United States Patent

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[54] SCRAPER STRUCTURE FOR STORAGE TANKS

19 Claims, 5 Drawing Figs.

[52] U.S. Cl. 220/26
[51] Int. Cl. B65d 87/18
[50] Field of Search ..... 220/26, 26 S, 26 D

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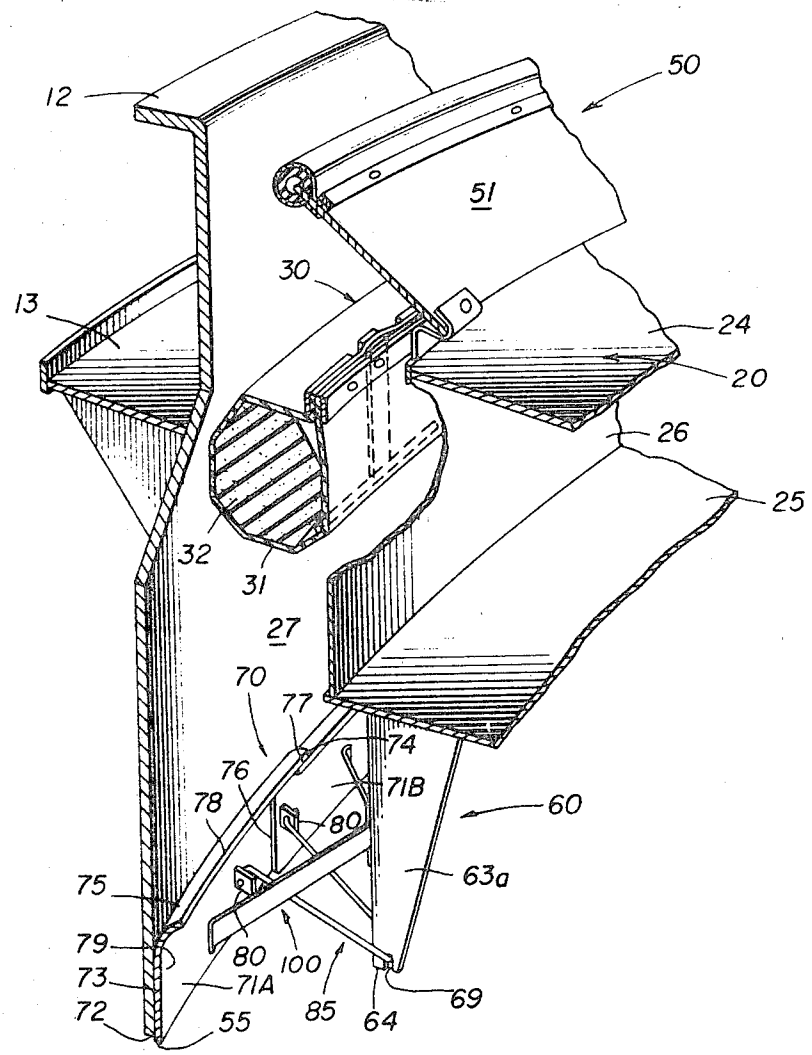
ABSTRACT: There is disclosed a scraper structure for petroleum storage tanks of the type having an upstanding cylindrical sidewall with an outer surface and an inner surface, a floating roof having a substantially cylindrical wall spaced inwardly from the inner surface of the tank sidewall thereby defining an annular space therebetween, and sealing means arranged in and sealing the annular space, the scraper structure being mounted on the cylindrical wall of the floating roof and spaced below the sealing means. The scraper structure includes a plurality of elongated plates arranged around and disposed against the inner surface of the tank sidewall, the adjacent ends of the adjacent plates overlapping, each of the plates having a lower edge in scraping contact with the inner surface of the tank sidewall, and including means for mounting the plates on the floating roof and means for yieldingly urging the plates toward and into contact with the inner surface of the tank sidewall.



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SHEET 1 OF 3

FIG. 1

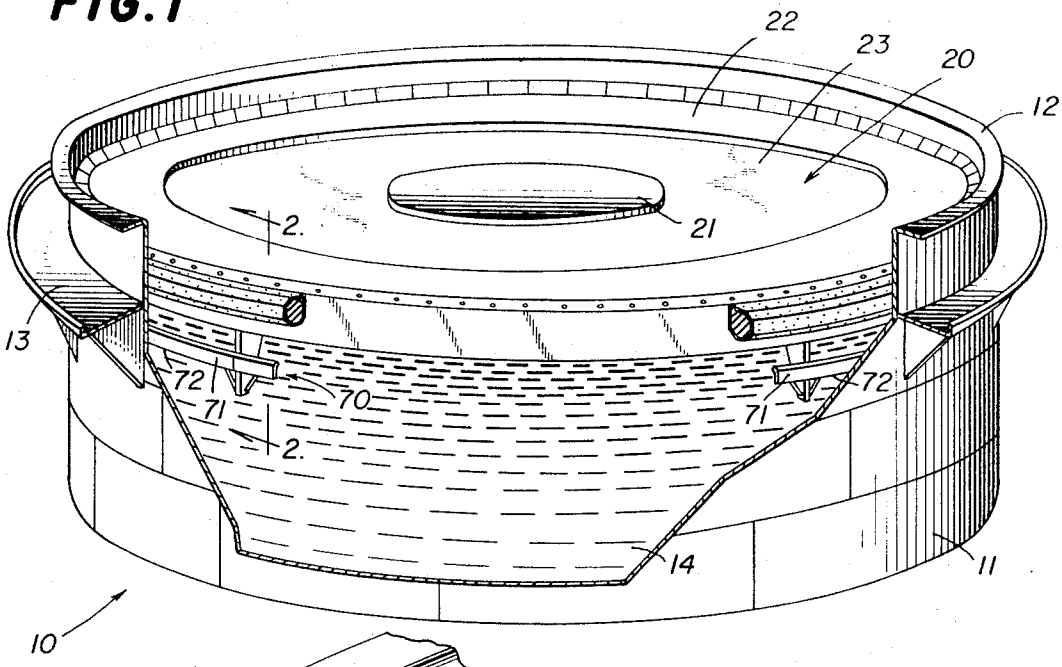

FIG. 2

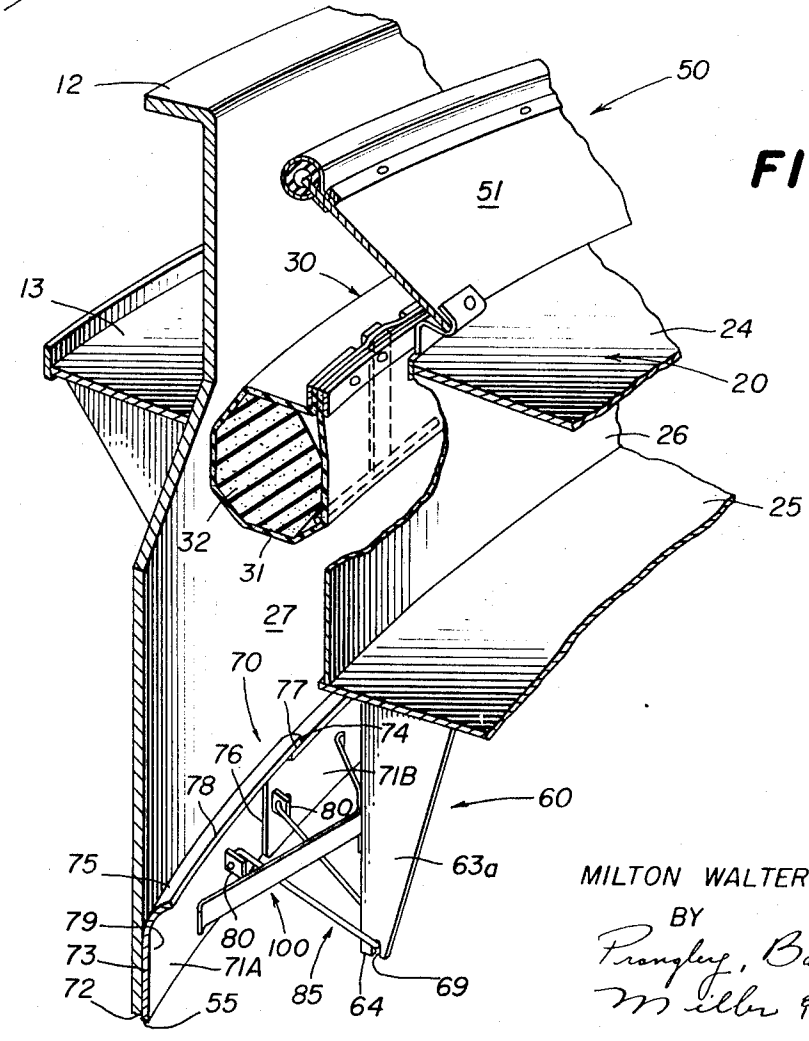

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FIG. 3

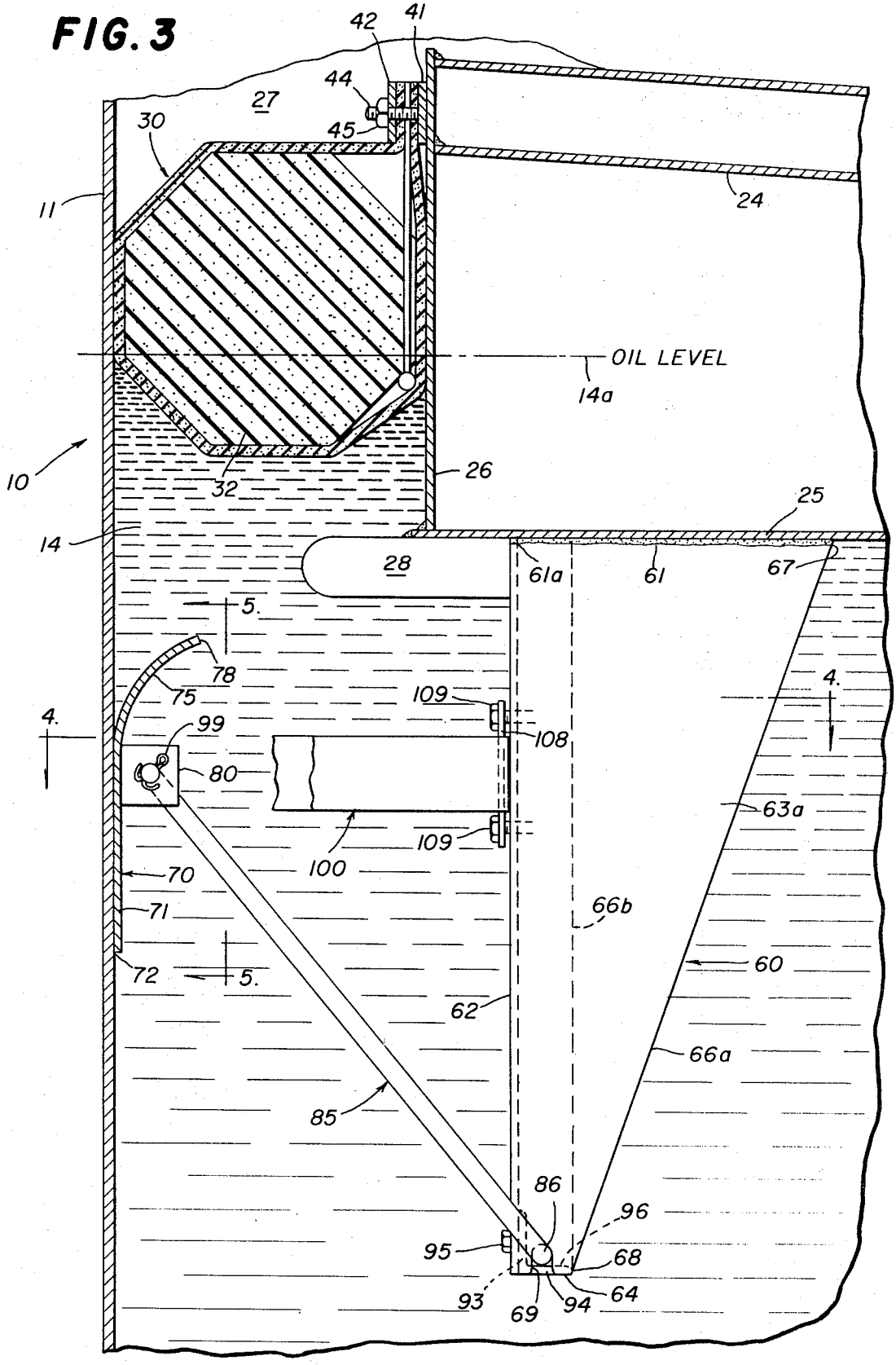
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FIG. 4

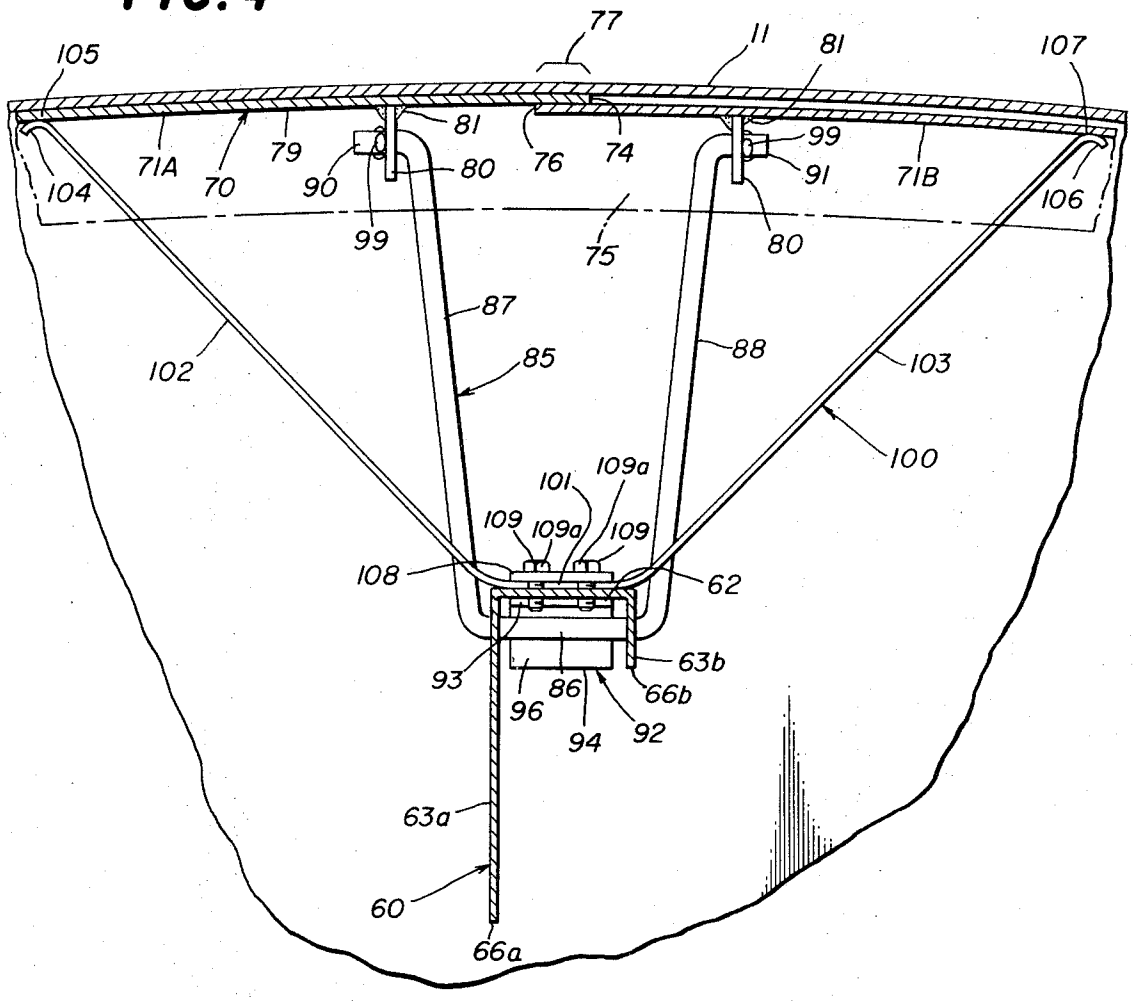
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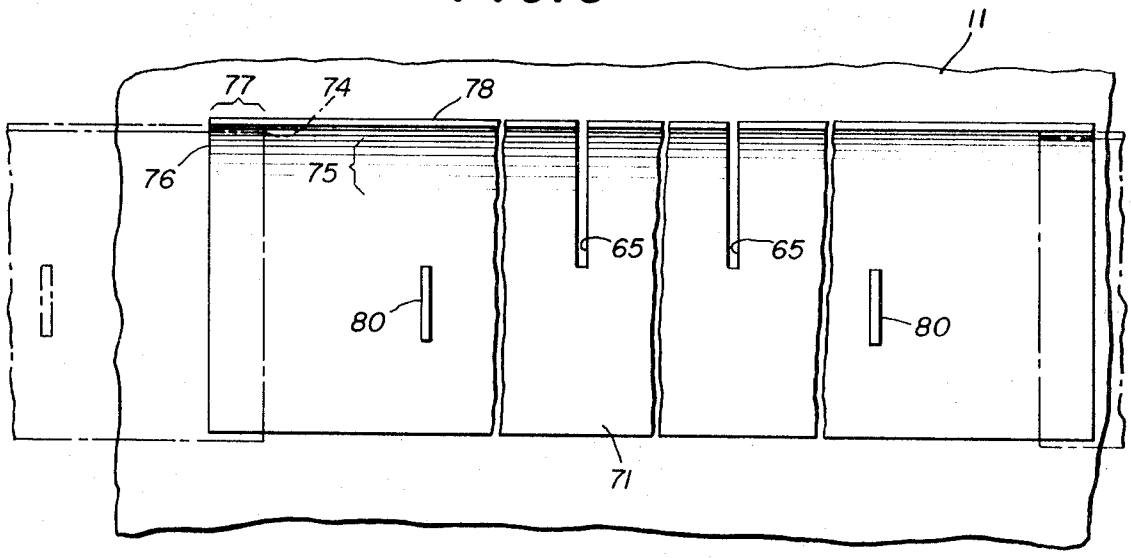
FIG. 5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SCRAPER STRUCTURE FOR STORAGE TANKS

This invention is directed to a scraper structure for a storage tank of the type for storing petroleum products, or the like, provided with a floating roof to which the scraper structure is mounted, whereby materials adhering to the inner surface of the tank sidewall are removed by the vertical downward movement of the scraper structure incident to the vertical downward movement of the floating roof as liquid is withdrawn from the tank.

It is an important object of this invention to provide an improved scraper structure comprising a plurality of overlapping elongated plates arcuate along the longitudinal axes thereof and arranged around and disposed against the inner surface of the tank sidewall, the lower edges of the plates being shaped generally complementary to the tank sidewall and being in scraping contact with the inner surface thereof. In connection with the foregoing object, it is another object of this invention to provide a scraper structure of the type set forth wherein the adjacent edges of the adjacent plates are slidably overlapping.

Still another object of this invention is to provide a scraper structure of the type set forth wherein the upper portion of each plate is curved in a direction transverse to the longitudinal axis thereof and extends laterally inwardly from the tank sidewall such that materials scraped from the inner surface of the tank sidewall are directed inwardly away from the sealing means and under the floating roof.

In connection with the foregoing object, it is a further object of this invention to provide a scraper structure of the type set forth wherein each of the plates has a plurality of longitudinally spaced-apart slots in the upper portion thereof extending transversely with respect to the longitudinal axis thereof to accommodate flexure of the plate in directions normal thereto.

Still another object of this invention is to provide a scraper structure of the type set forth wherein the plates are mounted on the floating roof by a plurality of hanger bars mounted on the floating roof, each hanger bar including a central portion pivotally mounted on the floating roof adjacent to the juncture between adjacent plates, a first leg pivotally mounted on one of the plates at the associated juncture and a second leg pivotally mounted on the adjacent plate at the associated juncture.

Yet another object of this invention is to provide a scraper structure of the type set forth which includes a plurality of springs, each spring having a central portion thereof mounted on the floating roof adjacent to the juncture between adjacent plates, and two spring members, each extending from the central portion of the spring and contacting adjacent plates respectively for urging the plates into contact with each other and with the inner surface of the sidewall.

Still another object of this invention is to provide a scraper structure of the type set forth wherein the spring arms are slidably disposed against the adjacent plates such that the spring arms are movable with respect to the plates.

Further features of the invention pertain to the particular arrangement of the parts whereby the above-outlined and additional operating features thereof are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings in which:

FIG. 1 is a top perspective view, partly broken away, of a tank for storing liquids, such as petroleum products, provided with a floating roof, sealing mechanism and scraper structure embodying the present invention;

FIG. 2 is an enlarged fragmentary top perspective view of a portion of the sidewall of the storage tank and an adjacent portion of the floating roof carrying the sealing mechanism and the scraper structure mentioned, this view being taken generally in the direction of the arrows along line 2–2 in FIG. 1;

FIG. 3 is an enlarged vertical sectional view of the sealing mechanism and scraper structure, as shown in FIG. 2;

FIG. 4 is an enlarged horizontal sectional view of the scraper structure, this view being taken in the direction of the arrows along line 4–4 in FIG. 3; and

FIG. 5 is an enlarged vertical fragmented view of certain ones of the scraper plates, this view being taken in the direction of the arrows along line 5–5 in FIG. 3.

Referring now to FIGS. 1 and 2 of the drawings, there is illustrated a tank 10 for storing liquids, such as petroleum products, that includes an upstanding substantially cylindrical sidewall 11 and provided with an open top bounded by an annular rim 12 and carrying an annular wind girder 13 arranged about the upper outer portion thereof and adjacent to and below the annular rim 12. Also an annular roof 20 of a piston-like construction is arranged in the tank 10 in floating relation with the stored liquid, indicated at 14; whereby the floating roof 20 rises and falls with respect to the sidewall 11 of the tank 10 in accordance with the height of the body of liquid 14 stored therein. As illustrated, the floating roof 20 comprises an inner structure defining a centrally disposed circular pontoon 21, an outer structure defining an outer annular pontoon 22, and a connecting structure defining an annular deck 23. As best shown in FIG. 2, the outer annular pontoon 22 comprises an upper annular plate 24, a lower annular plate 25, an outer upstanding annular rim 26, and an inner upstanding annular rim, not shown; wherein the outer annular rim 26, disposed in an upstanding position, is spaced radially inwardly from the tank sidewall 11 to define an annular space 27 therebetween.

The outer annular rim 26 of the outer annular pontoon 22 carries a sealing mechanism generally indicated at 30, comprising a substantially annular tubular casing 31 arranged in the annular space 27 and located above the liquid level, indicated at 14*a*, of the stored liquid 14, as shown in FIG. 3. An annular body 32 of self-supporting resilient material of cellular structure is enclosed by the casing 31; and the body 32 substantially completely fills the casing 31; whereby the casing 31 constitutes an outer wrapper for the body 32. The casing 31 is attached to the top of the annular rim 26, so that the casing 31 and the body 32 enclosed thereby are movable with the floating roof 20 and relative to the tank sidewall 11. The precise construction and method of operation of the sealing mechanism 30 are more particularly described in U. S. Patent No. 3,307,733 granted on March 7, 1967 to Walter L. DeBock, the disclosure of that patent being incorporated herein by reference.

The annular rim 26 further carries a weather hood 50 that may comprise a plurality of individual sections 51 and that may be of the construction and arrangement of that disclosed in U. S. Patent No. 2,997,200,granted on Aug. 22, 1961, to Anthony P. Giannini and Eli F. Smith. The weather hood 50 projects upwardly and outwardly from the top of the annular rim 26 and over the top of the annular space 27 and thus over the sealing mechanism 30 and into engagement with the interior surface of the tank sidewall 11; whereby the weather hood 50 protects the sealing mechanism 30 from the elements of weather and prevents entry of such elements through the annular space 27 and thus into the interior of the tank 10.

As is best shown in FIGS. 2 and 3, the lower annular plate 25 carries a mounting bracket 60 depending therefrom and spaced laterally inwardly with respect to the outer upstanding annular rim 26, which mounting bracket 60 supports the scraper structure 70 embodying this invention. The mounting bracket 60 includes a top attachment flange 61 which is mounted to the underside of the lower annular plate 25, such as by welding or other such suitable means; a side support panel 62 depending from the forward edge 61*a* of the top attachment flange 61 substantially normal with respect thereto, the side support panel 62 being spaced inwardly from the outer upstanding annular rim 26; and a pair of parallel sidewalls 63*a* and 63*b* extending downwardly from the top attachment flange 61 in normal relationship thereto and extend-

ing rearwardly from the side support panel 62 and in normal relation with respect thereto. The side walls 63*a* and 63*b* are respectively provided with bottom edges 64 which are disposed substantially parallel to the lower annular plate 25. The length of the bottom edge 64 of the sidewall 63*a* is substantially shorter than the length of the top edge thereof, the sidewall 63*a* having a rear edge 66*a* extending diagonally downward from the rear edge 67 of the top attachment flange 61 to the rear end 68 of the associated bottom edge 64. The sidewall 63*b* has a rear edge 66*b* disposed substantially parallel to the side support panel 62 and extending substantially vertically downwardly from the top attachment flange 61 to the rear end of the associated bottom edge 64.

Each of the sidewalls 63*a* and 63*b* is further provided with an inverted U-shaped slot 69 along the bottom end thereof. The open ends of the slots 69 are positioned along the bottom edges 64 of the sidewalls 63*a* and 63*b*, respectively, with the closed ends of the slots 69 being spaced upwardly therefrom. These slots 69 cooperate to engage the central portion of a hanger bar 85 from which the scraper structure 70 is supported, as will be more fully described hereinafter.

The arrangement of the scraper structure embodying the present invention as incorporated in a storage tank is generally shown in FIG. 1 of the drawings. The scraper structure 70 generally includes a plurality of elongated plates 71 arranged around the inner surface of the tank side wall 11 and disposed thereagainst, each of the plates 71 being arcuate along the longitudinal axis thereof such that the plates 71 are complementary to the inner surface of the tank sidewall 11 as illustrated in FIG. 1. The details of the construction of the scraper structure 70 are more clearly shown in FIGS. 2 through 5.

As indicated above, the scraper structure 70 consists of a plurality of elongated plates 71, each having top, bottom and side edges, and each of which is arcuate along the longitudinal axis thereof such that the plates 71 are complementary to the inner surface of the tank sidewall 11. The longitudinal dimension of each plate is considerably greater than the vertical dimension thereof, the precise dimensions of the plates being dependent upon the size of the storage tank in which such plates are utilized. The configuration of one of such plates is shown more clearly in FIG. 2 wherein there is illustrated a first plate 71A having a pair of side edges 73 and 74, a bottom edge 55 and a top edge 78.

The forward corner of the bottom edge 55 of the plate 71A constitutes a scraping edge 72, which is similarly arcuate along the longitudinal axis of the plate 71A and spaced complementary to the inner surface of the tank sidewall 11 such that the scraping edge 72 is in scraping contact therewith. In the embodiment illustrated in the drawings herein, the forward corner forming the scraping edge 72 is a 90° angle corner. However, the angle of this corner may be less than 90° so as to form a more prominent scraping edge.

The upper portion 75 of the plate 71A is curved in a direction transverse to the longitudinal axis thereof and extends laterally inwardly with respect to the tank sidewall 11, the curved portion 75 being spaced immediately below the sealing mechanism 30. The curved portion 75 serves the purpose of deflecting those materials which are scraped from the inner surface of the tank sidewall 11 laterally inwardly away from the sealing mechanism 30 and under the floating roof 20, thereby eliminating the danger of any buildup of wax or gummy deposits in the annular space 27 under the sealing mechanism 30. In addition, the curved upper portion 75 enables the plate 71A to slide over any deposits which may adhere to the inner surface of the tank sidewall 11 as the floating roof 20 rises during the filling cycle.

Referring now to FIGS. 2 and 4, it will be observed that the adjacent edges of adjacent plates are arranged in overlapping configuration in a normally circular storage tank. Referring more specifically to FIG. 2, there is shown a first plate 71A having side edges 73 and 74 and a second adjacent plate 71B having a first side edge 76 and a second side edge (not shown). The adjacent edges 74 and 76 of adjacent plates 71A and 71B are in overlapping arrangement as indicated at 77. The overlapping edges 74 and 76 are slidable with respect to one another such that the plates 71A and 71B may be slid apart. This overlapping arrangement is provided in order to accommodate irregularities which may exist in the tank sidewall 11, and more particularly, to accommodate any out-of-roundness portions existing in the tank sidewall 11, the precise manner in which the plates are urged to slide apart being more fully described hereinafter.

The upper portion 75 of the plates 71 is provided with a plurality of longitudinally spaced-apart slots 65, as more clearly shown in FIG. 5 of the drawings. These slots 65, are provided in order to accommodate flexure of the plate 71 in directions normal with respect to the plate 71 as the plate is caused to move upwardly or downwardly, or in sidewise movement as the floating roof 20 is caused to move in any of these directions.

The inner surface 79 of each of the plates 71 is provided with a pair of upstanding flanges 80 which are secured to the inner surface of the plate 71 by a weldment 81 or other such suitable means (FIG. 4). Each upstanding flange 80 is provided with an orifice (not shown) centrally positioned in the flange body. This orifice is adapted to receive an out-turned foot portion from the leg of a hanger bar for mounting the plate 71 to the floating roof 20 as will be more fully described hereinafter. Each upstanding flange 80 is positioned inwardly from the plate edge 74 a distance equal to about one-quarter of the length of the plate and disposed in normal relationship with respect to the plate 71A. The precise positioning of the upstanding flanges 80 along the inner surface 79 of the plates 71 is primarily determined by stability requirements necessary for maintaining the plates 71 in mounting relationship with respect to the floating roof 20 in a manner sufficient to maintain scraping contact with the inner surface of the tank sidewall 11.

The plates 71 are provided around the total circumference of the inside surface of the tank sidewall 11, as mentioned previously. The number of plate segments which are necessary for a given tank is primarily dependent upon the length of each plate as well as the circumference of the tank. For example, where the diameter of the tank is about 180 feet and each plate measures 6½ feet in length, approximately 90 plate segments are necessary in order to form a complete ring around the inside circumference of the tank. Of course, the total end-to-end length of all of the plate segments will be greater than the circumference of the inside surface of the tank wall to accommodate the plate area taken up by the overlapping edges of each of the adjacent plates.

The plates 71 are supported from the floating roof 20 by a plurality of hanger bars 85 mounted on the mounting brackets 60 which depend from the lower annular plate 25 of the floating roof 20 as previously described. Each hanger bar 85 includes a central portion 86, which is substantially parallel to the horizontal axis of the side support panel 62; a first leg 87 which extends outwardly toward a first plate 71A; and a second leg 88 which extends outwardly to a second plate 71B adjacent the first plate 71A, as more clearly shown in FIG. 4. The first leg 87 is provided with an out-turned foot portion 90 at the outer end thereof, and similarly the second leg 88 is also provided with an out-turned foot portion 91 at the outer end thereof.

The central portion 86 is fitted within the inverted U-shaped slots 69 provided in the parallel sidewalls 63*a* and 63*b* of the mounting bracket 60. The central portion 86 is securely held within the U-shaped slots 69 by means of an angle iron 92 shown in vertical cross section in FIG. 3. The angle iron 92 includes a vertical flange 93 which is secured to the inner surface 62*a* of the side support panel 62 by means of a threaded bolt 95 (FIG. 3) extending through orifices (not shown) provided in the side support panel 62 and the vertical flange 93, and a support flange 94 which is integral with the vertical flange 93 and extends laterally inwardly therefrom and in normal relationship thereto, the support flange 94 being fitted

between the sidewalls 63*a* and 63*b* along the bottom ends 64*a* and 64*b* thereof. The upper surface 96 of the support flange 94 provides a support platform against which the central portion 86 of the hanger bar 85 rests. In this manner, the central portion 86 of the hanger bar 85 is securely locked within the U-shaped slots 69 in such a manner as to allow pivotal movement of the central portion 86 of the hanger bar 85 within the slots 69 with respect to the mounting bracket 60.

As mentioned above, the hanger bar 85 includes a pair of legs 87 and 88 which extend outwardly toward adjacent plates, as is more clearly shown in FIG. 4 of the drawings. The first leg 87 extends outwardly toward the first plate 71A, the outer end of the leg 87 being formed into an out-turned foot portion 90 which fits through the orifice provided in the upstanding flange 80 along the inner surface 79 of the first plate 71A. Similarly, the second leg 88 extends outwardly toward the second plate 71B, which is adjacent the first plate 71A, the outer end of the leg 88 also being formed into an out-turned foot portion 91 which fits through the orifice provided in the upstanding flange 80 along the inner surface of the second plate 71B. The out-turned foot portions 90 and 91 are securely held in engagement with the upstanding flanges 80 by means of cotter pins 99 which are inserted through appropriate apertures provided in the out-turned foot portions 90 and 91. In this manner, the legs 87 and 88 are mounted in pivotal engagement with the plates 71A and 71B while the central portion 86 of the hanger bar 85 is mounted in pivotal engagement with the mounting bracket 60 as previously described. Hence, the plates 71 are mounted to the floating roof 20 in pivotal engagement by the hanger bar 85 such that the plates 71 are movable vertically with respect to the tank sidewall 11 as the floating roof 20 is caused to move in sidewise directions, while still maintaining scraping contact between the plates 71 and the tank sidewall 11. Any other suitable means may be provided for securing the plates 71 to the floating roof 20 so long as such means enables the plates 71 to be movable vertically with respect to the tank sidewall 11, while still being held in scraping contact therewith, in order to accommodate movement of the floating roof 20 in sidewise directions.

The hanger bars 85 are formed of a relatively rigid material which yet has sufficient resiliency to enable the legs 87 and 88 of the hanger bar 85 to stretch apart and return to their normal position. Hence, where the plates encounter surface irregularities, such as out-of-roundness in the tank sidewall 11, the plates 71 are urged to slide apart, as will be more fully described hereinafter. The legs of the hanger bars must be sufficiently yieldable to cooperate with the sliding movement of the plates and sufficiently resilient to return to their normal position and therefore urge the plates together as the plates once again encounter a normally round tank surface. A suitable material for the hanger bars includes steel bars as well as other such materials which have some resiliency.

The mounting brackets 60 also carry a plurality of springs 100 which are mounted thereon. Each spring 100 includes a central portion 101 which is mounted to the side support panel 62 of the mounting bracket 60, and further includes a pair of spring members 102 and 103 extending from the central portion to adjacent plates 71A and 71B, as is more clearly shown in FIG. 4 of the drawings. The first spring member 102 extends from the central portion 101 to a distal end which is formed into an inwardly curved flange 104, thereby providing a curved outer surface 105 which is in sliding contact with the inner surface 79 of the first plate 71A. Similarly a second spring member 103 extends from the central portion 101 outwardly therefrom and toward a second plate 71B adjacent the first plate 71A, the distal end of which second spring member 103 is also formed into an inwardly curved flange 106, thereby providing a curved surface 107 in sliding contact with the inner surface of the plate 71B.

The central portion 101 is securely mounted to the side support panel 62 of the mounting bracket 60 by means of threaded bolts 109 which are threaded through openings provided in the central portion 101 and the side support panel 62. A spacer plate 108 is provided between the heads 109*a* of the threaded bolts 109 and the central portion 101 of the spring 100, the spacer plate 109 providing a secure mounting of the central portion 101 to the side support panel 62 throughout the entire surface area thereof.

The spring members 102 and 103 are respectively in sliding engagement with plates 71A and 71B and yieldingly urge the plates into contact with each other and with the inner surface of the tank sidewall 11. As the floating roof 20 moves vertically downward during the pumpout cycle of the tank 10, and the plates 71A and 71B encounter surface irregularities such as out-of-roundness portions of the tank sidewall 11, the spring members 102 and 103 urge the plates to slide apart such that the plates 71A and 71B maintain scraping contact with the inner surface of the tank sidewall 11, and more particularly to insure that the scraping edge 72 is in scraping contact therewith. For this purpose, the springs 100 are of the "-compression" type being formed of a suitable resilient steel material.

A hanger bar 85 and a spring 100 are provided for each juncture of overlapping edges of adjacent plates. As a result, each edge of each plate 71 has one leg of a hanger bar 85 pivotally engaged to the respective upstanding flange 80 which is provided adjacent that edge, and each edge further has one spring member of each spring slidably disposed against the inner surface 79 of the plate 71 thereat. The mounting bracket 60, hanger bar 85 and spring 100 are mounted in horizontal alignment adjacent the associated juncture of overlapping edges of adjacent plates, and more precisely, are in horizontal alignment with the centerline of overlap of respective adjacent plate edges. In other words, a mounting bracket 60, a hanger bar 85, and a spring 100 are provided at each juncture of overlapping edges of adjacent plates throughout the total circumference of the scraper structure 70.

In operation, as liquid is pumped out of the tank 10, the floating roof 20 moves vertically downward thereby also causing the mounting bracket to move vertically downward. The scraper structure 70, being mounted to the mounting bracket 60 by means of the hanger bars 85 are similarly caused to move vertically downward during the pumpout cycle and will be held in scraping contact with the inner surface of the tank sidewall 11 by means of the springs 100 which yieldingly urge the plates 71 against the sidewall 11. As irregularities are encountered in the surface of the tank sidewall 11, the springs 100 urge the plates 71 to slide apart in order to maintain the plates 71 in scraping contact with the tank sidewall 11. As waxes or other gummy deposits are scraped from the tank sidewall 11, these materials will fall and settle along the bottom surface of the tank 10. The curved upper portion 75 of the plates 71 prevent any scraped materials from accumulating in the annular space 27 provided between the floating roof 20 and the tank sidewall 11 by directing such materials laterally inwardly away from the sealing mechanism 30 and under the floating roof 20, the materials ultimately settling to the bottom surface of the tank. During the filling cycle of the tank 10, as liquid is pumped into the tank 10, the floating roof 20 is caused to move vertically upward thereby moving the mounting brackets 60 and the scraper structure 70 mounted thereon in a vertically upward direction. The curved portions 75 of the plates 71 facilitate the vertical upward movement of the scraper structure 70 by enabling the plates 71 to slide over any deposits which remain adhering to the inner surface of the tank sidewall 11.

The scraper structure described herein has been illustrated in connection with storage tanks of the type having a floating roof and foam or liquid soft seals as described herein and in greater detail in U. S. Patent No. 3,307,733 mentioned previously herein. However, the scraper structure embodying this invention may equally be applied to storage tanks of the type having floating roofs and metal shoes as the sealing mechanism, such as those described in U. S. Patent No.

2,846,110 granted on Aug. 5, 1958 to Clifford E. Stoyer and U. S. Patent No. 2,960,252 granted on Nov. 15, 1960 to Reign C. Ulm.

In view of the foregoing description, it is apparent that there has been provided in a tank for storing liquids, such as petroleum products, and including a floating roof, and a sealing mechanism for the annular space disposed between the upstanding annular sidewall of the tank and the upstanding annular rim of the floating roof, an improved scraper structure for removing wax deposits adhering to the inner surface of the tank sidewall incident to the vertical downward movement of the floating roof as liquid is withdrawn from the tank.

While there has been described what is at present considered to be the preferred embodiment of this invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What I claim is:

1. In a tank for storing liquids such as petroleum products, including an upstanding cylindrical sidewall having an outer surface and an inner surface, a floating roof arranged in said tank and including an upstanding substantially cylindrical wall structure spaced radially inwardly from said cylindrical sidewall and defining a substantially annular space therewith, and sealing means attached to said roof wall structure and arranged in and sealing said annular space; a scraper structure mounted on said floating roof for scraping the inner surface of said cylindrical sidewall, said scraper structure comprising a plurality of elongated arcuate plates arranged in substantially end-to-end relation circumferentially around the inner surface of said sidewall and disposed thereagainst, the adjacent end portions of adjacent ones of said plates overlapping, each of said plates having a lower arcuate edge shaped generally complementary to said sidewall and in scraping contact with the inner surface thereof, means for mounting said plates on said roof wall structure below and apart from the sealing means mounting structure such that said plates are movable with said floating roof, and means yieldingly urging said overlapping plates toward and into contact with the inner surface of said sidewall, whereby materials adhering to the inner surface of said sidewall are removed by the vertical downward movement of said scraper structure incident to the vertical downward movement of said floating roof as liquid is withdrawn from said tank.

2. The scraper structure as set forth in claim 1, wherein said plate end portions are slidably overlapping.

3. The scraper structure as set forth in claim 1, wherein said means for mounting said plates comprise a plurality of support bars mounted on said floating roof for supporting said plates from said floating roof.

4. The scraper structure as set forth in claim 1, wherein said means for yieldingly urging said overlapping plates toward and into contact with the inner surface of said sidewall comprise a plurality of springs mounted on said floating roof and each yielding engaging the adjacent ones of said plates.

5. In a tank for storing liquids such as petroleum products, including an upstanding cylindrical sidewall having an outer surface and an inner surface, a floating roof arranged in said tank and including an upstanding substantially cylindrical wall structure spaced radially inwardly from said cylindrical sidewall and defining a substantially annular space therewith, and sealing means attached to said roof wall structure and arranged in and sealing said annular space; a scraper structure mounted on said floating roof and disposed therebelow for scraping the inner surface of said cylindrical sidewall, said scraper structure comprising a plurality of elongated arcuate plates arranged in substantially end-to-end relation circumferentially around the inner surface of said sidewall and disposed thereagainst, the adjacent end portions of adjacent ones of said plates overlapping, each of said plates having a lower arcuate edge shaped generally complementary to said sidewall and in scraping contact with the inner surface thereof, each of said plates having the upper portion thereof curving radially inwardly from said sidewall, means for mounting said plates on said roof wall structure below said sealing means such that said plates are movable with said floating roof, and means yieldingly urging said overlapping plates toward and into contact with the inner surface of said sidewall, whereby materials adhering to the surface of said sidewall are removed by the vertical downward movement of said scraper structure incident to the vertical downward movement of said floating roof as liquid is withdrawn from said tank and are directed by the upper portions of said plates inwardly away from said sealing means and under said floating roof.

6. The scraper structure set forth in claim 5, wherein each of said plates has a plurality of longitudinally spaced-apart slots in said upper portion thereof extending transversely thereof to accommodate flexure of said plate in directions normal thereto.

7. In a tank for storing liquids such as petroleum products, including an upstanding cylindrical sidewall having an outer surface and an inner surface, a floating roof arranged in said tank and including an upstanding substantially cylindrical wall structure spaced radially inwardly from said cylindrical sidewall and defining a substantially annular space therewith, and sealing means attached to said roof wall structure and arranged in and sealing said annular space; a scraper structure mounted on said floating roof for scraping the inner surface of said cylindrical sidewall, said scraper structure comprising a plurality of elongated arcuate plates arranged in substantially end-to-end relation circumferentially around the inner surface of said sidewall and disposed thereagainst, the adjacent end portions of adjacent ones of said plates overlapping, each of said plates having a lower arcuate edge shaped generally complementary to said sidewall and in scraping contact with the inner surface thereof, a plurality of support bars mounted on said floating roof adjacent to the junctures between adjacent plates for supporting said plates from said floating roof below and apart from the sealing means mounting structure such that said plates are movable with said floating roof, each of said support bars being connected to both of the plates at the associated juncture, and means disposed adjacent to the junctures between adjacent plates for yielding urging said overlapping plates toward and into contact with the inner surface of said sidewall, whereby materials adhering to the inner surface of said sidewall are removed by the vertical downward movement of said scraper structure incident to the vertical downward movement of said floating roof as liquid is withdrawn from said tank.

8. The scraper structure as set forth in claim 7, wherein each of said support bars includes a central portion pivotally mounted to said floating roof, a first leg pivotally mounted on one of said plates at the associated juncture, a second leg pivotally mounted on the other plate at the associated juncture.

9. In a tank for storing liquids such as petroleum products, including an upstanding cylindrical sidewall having an outer surface and an inner surface, a floating roof arranged in said tank and including an upstanding substantially cylindrical wall structure spaced radially inwardly from said cylindrical sidewall and defining a substantially annular space therewith, and sealing means attached to said roof wall structure and arranged in and sealing said annular space; a scraper structure mounted on said floating roof for scraping the inner surface of said cylindrical sidewall, said scraper structure comprising a plurality of elongated arcuate plates arranged in substantially end-to-end relation circumferentially around the inner surface of said sidewall and disposed thereagainst, the adjacent end portions of adjacent ones of said plates overlapping, each of said plates having a lower arcuate edge shaped generally complementary to said sidewall and in scraping contact with the inner surface thereof, means for mounting said plates on said roof wall structure below the sealing means mounting structure such that said plates are movable with said floating roof, and a plurality of springs mounted on said floating roof ad-

jacent to the junctures between adjacent plates, each of said springs having two spring members respectively engaging the plates at the associated juncture for urging said plates into contact with each other and into contact with the inner surface of said sidewall, whereby materials adhering to the inner surface of said sidewall are removed by the vertical downward movement of said scraper structure incident to the vertical downward movement of said floating roof as liquid is withdrawn from said tank.

10. The scraper structure as set forth in claim 9, wherein each spring includes a central portion mounted on said floating roof, a first arm extending from said central portion and disposed against one of said plates, a second arm extending from said central portion and disposed against a second plate adjacent said first plate, said first and second arms yieldingly urging said overlapped edges of said plates toward and into contact with said inner surface of said sidewall.

11. The scraper structure as set forth in claim 10, wherein said first and second arms are disposed against said adjacent plates at opposing points spaced longitudinally inwardly from the free ends of said end portions a distance equal to about one-quarter of the length of said plates.

12. The scraper structure as set forth in claim 10, wherein said first and second arms are slidably disposed against said adjacent plates.

13. In a tank for storing liquids such as petroleum products, including an upstanding cylindrical sidewall having an outer surface and an inner surface, a floating roof arranged in said tank and including a substantially cylindrical wall structure spaced radially inwardly from said cylindrical sidewall and defining a substantially annular space therewith, and sealing means attached to said roof wall structure and arranged in and sealing said annular space; a scraper structure mounted on said floating roof and disposed therebelow for scraping the inner surface of said cylindrical sidewall, said scraper structure comprising a plurality of elongated arcuate plates arranged in substantially end-to-end relation circumferentially around the inner surface of the said sidewall and disposed thereagainst, the adjacent end portions of adjacent ones of said plates overlapping, each of said plates having a lower arcuate edge shaped generally complementary to said sidewall and in scraping contact with the inner surface thereof, each of said plates having the upper portion thereof curving radially inwardly from said sidewall, a plurality of support bars mounted on said floating roof respectively adjacent to the junctures between adjacent plates for supporting said plates from said floating roof below and apart from the sealing means mounting structure such that said plates are movable with said floating roof, a plurality of springs mounted on said floating roof respectively adjacent to the junctures between adjacent plates, each of said springs engaging both of the adjacent ones of said plates for yieldingly urging said plates into scraping contact with the inner surface of said sidewall, whereby materials adhering to the inner surface of said sidewall are removed by the vertical downward movement of said scraper structure incident to the vertical downward movement of said floating roof as liquid is withdrawn from said tank and are directed by the upper portion of said plates inwardly away from said sealing means and under said floating roof.

14. The scraper structure as set forth in claim 13, wherein said plate end portions are slidably overlapping.

15. The scraper structure set forth in claim 13, wherein each of said plates has a plurality of longitudinally spaced-apart slots in said upper portion thereof extending transversely thereof to accommodate flexure of said plate in directions normal thereto.

16. The scraper structure as set forth in claim 13, wherein each of said support bars includes a central portion pivotally mounted on said floating roof, a first leg pivotally mounted on one of said plates at the associated juncture, a second leg pivotally mounted on the other plate at the associated juncture.

17. In a tank for storing liquids such as petroleum products, including an upstanding cylindrical sidewall having an outer surface and an inner surface, a floating roof arranged in said tank and including a substantially cylindrical wall structure spaced radially inwardly from said cylindrical sidewall and defining a substantially annular space therewith, and sealing means attached to said roof wall structure and arranged in and sealing said annular space; a scraper structure mounted on said floating roof and disposed therebelow for scraping the inner surface of said cylindrical sidewall, said scraper structure comprising a plurality of elongated arcuate plates arranged in substantially end-to-end relation circumferentially around the inner surface of said sidewall and disposed thereagainst, the adjacent end portions of adjacent ones of said plates overlapping, each of said plates having a lower arcuate edge shaped generally complementary to said sidewall and in scraping contact with the inner surface thereof, each of said plates having the upper portion thereof curving radially inwardly from said sidewall, a plurality of support bars mounted on said floating roof respectively adjacent to the junctures between adjacent plates for supporting said plates from said floating roof below and apart from the sealing means support structure such that said plates are movable with said floating roof, a plurality of springs mounted on said floating roof respectively adjacent to the junctures between adjacent plates, each of said springs including a central portion mounted on said floating roof, a first arm extending from said central portion and disposed against one of said plates, a second arm extending from said central portion and disposed against a second plate adjacent to said one plate, said first and second arms yieldingly urging said overlapped end portions of said plates toward and into contact with said inner surface of said sidewall, whereby materials adhering to the inner surface of said sidewall are removed by the vertical downward movement of said scraper structure incident to the vertical downward movement of said floating roof as liquid is withdrawn from said tank and are directed by the upper portion of said plates inwardly away from said sealing means and under said floating roof.

18. The scraper structure as set forth in claim 17, wherein said first and second arms are disposed against said adjacent plates at opposing points spaced longitudinally inwardly from the free ends of said end portions a distance equal to about one-quarter of the length of said plates.

19. The scraper structure as set forth in claim 17, wherein said first and second arms are slidably disposed against said adjacent plates.