

- [72] Inventors **Earl M. Kelly**
Hillsborough, Calif.;
Jack W. Pratt; Ralph B. Haymore, both of
Salt Lake City; Jay M. Smith, Bountiful, all
of Utah
- [21] Appl. No. **872,517**
- [22] Filed **Oct. 30, 1969**
- [45] Patented **Dec. 14, 1971**
- [73] Assignee **Envirotech Corporation**
Salt Lake City, Utah

Primary Examiner—Reuben Friedman
Assistant Examiner—Thomas G. Wyse
Attorneys—Robert R. Finch and Richard F. Bojanowski

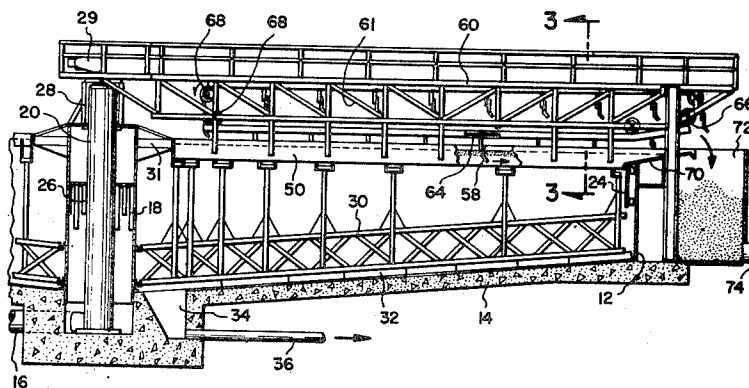
[54] **SCUM-SKIMMING METHOD AND APPARATUS**
13 Claims, 5 Drawing Figs.

- [52] U.S. Cl. **210/83,**
210/525
- [51] Int. Cl. **B01d 21/06**
- [50] Field of Search **210/83, 525**

- [56] **References Cited**
UNITED STATES PATENTS
2,681,151 6/1954 Coulter **210/528**

ABSTRACT: Scum removal apparatus and method, including a biased skimming blade mounted to span the surface of a confined liquid body and to move toward a baffle positioned in the path of the approaching blade to block and, thereby collect the scum pushed ahead of the blade. A cam, located ahead of the baffle, depresses the approaching blade to disengage it from the scum so that it passes below the baffle, leaving the collected scum deposited in front of the baffle.

In a particular modification, a two-sided channel is formed by parallel baffles, the cam is formed as a ramp coextensive with the entire lower edge of the first baffle and extending upwardly therefrom to terminate above the liquid surface. The moving blade is depressed as it follows the ramp, thus forcing the scum under the first baffle, whence it is released to refloat within the channel. In both modifications, the collected scum is engaged by a supplemental high capacity conveyor which moves the scum radially of the tank to discharge.



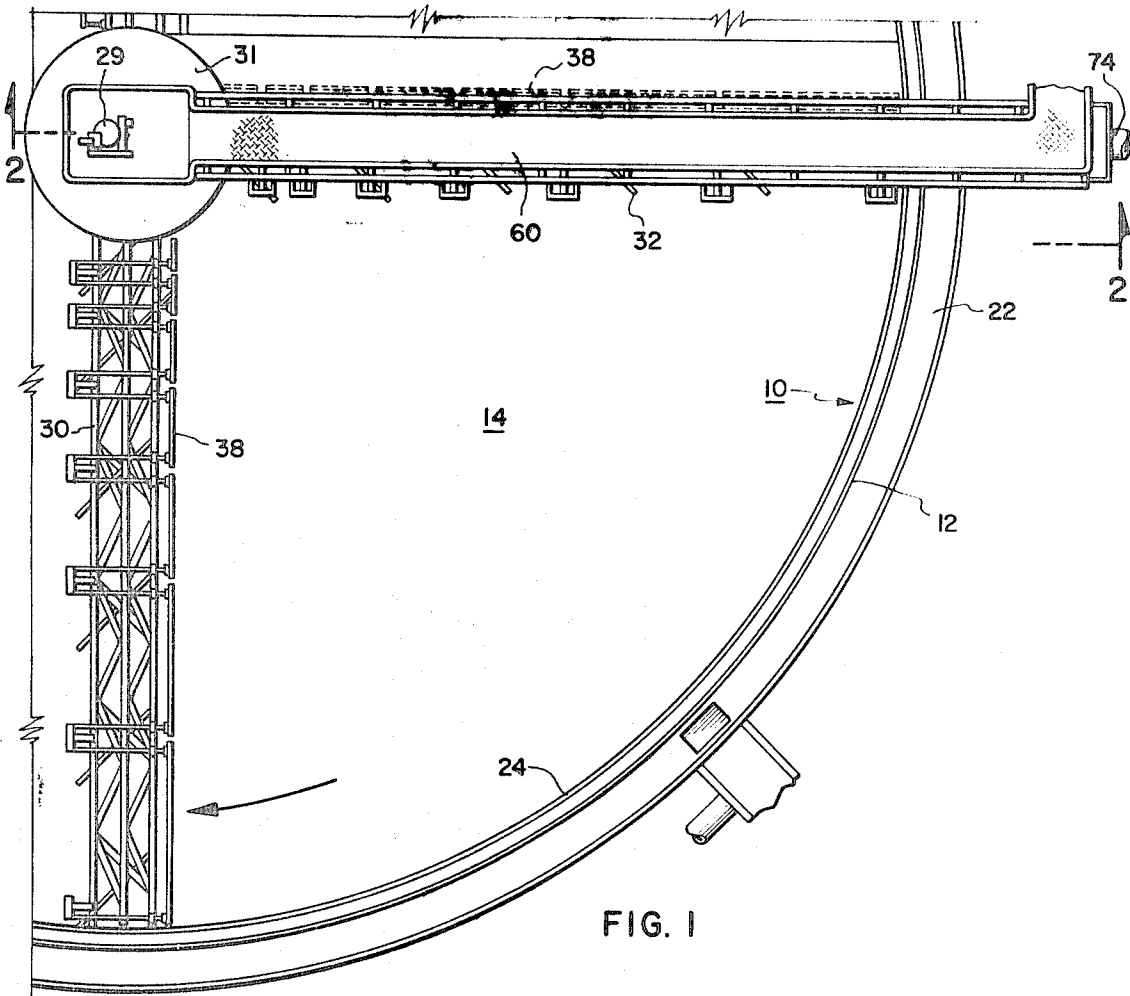


FIG. 1

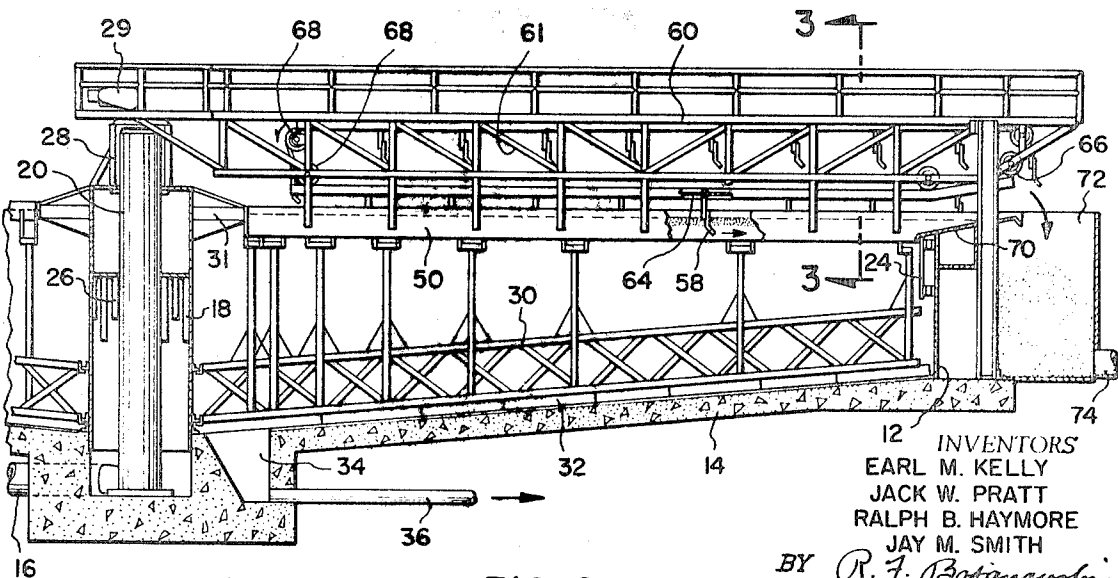
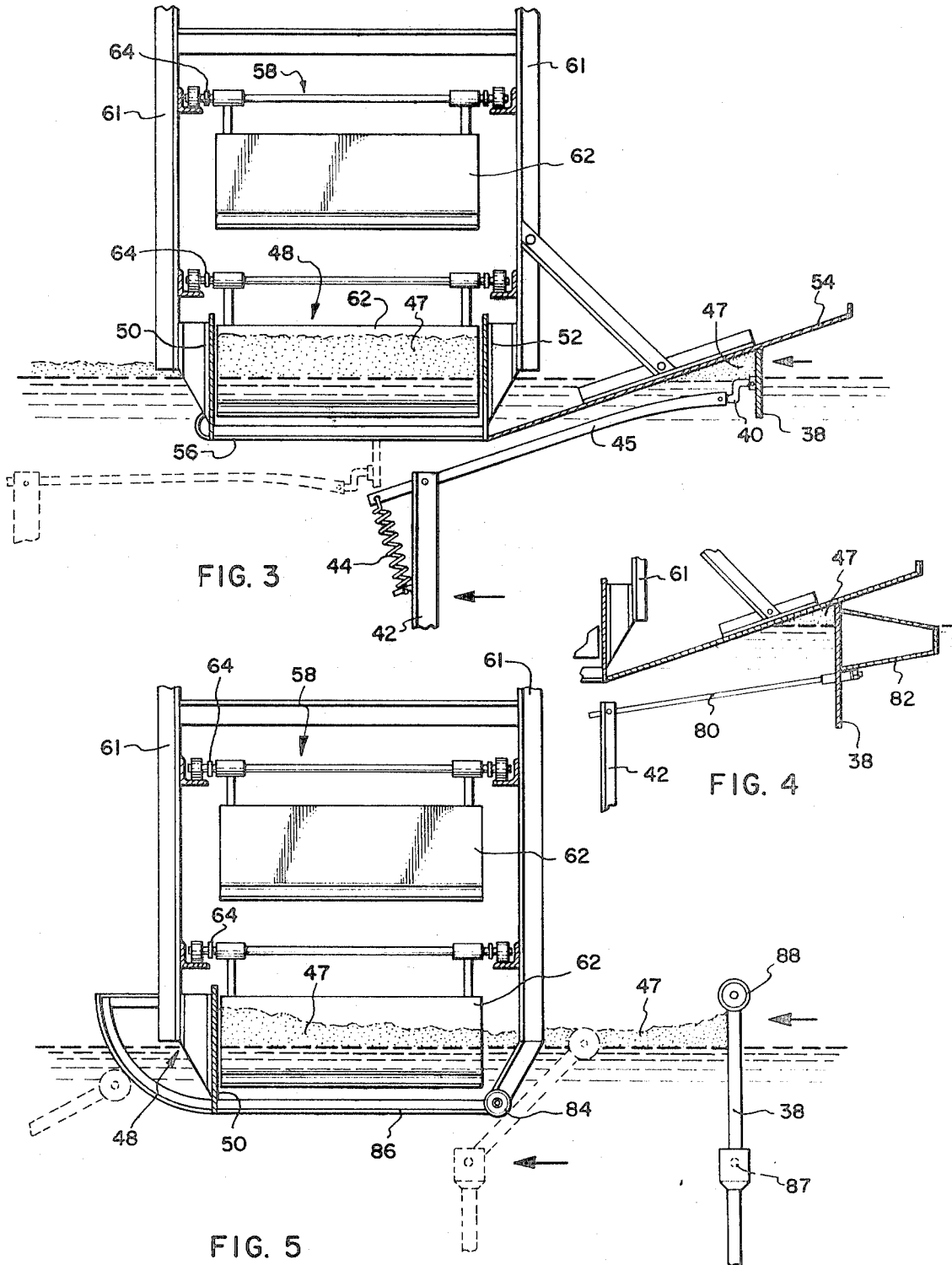


FIG. 2

INVENTORS
EARL M. KELLY
JACK W. PRATT
RALPH B. HAYMORE
JAY M. SMITH
BY *R. F. Bofanowski*
ATTORNEY



INVENTORS
EARL M. KELLY
JACK W. PRATT
RALPH B. HAYMORE
JAY M. SMITH
BY *R. F. Bofanowski*
ATTORNEY

SCUM-SKIMMING METHOD AND APPARATUS

BACKGROUND OF INVENTION

This invention relates generally to liquid clarifying apparatus and method and particularly to ways and means for positively removing large volumes of surface scum from liquid contained in various-sized tanks, including relatively large tanks.

DESCRIPTION OF PRIOR ART

Clarifiers for separation of materials from liquids by sedimentation and/or flotation are well known and are used extensively in the separation of solids from liquids.

Materials, such as waste oils, greases, food cannery wastes, and the like, are regularly separated from their carrying waters by flotation, followed by mechanical removal of the floated material.

In many cases, flotation occurs naturally. In others, it is induced by dispersing gas into the liquid to buoy up the float product. In the latter cases, it is important that the floated material be removed quickly; otherwise, the flotation gas may be dissipated, causing the material to resubmerge.

In accordance with prior practice, floating scum is carried toward the tank periphery by a slight current in the effluent or swept towards a peripheral discharge by an angled surface scraper.

At the periphery, the scum is engaged by a relatively short skimmer blade which pushes it up an approach ramp into a scum discharge trough for eventual discharge.

Although the above prior art techniques and designs are satisfactory for small-sized tanks or low scum volume, they are relatively inefficient, hence not suitable for use in tanks having a diameter of, for example, greater than 12-20 meters or where high volumes of scum have to be removed quickly.

Moreover, in such prior systems, there is no positive control of the scum removal rate to accommodate surges or other special conditions.

In general, therefore, it can be said that prior art flotation systems are limited to small diameter tanks and/or to installations developing only low volumes of stable scum and cannot be used economically or with any degree of reliability or flexibility in large-diameter tanks and/or in operations generating high volumes of scum.

OBJECTS OF INVENTION

It is a primary object of this invention to provide scum removal apparatus and method capable of handling large volumes of floated scum and to effect rapid discharge thereof under positive control.

Another object is to provide a way and means for removing scum efficiently from a wide range of sizes of circular tanks from 12-50 meters diameter at efficiencies comparable to those obtained in smaller tanks.

Still another object is to provide a scum collecting device capable of collecting and accumulating scum in a localized area for easy and efficient removal therefrom.

A further object is to provide apparatus for removing high volumes of aerated float material as quickly and as efficiently as possible without disturbing the material's floating characteristics.

Other objects of this invention will be more readily apparent from a perusal of this disclosure and drawings which follow.

SUMMARY OF INVENTION

The foregoing and other objects of this invention are attained in a clarifier by scum removal apparatus which includes a tank for holding a liquid feed material; a skimming blade mounted to span the tank and move across the entire area thereof at a predetermined normal elevation corresponding to the upper surface of liquid therein; a fixed, vertical baffle mounted to span the tank in the path of the moving skimming blade and extending between points above and below the

liquid surface; and means operative on the skimming blade to depress it as it approaches the baffle and hold it depressed while it passes therebeneath, then to return it to its normal elevation.

The term "span" as used in the present specification and claims applies to a variety of tank shapes. For instance, in a circular tank, a radial blade or baffle extending between a center pier and tank edge spans the tank. In a rectangular tank, a transversely extending blade or baffle spans the tank.

Although, with proper modifications, the invention may be embodied in rectangular tanks, it finds its greatest use in circular tanks. In a circular tank, the skimming blade which spans the tank is substantially radial and is mounted to rotate about the tank's center section so that as it rotates, the entire surface of the tank contents is skimmed or swept and floating scum is accumulated and pushed toward a radially extending scum-collecting zone.

The collecting zone is defined on one side by a fixed vertical baffle which spans the tank in the path of the skimming blade and extends above and below the liquid level. The skimming blade is biased, by springs or other means to be described, to normally ride in a plane at the liquid surface; and cam means, operating on the blade as it approaches the baffle, are provided to depress the blade below the collecting zone and the fixed baffle.

When this occurs, the accumulated scum is deposited in the collecting zone adjacent the fixed baffle. Separate conveying means are provided for engaging and moving the scum along the fixed baffle radially of the tank to a point of discharge.

In a particular modification of this invention, the scum-collecting zone is formed as an open, substantially radial disposal channel defined between a pair of parallel baffles. An inclined ramp is slanted upward from the submerged edge of the leading baffle to an elevation above the liquid level. The moving skimming blade follows the ramp downward below the liquid surface, pushing the accumulated scum ahead of it. As the scum passes under the open channel, it disengages from the blade and refloats into the channel. The blade then travels on past the second baffle before returning to its normal position adjacent the surface to resume its skimming action.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a partial top elevational view of a clarifier embodying the invention.

FIG. 2 is a sectional view taken in the plane of line 2-2 of FIG. 1.

FIG. 3 is a sectional view taken in the plane of line 3-3 of FIG. 2 and enlarged for clarity.

FIG. 4 is a sectional view illustrating a modified form of a skimming blade useful in the arrangement shown in FIG. 3.

FIG. 5 is a view looking at the end of a collecting trough, as in FIG. 3, but illustrating a still different modification of the invention.

In the drawings, in which like elements are designated by the same reference numerals, there is illustrated a circular clarifier tank 10 defined by sidewalls 12 and a bottom 14 and provided with an influent conduit 16 passing through the bottom into a centrally located feedwell 18 which is mounted for rotation about a central support pier 20. A peripheral launder 22 for effluent discharge is mounted on the tank wall. Scum is blocked from overflowing into the launder by an annular baffle 24 spaced inwardly from the launder and extending above and below the liquid surface. From conduit 16, feed passes into the feedwell, whence it disperses into the tank through vertical slots 26 in the feedwell wall. The feedwell is mounted on a drive cage 28 which, in turn, is connected for rotation with a conventional drive mechanism 29 supported by the center pier in usual fashion. Intermediate the feedwell and the drive cage is an annular deflector 31.

The feedwell serves as the torque tube and has trussed rake arms 30 extending radially therefrom over the tank floor. Upon rotation of the feedwell, the rake arms sweep over the

floor and the rake blades 32 move settled sludge to a sump 34 for discharge through a sludge outlet pipe 36.

A biased segmented blade 38 for skimming the surface of the liquid is mounted on the rake arms for rotation therewith through interconnecting tow rods 40 pivotally connected to a vertical post 42 through a lever arm 45, thereby to pull the blades across the surface of the liquid as the rake arms rotate. The blades are maintained at the liquid surface level by one or more springs 44 which bias or hold the blade normally in the upper or operative position.

As the skimming blade rotates, scum or other floating material 47 skimmed from the surface accumulates in front thereof and is pushed to a collection zone or compartment 48 defined by a pair of fixed baffles 50 and 52 which span the tank radially. The bottom edges of the baffles are below the liquid level and the upper edges above the scum level.

The leading or first baffle 52 has a ramp 54 coextensive with and connected to its bottom edge. The ramp extends upwardly at an angle of about 15°-45° to a point above the scum level. As the skimming blade is pulled about the tank, scum skimmed from the liquid accumulates ahead of the blade and is forced below the liquid surface by the blade as the latter follows the slanted ramp. As the scum passes under the leading baffle 52, it is released and refloats upwardly into the collection zone.

The skimming blade continues to rotate, being held in depressed position by the guide rails 56 attached to the bottom edges of the baffles. In effect, the down ramp and guide rails function as cams which overcome the biasing effect exerted by the spring 44.

After the skimming blade passes the second baffle, it becomes disengaged from the cams and is urged back to the surface by the spring and, upon resurfacing, resumes its skimming action about the tank.

A chain-driven rake blade apparatus 58, which extends between the tank walls 12 and the support pier 20, is suspended below the walkway 60 by trusses 61. Such conveyor comprises transverse flights 62 mounted on an endless chain 64 trained over a drive pulley 66 and an idler pulley 68 adjacent opposite ends of the channel. The blades dip into the liquid at the top of the collecting zone to push the scum along the channel, thence up a ramp 70 for delivery to a trough or sump 72 for discharge through a conduit 74.

In FIG. 4, a ramp and skimming blade is depicted that is essentially the same as that shown in FIG. 3 except that in place of a spring 44 for biasing the blades to the operative position, a float arrangement is provided. This comprises tow rods 80, which are pivotally attached at one end to vertical post 42 and at the other end to skimming blade 38. Floats 82 are mounted on the reverse face of the skimming blade and serve to maintain the blade normally at liquid level.

In FIG. 5, the collecting zone 48 is defined by a single fixed baffle 50 on one side and on the other side by the rotating skimming blade itself. As the skimming blade approaches the fixed baffle, it becomes substantially parallel thereto while the zone defined between the blade and baffle is being continuously reduced, thereby concentrating the scum. During this period of accumulation, the collected scum is continuously removed by the chain-driven rake blades 62.

The skimming blade of FIG. 5 backward normally held in an operative skimming position by biasing means, such as springs, counterweights, etc. In operation, the skimming blade remains upright until it reaches a predetermined point just ahead of the raking apparatus 58, where it engages a cam or roller 84 mounted on a submerged frame member at the leading side of the collecting zone. Curved guide rails 86 mounted transversely across the bottom edge of baffle 50 contact the skimming blade 38, tilting it backward about a pivot point 87. When the top of the blade reaches the guide rails 86, rollers 88 on the blade follow the rails which thus hold the blade in a depressed position until it passes the fixed baffle 60, whereupon the blade disengages from the rail and returns to its upright position by action of the housing means.

Although the invention has been described with reference to specific embodiments of the invention, it should be understood that certain changes in construction would be evident to one skilled in the art and would not depart from the spirit and scope of this invention, which is limited only by the claims appended hereto.

What is claimed is:

1. Float apparatus comprising a tank having a means for maintaining the surface of a liquid therein at a predetermined elevation; a skimming blade mounted to span said tank, means resiliently biasing said skimming blade to a normal skimming position in a plane parallel and adjacent to said predetermined elevation; means for moving said skimming blade across the full extent of said tank; a fixed baffle plate mounted in and spanning said tank in the path of said moving skimming blade, said baffle extending vertically from above to below said predetermined elevation to provide a float-collecting zone adjacent thereto; means to operatively engage said moving skimming blade at a fixed distance from said baffle to overcome the bias of said means resiliently biasing said skimming blade thereby to depress said skimming blade and hold it depressed during movement beneath said baffle and radially mounted raking means positioned upstream from said fixed baffle plate with respect to said skimming blade movement.

2. Apparatus according to claim 1, in which said means for depressing said skimming blade includes a cam associated with said baffle and a cam follower on said skimming blade cooperative with said cam to depress said blade against the urging of said means resiliently biasing said skimming blade during the time said skimming blade is moving beneath said baffle.

3. Apparatus according to claim 2, wherein said means resiliently biasing said skimming blade to said normal skimming position comprises float means on said skimming blade.

4. Apparatus according to claim 2, wherein said means resiliently biasing said skimming blade to said normal skimming position comprises a spring operative on said skimming blade.

5. In a liquid clarifying apparatus of the type comprising a tank open at the top for holding a scum-bearing liquid introduced therein and having scum removal apparatus comprising a substantially radial skimming blade mounted to rotate about the central portion of said tank at a predetermined elevation corresponding to the upper liquid level in the tank; the improvement comprising means for moving said blade across the full area of said tank thereby to accumulate scum ahead of said blade; a scum collecting zone defined on one side by a fixed baffle plate extending radially from said tank center and vertically from above to below the upper liquid level and located in the path of travel of said skimming blade; scum withdrawal means adjacent the face of the baffle for moving collected scum therealong to discharge; and means operative on said skimming blade to depress it below said scum withdrawal means and said fixed baffle plate on approach thereto and to elevate it back to said predetermined elevation after it rotates past said fixed baffle plate.

6. Apparatus according to claim 5, with the addition of a second baffle extending radially from the tank center and downwardly from an elevation above to an elevation below said predetermined elevation, said baffle being spaced apart from the first baffle to define therebetween an elongated scum collecting zone, said second baffle being located upstream from said first baffle with respect to skimming blade movement.

7. Apparatus according to claim 6, wherein the means operative on said skimming blade to depress it below said scum withdrawal means comprises a ramp extending upwardly from the bottom edge of said second baffle to terminate above the liquid level at a location upstream thereof with respect to skimming blade movement.

8. Apparatus according to claim 7, wherein said skimming blade is spring biased to said predetermined elevation, said

5

6

biasing being overcome by contact of said blade with said ramp.

9. Apparatus according to claim 5, in which said means operative on said skimming blade to depress it below said scum withdrawal means include guide rails mounted transversely to the bottom edge of said fixed baffle plate for engaging and guiding said skimming blade beneath said scum withdrawal means.

10. Apparatus according to claim 9, with the addition of rollers rotatably mounted to the top of said skimming blade for engaging said guide rails.

11. Apparatus according to claim 6, wherein said scum withdrawal means comprises a plurality of blades mounted transversely on an endless chain moving longitudinally of said elongated scum collecting zone for pushing scum to discharge.

12. Apparatus of claim 7, wherein said skimming blade is maintained at said predetermined elevation corresponding to the liquid level by float means on said skimming blade.

13. Method for accumulating and removing scum floating on the surface of a confined liquid comprising the steps of

- a. Moving said scum along the surface of the liquid toward a collecting zone,
- b. Confining said scum and directing the same below the surface of the liquid and into position beneath the collecting zone,
- c. Releasing said scum beneath said collecting zone, thereby permitting said scum to rise to the surface of the liquid within the collecting zone, and
- d. Removing said scum from the collecting zone.

* * * * *

20

25

30

35

40

45

50

55

60

65

70

75