

5 FMC 45-11788

Wear Strip Assembly for Use in a Waste Water Treatment Facility

Background of the Invention

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1. Field of the Invention

This invention relates to sludge collectors for removing sludge from rectangular settling tanks and more particularly to a wear strip assembly for supporting a flight for use
15 in sludge collection.

2. Description of Related Art

Sludge collectors are commonly used in waste water treatment plants to scrape
20 settled sludge from the bottom of the settling tank and also to skim floating waste off the surface of the waste water. These sludge collectors typically include a number of sludge flights which are usually elongated members that extend the width of the tank. The ends of the flights are connected to drive chains which carry flights in a circuit lengthwise along the bottom of the tank and back over the surface of the water to perform the scraping and
25 skimming functions.

Rectangular settling tanks used in waste water treatment facilities typically include field installed steel T-rails having floor wear bars disposed on the T-rails for supporting the flight when collecting sludge. The T-rails may be spliced together with separate steel plate splice bars and may be secured to the concrete floors of the settling tank by the use of
30 standard hardware. Alternatively, the floors of the settling tank may be poured without T-rails and the wear bars may be directly mounted to the concrete floors.

Because wear bars are often formed of non-metallic material, such as UHMW polyethylene, nylon, or polyurethane, they have a different coefficient of linear expansion than the concrete floors or steel T-rails to which they may be mounted and special design
35 considerations must be made. Wide variances in the ambient temperature within the concrete basins during installation or variances in water temperature when in final operation are common and therefore the wear bars may become loose, buckled, or otherwise out of line. Consequently, the flights may become jammed and may result in breakage of the chain supporting the flights.

5 Further, because wear bars are typically secured to the T-rail or concrete floor by screws or bolts, a portion of the wear bar surface is lessened due to the presence of these fasteners. Moreover, a multitude of fasteners may be needed to secure the wear bars to the concrete floors or T-rails, adding to the overall cost and field labor required. It is therefore desirable to have a wear bar that may be secured to the bottom of a settling tank without the
10 use of screws or bolts so that the total wear bar surface may be utilized and the installation is less costly, easier to install and easier to replace when necessary.

Summary of the Invention

15 There is provided an a wear strip assembly for use in a waste water treatment facility comprising at least one anchor plate secured to the bottom of a tank and at least one wear strip disposed around the anchor plate having a c-shaped cross section.

There is also provided a wear strip assembly for use in a waste water treatment facility comprising a plurality of anchor plates arranged in a longitudinal direction, each of
20 the anchor plates being secured to the bottom of a tank and a plurality of wear strips, each of the wear strips having a c-shaped cross section and being disposed around a number of the anchor plates.

There is further provided a waste water treatment systems comprising a settling tank comprising a wear bar expansion pocket in a rear end of the settling tank and a wear
25 strip assembly disposed upon a bottom of the tank. The wear strip assembly of the waste water treatment system comprises a plurality of anchor plates arranged in a longitudinal direction, each being secured to the tank bottom and a plurality of wear strips, each having a c-shaped cross section and being disposed around a number of the anchor plates. The plurality of wear strips may expand into the wear bar expansion pocket when the ambient
30 temperature of the concrete basin during installation or the temperature of the water during operation increases.

Brief Description of the Drawings

35 Figure 1 is a partial plan view of a flight disposed on the wear strip assembly of the present invention.

Figure 2 is a cross section of a wear strip.

Figure 3A is a top view of an anchor plate. Figure 3B is an end view of the anchor plate.

5 Figure 4 is a cross-sectional view taken along the lines C-C of Figure 1.
 Figure 5A is a top view of a stop plate. Figure 5B is a side view of the stop plate.
 Figure 6 is a cross sectional view taken along the lines A-A of Figure 1.
 Figure 7 is a cross sectional view taken along the lines B-B of Figure 1.
 Figure 8 is a cross sectional view of the rear end of the settling tank.
10 Figure 9 is a cross sectional view taken along the lines X-X of Figure 8.

Description of the Preferred Embodiments

 Referring now to Figure 1, there is shown a plan view of a flight 10 disposed upon
15 the wear strip assembly 12 of the present invention. The wear strip assembly 12 comprises
 at least a wear strip 14 and an anchor plate 34. Referring also to Figure 2, the wear strip 14
 is c-shaped in cross section.

 The wear strip 14 may, for example, be ten feet in length and have a cross sectional
 area of 2.75 inches squared. The c-shaped cross section is formed of a horizontal base 16
20 which may have a length 18 of 4.25 inches and a thickness 20 of 0.5 inches, transverse
 stems 22 which may have a height 24 of 0.625 inches and a thickness 26 of 0.3125 inches,
 and lips 28 which may have a height 30 of 0.3125 inches and a length 32 of 0.375 inches. A
 plurality of wear strips 14 are aligned along a longitudinal direction forming a wear bar 15.
 The wear strip 14 is preferably extruded UHMW polyethylene which, in the preferred
25 embodiment of the invention, is virgin material certified in accordance with ASTM
 specification D-4020-81, with a molecular weight of 4.0 million or greater, a relative
 abrasion resistance of twelve, an intrinsic viscosity of twenty four or greater, and a water
 absorption of zero.

 Referring also to Figures 3A and 3B, there is shown an anchor plate 34 of the
30 present invention. Preferably, the anchor plate 34 has a top plate 36 which may have a
 length 38 of 3.5 inches, a width 40 of 3.5 inches, and a height 42 of 0.1875 inches. The
 anchor plate 34 is secured to the bottom 44 of the tank 43 such that the top plate 36 is
 generally parallel with the tank bottom 44. Two legs 46 are disposed on the bottom side of
 the top plate 36 along the longitudinal direction of the wear bar 15 which may have a width
35 48 of 0.1875 inches and a height 50 of 0.5 inches. Preferably, in the example provided, the
 longitudinal ends of the legs 46 are shy from reaching the ends of the top plate 36 by
 approximately 0.25 inches at each end. Further, the legs 46 may be positioned such that
 they form extensions 52 in the top plate 36 because the sides of the legs 46 are shy from
 reaching the sides of the top plate 36 by approximately 0.375 inches.

5 The anchor plate 34 further comprises a bore 54 which may be centrally located on the anchor plate. Preferably, bore 54 is a cored 0.4375 inch diameter hole having a countersink for a 0.375 inch diameter flat head screw 62. A hub 56 is disposed on the bottom side of the top plate 36 around the bore 54. The cylindrical extension may have an outer diameter 58 of 0.75 inches, an inner diameter which matches the 0.375 inch diameter
10 of the bore 54 and a height 60 of 0.5625 inches. The height 50 of the legs 46 is slightly smaller than the height 60 of the hub 56 to allow for some clearance should the tank bottom 44 be uneven.

 Referring also to Figure 4, a flat head screw 62 secures the anchor plate 34 to the tank bottom 44. A plastic anchor 64 may be used to help secure the screw 62 to the tank
15 bottom 44. The anchor plate 34 receives the wear strip 14. Specifically, the lips 28 and stems 22 of the wear strip 14 are preferably slipped around the extensions 52 of the anchor plate 34. Preferably, there are at least three anchor plates for each ten foot section of the wear strip 14. Further, preferably, an anchor plate 34 is disposed approximately six inches from each of the ends of a given wear strip 14.

20 As stated, the wear strips 14 may each be ten feet in length and the wear strips may be aligned in a longitudinal direction. The wear strips 14 may be aligned, resulting in a wear bar 15 which may be, for example, three hundred feet in length. Preferably, there is a gap 66 of 0.5 inches between wear strips 14 when the wear strip assembly 12 is originally installed. This allows the wear strips 14 to extend somewhat along the longitudinal
25 direction should the temperature increase. Further, the ends of the wear strip 14 should be beveled at approximately forty five degrees as is commonly done in the industry for smooth transition of flight movement.

 The anchor plate 34 is preferably non-metallic and is molded as a single unit from polypropylene, UHMW polyethylene, or a similar non-metallic material. In the preferred
30 embodiment of the invention, the polypropylene has the following properties: a tensile strength of 500 psi, and elongation of 10-20%, a tensile modulus of 1.6×10^5 psi, a Rockwell hardness of 80-110, a flexural modulus of $1.7-2.5 \times 10^5$ psi, a specific gravity of 0.905, a specific volume of $30.4 \text{ in}^3/\text{Lb.}$, and a water absorption of 0.01-0.03% in 24 hours based on a 1/8 inch thick material.

35 Referring now to Figures 1, 5A, and 5B, the wear strip assembly 12 may further comprise a stop plate 70 which may be formed of stainless steel number 316. Stop plate 70 comprises a horizontal base 72, a first extension 74, and a second extension 76. The horizontal base 72 comprises a bore 78. Preferably, the horizontal base 72, first extension 74, and second extension 76 are welded together. Alternatively, they may be formed of a

5 single piece of stainless steel material or of the same material as anchor plate 34. The first extension 74 and the second extension 76 are sized such that the horizontal base 72 is generally parallel with the tank bottom 44 and such that there is sufficient room so that the stop plate 70 may be slid under the anchor plate 34.

10 The horizontal base 72 may be 2.875 inches in length, 2.25 inches in width, and 0.25 inches in thickness. The first extension 74 may be 0.375 inches in length, 4.25 inches in width, and 0.75 inches in thickness. The second extension 76 may be 0.25 inches in length, one inch in width, and 0.25 inches in thickness. Preferably all corners and edges of the horizontal base are ground in order to remove any sharp corners and edges. The bore is preferably a 0.8125 inch diameter hole which is centered approximately 1.78125 inches
15 from the edges of the extension 74.

Referring also to Figures 6 and 7, an anchor plate 34 is secured to the tank bottom 44 at one end of the plurality of wear strips which is disposed near the discharge end 80 of the flight 10 travel (i.e., near a sludge discharge end 80 of the concrete tank 43), as best illustrated in Figure 1. The stop plate 70 is slidably received at the bottom end of the
20 anchor plate 34. A screw 62 secures both the stop plate 70 and the anchor plate 34 to the concrete tank bottom 44 via the use of a plastic anchor 64. The screw is disposed through bore 78 in the stop plate 70 and bore 54 in the anchor plate. The stop plate helps prevent the expansion of the plurality of wear strips 14 toward the sludge discharge end 80 of the concrete tank 43.

25 Referring now to Figure 1, the flight 10, may be, for example, a flight manufactured by FMC Corporation, applicants' assignee. The flight 10 may be formed, for example, of fiberglass and may have floor scrapers 82 and 84 mounted to the center and ends, respectively, of the flight 10. The floor scrapers may be adjustably mounted to the flight 10 via bolts 86, slots 85 and 87 in the scrapers 82, 84, and slots 89 in the flight 10, as seen in
30 Figure 7.

The flight 10 may have a first pair of wear shoes 88 which may be secured to the flight 10 via bolts 90. The first pair of wear shoes 88 may be used when the flight is performing the skimming operation. The flight 10 may have a second pair of wear shoes 92 which may be secured to the flight 10 via bolts 94. The wear shoes 92 contact the wear bar
35 15 surface during sludge collection. Bolts 93 may secure the flight 10 to a chain, not shown, for transporting the flight.

UHMW polyethylene, from which the wear strips 14 are formed, tends to have a high coefficient of linear expansion as described earlier. The expansion generally occurs along the longitudinal direction of the wear strips 14. As mentioned earlier, the stop plates

5 70 prevent the wear strips 14 from expanding into the discharge end 80 of the tank 43. In order to allow for the expansion of the plurality of wear strips 14, a grout pocket 98 is formed in the rear end 96 of the tank 43, as shown in Figures 8 and 9. Further, a wear bar expansion pocket 99 is formed in the grout pocket 98.

10 The wear bar expansion pocket 99 is an indentation in the formation of the grout pocket 98 in the region where the wear bar 15 is located to allow for the expansion of the wear strips 14 toward the rear 96 of the tank 43. As best seen in Figure 8, the grout pocket 98 is formed in the rear 96 of the tank 43 in a region between the bottom 44 of the tank and the rear side wall 100 and is typically curved in cross section for allowing the flight 10 to move downward while collecting debris in the rear corner prior to entering the scraping
15 operation. Alternatively, the wear bar expansion pocket 99 may be formed directly into the concrete tank 43 without the use of a grout pocket 98. The anchor plates 34 serve as a guide for the expansion of the wear strips 14 toward the rear of the tank and for the contraction of the wear strips away from the rear of the tank.

20 The dimensions of the wear bar expansion pocket 99 and the grout pocket 98 depend upon the length of the tank 43. Specifically, the longer the tank, the greater the collective amount of expansion caused by the various wear strips 14. Further, the 0.5 inch spacing of the wear strips 14 during installation allows for additional room to which a given wear strip may expand before touching an adjacent wear strip 14.

25 Where the wear bar 15 is approximately 250 feet in length, the wear bar expansion pocket 99 should extend approximately one foot two inches along the longitudinal direction of the wear bar 15 from where the wear bar is scheduled to end (i.e., one foot two inches from the centerline of the shaft 101 which returns the flights 10 downward for the scraping operation). Further, the wear bar expansion pocket 99 is sized such that the wear bar 15 may easily extend into the wear bar expansion pocket 99. Where, for example, a wear strip
30 14 has a dimension 18 of 4.5 inches as shown in Figure 2, the width of the wear bar expansion pocket 99 may be six to seven inches. As shown in the example of Figures 8 and 9, the rearmost wear strip 14 has extended approximately one foot into the wear bar expansion pocket 99. The grout pocket 98 is preferably configured such that it begins in a region around the centerline of the shaft 101 and may extend, for example, by a distance
35 beyond the wear bar expansion pocket 99 of several inches.

As also seen in Figure 8, there is a 1/8 inch gap between the edge of the wear bar 15 and the tank bottom 44. This gap is desirable because the tank bottom 44 may be somewhat uneven.

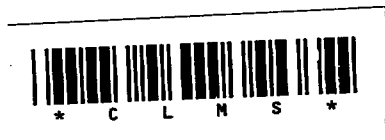
5 The anchor plates 34 may first be installed via the use of screws 62 and plastic
anchors 64 to secure the anchor plates 34 to the tank bottom 44. Further, a stop plate 70
may slide under the top plate 36 of the anchor plate 34 closest to the discharge end 80 of the
tank 43. Similarly, a screw 62 and a plastic anchor may be used to secure the stop plate 70
and anchor plate 34 to the tank bottom 44. The anchor plate 34 closest to the discharge end
10 80 of the tank 43 may be secured to the tank bottom 44 approximately where the discharge
end 80 of the tank 43 begins. The extension 74 of the stop plate 70 prevents the wear bar 15
from extending toward the discharge end 80 of the tank 43 should the temperature increase
and expansion occur.

 The wear strips 14 may then be slid onto the extensions 52 of the anchor plates 34.
15 As stated earlier, preferably there are three anchor plates 34 for a given wear strip 14, the
first and second being approximately six inches from each end of the wear strip where a ten
foot wear strip is employed and the third being positioned approximately half way in
between the first and second anchor plates during initial installation. However, as stated
above, the anchor plate 34 closest to the discharge end 80 of the tank 43 is not positioned
20 six inches from the end of the wear strip 14 but rather at the wear bar end. The anchor plate
34 closest to the rear end of the tank is preferably positioned six inches from the beginning
of the grout pocket 98 during initial installation. Should a given wear strip 14 become
damaged during the sludge collection process, the old wear strip may easily be removed by
cutting off the old wear strip and sliding on a new one.

25 It should be recognized that, while the present invention has been described in
relation to the preferred embodiments thereof, those skilled in the art may develop a wide
variation of structural details without departing from the principles of the invention.
Therefore, the appended claims are to be construed to cover all equivalents falling within
the true scope and spirit of the invention.

What is claimed is:

1. A wear strip assembly for use in a waste water treatment facility comprising:
at least one anchor plate secured to the bottom of a tank; and
at least one wear strip disposed around said anchor plate, said wear strip having a c-shaped cross section.
2. The invention of claim 1 wherein said anchor plate comprises a top plate being generally parallel with the bottom of said tank, a first leg and a second leg arranged along a bottom side of said anchor plate along a longitudinal direction, said first and second legs being disposed at opposing regions of said anchor plate at a distance from each side of said top plate forming extensions in said top plate for receiving said c-shaped wear strip.
3. The invention of claim 2 wherein said wear strip is slid onto said extensions on said anchor plate.
4. The invention of claim 1 further comprising a stop plate, said stop plate being disposed at one end of said wear strip for preventing said wear strip from expanding toward a sludge discharge end of said tank.
5. The invention of claim 1 wherein said wear strip comprises UHMW polyethylene material and said anchor plate comprises polypropylene material.
6. A wear strip assembly for use in a waste water treatment facility comprising:
a plurality of anchor plates arranged in a longitudinal direction, each of said anchor plates being secured to the bottom of a tank; and
a plurality of wear strips, each of said wear strips having a c-shaped cross section and being disposed around a number of said anchor plates.
7. The invention of claim 6 wherein each of said wear strips is disposed around three of said anchor plates.
8. The invention of claim 6 wherein said plurality of wear strips are disposed approximately one-half-of-an-inch apart along said longitudinal direction.



9. The invention of claim 6 wherein each of said anchor plates comprises a top plate being generally parallel with said bottom of said tank, a first leg and a second leg arranged along a bottom side of said anchor plate along a longitudinal direction, said first and second legs being disposed at opposing regions of said anchor plate at a distance from each side of said top plate forming extensions in said top plate for receiving said c-shaped wear strips.

10. The invention of claim 9 wherein each of said wear strips is slid onto said extensions in said anchor plate.

11. The invention of claim 9 wherein each of said anchor plates comprises a bore for receiving a fastener for securing each of said anchor plates to said tank bottom.

12. The invention of claim 6 wherein one anchor plate is secured to said tank at one end of said plurality of wear strips, said one end being disposed near a sludge discharge end of said tank, and a stop plate is slidably received at a bottom end of said one anchor plate for preventing the expansion of said plurality of wear strips toward said discharge end.

13. The invention of claim 12 wherein said stop plate comprises a horizontal base, a first extension at a first end of said horizontal extension for preventing said plurality of wear strips from expanding toward said discharge end and a second extension disposed at an opposing end of said horizontal base.

14. A waste water treatment systems comprising:

a settling tank comprising a wear bar expansion pocket in a rear end of said settling tank; and

a wear strip assembly disposed upon a bottom of said tank, said wear strip assembly comprising a plurality of anchor plates arranged in a longitudinal direction, each of said anchor plates being secured to said tank bottom and a plurality of wear strips, each of said wear strips having a c-shaped cross section and being disposed around a number of said anchor plates;

wherein said plurality of wear strips may expand into said wear bar expansion pocket when a temperature rise occurs.

15. The invention of claim 14 wherein each of said anchor plates comprises a top plate being generally parallel with said bottom of said tank, a first leg and a second leg arranged



along a bottom side of said anchor plate along a longitudinal direction, said first and second legs being disposed at opposing regions of said anchor plate at a distance from each side of said top plate forming extensions in said top plate for receiving said c-shaped wear strips.

16. The invention of claim 14 wherein each of said anchor plates comprises a bore for receiving a fastener for securing each of said anchor plates to said tank bottom.

17. The invention of claim 14 wherein one anchor plate is secured to said tank at one end of said plurality of wear strips, said one end being disposed near a sludge discharge end of said tank, said discharge end being disposed at an opposing end to said rear of said tank, and a stop plate is slidably received at a bottom end of said one anchor plate for preventing the expansion of said plurality of wear strips toward said discharge end.

18. The invention of claim 17 wherein said stop plate comprises a horizontal base, a first extension at a first end of said horizontal extension for preventing said plurality of wear strips from expanding toward said discharge and a second extension disposed at an opposing end of said horizontal base.

