free of pins 64 and 66 for assembly on and removal from arm 24. In assembly the collar is moved over pin 66 with notch 70 in registry with the pin. The notch affords clearance to permit the collar to slip between the pins. When so positioned the stirring blade is rotated to its normal operational position trailing the paddle arm. This displaces the notch from the pins and the stirring paddle assembly is securely held on the paddle arm between the pins. As mentioned above, for better illustration the paddle assembly is illustrated in FIG. 3 rotated 90° from its normal trailing position, which would be rotated 90° counterclockwise as viewed in FIG. 4. For consistency in the drawings the orientation of FIG. 3 has been carried through FIGS. 4, 5 and 6. In the normal trailing position the notch and pin are located on diametrically opposite sides of arm portion 24c. This orientation of the pins and notch permits the blade, and its connecting arm, to swing freely through a relatively large arc without danger of the notch engaging pin 66 and locking the blade against movement. Thus, in use the pins are on the downstream side of the paddle arm, i.e. downstream with respect to the direction of travel through the curd, and the notch is on the upstream side. For removal, the assembly procedure is reversed with the paddle assembly being pivoted around the arm until the notch registers with pin 66.

It should be pointed out that prior stirring blade assemblies have generally been arrangements wherein the stirring blade is pushed through the curd. When the blade is pushed the forces exerted on the stirring are revolved such that result in a relatively large component tending to wedge the blade into the vat bottom wall. This can result in jamming and can become severe to the point of causing actual structural damage to the stirring paddle assembly and/or the vat. For this reason, such stirring blades have been designed with relatively small stirring faces thereby reducing the area of contact with the curd and consequentially reducing the blade load and wedging force. Such prior blades have generally had a limited extension above the vat bottom wall.

It was discovered that when the stirring paddle trails the paddle arm, the blade is capable of functioning under much larger curd loads and the size of the stirring paddle blade can be increased substantially without danger of jamming the blade against the vat bottom or the occurrence of actual structural damage to the stirring blade or the paddle assembly as a result of excessive loading. As a result of this recognition that blade loading could be reduced by a trailing blade arrangement, the simplified and yet highly effective arrangement illustrated in the drawing was provided. Stirring blades 36 and 38, in contrast to prior pushed blades which were limited to an area immediately adjacent the bottom wall, have a substantial extension above the bottom wall, or in other words, have a substantial extension through the vat depth. With this arrangement of the stirring blade extending over a substantial depth of the process vat, the blades can be made to extend through the entire depth of curd in the vat or at least through a major portion of that depth, and thereby effect positive agitation of the curd from the bottom of the vat through to the surface of the curd. As illustrated in FIG. 1, the curd is filled into the vat to a level where it is just below the lower edge of extension 60. It will be noted that although this is the preferred orientation of the blade in the curd others are possible, e.g. the entire blade could be submerged in the curd.

The stirring blades trail their respective paddle through the curd along the circle illustrated in FIG. 2. In this respect it will be noted that wiper 58 extends beyond both of the side edges 48 and 50 of the stirring blades, this extension serves two functions, it insures a wider engagement with curd at the vat bottom and also prevents engagement between the stirring paddle sides and the side walls of the vat. It will be noted from FIG. 2 that the stirring blade normally follows a circular path the diameter of which is greater than the distance between the vat side walls but the free connection of the stirring paddle on the paddle arm permits the blade to pivot inwardly from that path and move along the vat wall without jamming.

As the stirring blades move through the curd the curd is moved to either side of the paddle and also vertically along the faces 46 thereof. Movement of the stirring paddle through the curd has a tendency to create a cavity behind the stirring paddle and it is with respect to this cavity that it is believed the horizontal extension 60 of the stirring paddle offers particular advantages. If the principal face 46 of the stirring paddle terminated abruptly at its upper end the curd traveling vertically on that face would fall over the edge and back into the cavity. In contrast, by providing the horizontal extension, which projects rearwardly of the main face, direct flowback of the curd into the cavity is prevented and this results in the formation of a larger cavity behind the blade. This

permits a larger amount of the curd from either side of the blade to flow into the cavity and thereby enhance mixing. By angling extension **60** to one side or the other of the stirring blade mixing is further enhanced in that the vertically displaced curd is returned to the cavity both to one side and the rear of the cavity.

It will be appreciated that the actual dimensional relationship between the blade height in the vat and the vat height can vary. As an example, an approximately 12 inch blade (i.e. a 12 inch verical extension above the vat bottom and not a 12 inch blade face) has given satisfactory results in vat depths of from 12 to 18 inch up to 36 to 38 inch depths and with various degrees of covering or exposure of the blade by the curd.

As illustrated in the drawing (FIG. 3), the blades trail their paddle arms and slope up and away from the direction of travel. With this arrangement the curd load has less of a tendency to wedge the blade into the vat bottom so that the principal curd engaging surface can be larger, the freedom of movement of the blade in both vertical and horizontal planes by virtue of its connection at the paddle arm also being a contributing factor in the lower wedging forces which are encountered. As an example, a blade having an angle of approximately 40° with the vat bottom, when at rest and without loading, has given satisfactory results. The blade angle varies from the base angle as it travels through the curd depending upon the area of contact with the vat bottom, the vat bottom being normally angled to the center in accordance wih conventional practice but not shown. Again, the freedom of movement resulting from the connection of the blade at the arm permits this variation in angle.

The single blade stirring paddle arrangement has provided exceptionally good results and also is a marked simplification over heretofore proposed types of stirring paddle assemblies. A pair of mixing blades have been provided to enhance the mixing action and it will be noted that the two blades are connected to hub **32** at diametrically opposite points to thereby balance the load on the agitator portion of the carriage drive.

Although in many applications the paddle arm could be a continuous rod, it was found that the structural strength of the arm could be improved by providing a connecting portion **24***b* which is in the form of a hollow pipe having a larger diameter than the rod portion **24***a* and **24***c*. As can be seen in FIG. 7, pipe portion **24***b* has a considerably larger diameter than portion **24***a* and this provides a more advantageous moment of inertia to resist the bending forces which are exerted on the paddle arm by movement of the stirring blade through the curd. The pipe is connected to the rod by welds as illustrated in FIG. 7.

The paddle assembly is made of stainless steel for sanitary reasons and the open ends of pipe **24***b* and arm **40** are capped also for sanitary reasons.

I claim:

1. Apparatus of the type described comprising, in combination,

a vat having inner walls,

a stirring assembly extending into said vat,

means for moving said stirring assembly in and relative to said vat,

and said stirring assembly including a paddle arm movable through said vat, a single stirring blade, means connecting said stirring blade to and in trail- movable through said vat, a single stirring blade, moving with said paddle arm in trailing relation therewith through said vat and said blade engaging an inner vat wall and having a substantial extension outwardly from said vat wall with said blade extending through a substantial portion of process medium in said vat.

2. The combination of claim **1** wherein said inner vat wall is the bottom wall of said vat and said blade includes a principal process medium contacting surface facing downstream relative to the path of travel of said blade through said vat and terminating in an extension spaced outwardly from said bottom vat wall and projecting upstream with respect to said path of travel whereby at least a portion of the process medium moving along said principal surface passes over said extension before leaving said blade.

3. The combination of claim **2** wherein said extension is also angled to one side of said path of travel whereby process medium leaves said extension upstream and to at least one side thereof.

4. Apparatus of the type described comprising, in combination,

a vat having inner walls,

a stirring assembly extending into said vat,

means for moving said stirring assembly in and relative to said vat,

said stirring assembly including a paddle arm movable through said vat and a single stirring blade connected to said paddle arm, said stirring blade moving with said paddle arm in trailing relation therewith through said vat and said blade having a substantial extension from adjacent an inner vat wall outwardly from said vat wall so that blade can extend through a substantial portion of process medium in said vat,

and means connecting said stirring blade to said paddle arm and providing for free movement of said striring blade relative to said vat wall in a first plane generally normal to said vat wall.

5. The combination of claim **4** wherein said means connecting said stirring blade to said paddle arm also provides for free movement of said stirring blade in a second plane generally normal to said first plane.

6. Apparatus of the type described comprising, in combination,

a vat having inner walls including a bottom wall,

a stirring assembly extending into said vat,

means for moving said stirring assembly in and relative to said vat,

and said stirring assembly including a paddle arm movable through said vat and a single stirring blade connected to said paddle arm, said stirring blade moving with said paddle arm in trailing relation therewith through said vat and said blade engaging and having a substantial generally vertical extension from said bottom vat wall so that said blade can extend through a substantial portion of process medium in said vat,

said blade includes a principal process medium contacting surface facing downstream relative to the path of travel of said blade through said vat and terminating in an etxension spaced from said bottom vat wall and projecting upstream with respect to said path of travel whereby at least a portion of the process medium moving along said principal surface passes over said extension before leaving said blade,

and including means connecting said stirring blade to said paddle arm and providing for free movement of said stirring blade relative to said bottom vat wall in a generally vertical plane.

7. The combination of claim **6** wherein said means connecting said stirring blade to said paddle arm also provides for free movement of said stirring blade in a generally horizontal plane.

8. The combination of claim **7** wherein said means connecting said stirring blade to said paddle arm includes

means defining a hollow collar connected to said stirring blade and surrounding a vertical portion of said paddle arm and having an inner diameter larger than the outer diameter of said vertical portion of said arm,

and vertically spaced pin means on said paddle arm and between which said collar is held on said paddle arm.

9. The combination of claim 8
wherein said collar includes means defining a notch in one end thereof facing toward said stirring blade and having a length sufficient to permit removal of said collar from between said pins,
and wherein said pins are spaced angularly from the upstream side of said vertical paddle arm portion so that said notch and pins are out of registry when said stirring blade is trailing said paddle arm.

10. Apparatus of the type described comprising, in combination,
a vat having a bottom and side walls,
a stirring assembly extending into said vat,
means for moving said stirring assembly in and relative to said vat,
and said stirring assembly including a paddle arm movable through said vat between said side walls and a stirring blade engaging said bottom wall, said stirring blade extending vertically from said bottom wall and terminating in a generally horizontal extension, said horizontal extension spaced from said bottom wall and projecting from said stirring blade upstream with respect to the path of travel of said stirring blade through said vat.

11. The combination of claim 10 wherein said horizontal extension is angled to one side of said stirring blade.

12. The combination of claim 10
including means connecting said stirring blade to said paddle arm and providing for free movement of said stirring blade in vertical and horizontal planes.

13. The combination of claim 12 wherein said stirring blade is disposed at an angle to said bottom vat wall and slopes vertically and away from said path of travel.

14. The combination of claim 13 wherein said stirring assembly includes hub means supporting
said paddle arm and said paddle arm includes a first rod portion engaging said hub means,
a second rod portion to which said stirring blade connecting means is connected,
and an intermediate portion connected between said first and second rod portions and having a diameter greater than said first rod portion.

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ROBERT W. JENKINS, Primary Examiner

U.S. Cl. X.R.

259—178

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,476,364 November 4, 1969

Meredith C. Thomson

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 66, "moveable through said vat, a single stirring blade," should read -- ing relation with said paddle arm, said stirring blade --.

Signed and sealed this 21st day of April 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents