

Oct. 6, 1936.

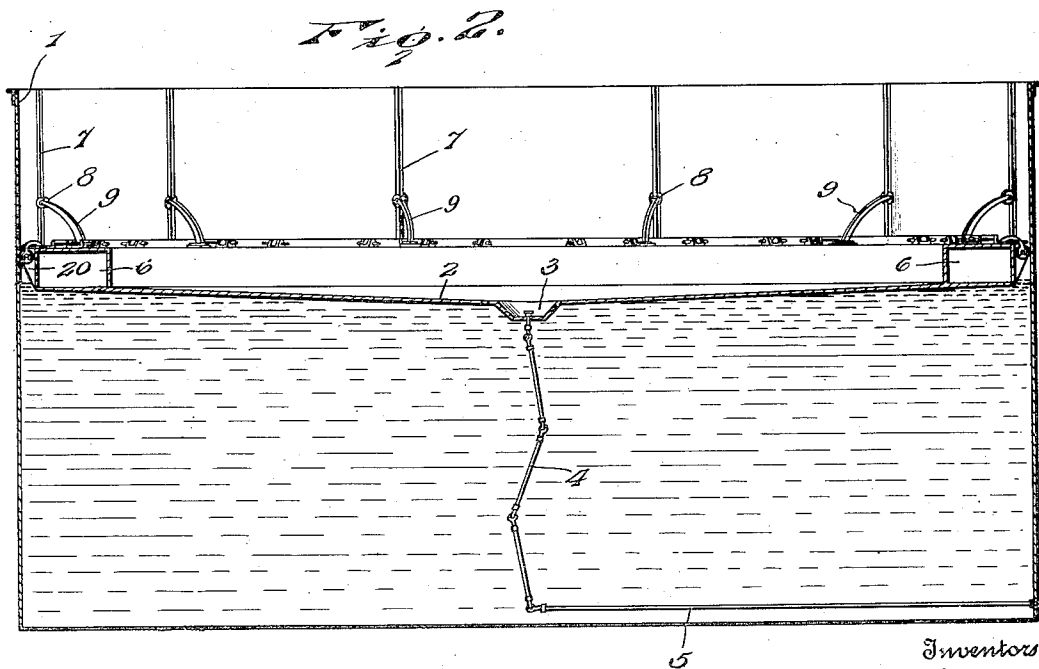
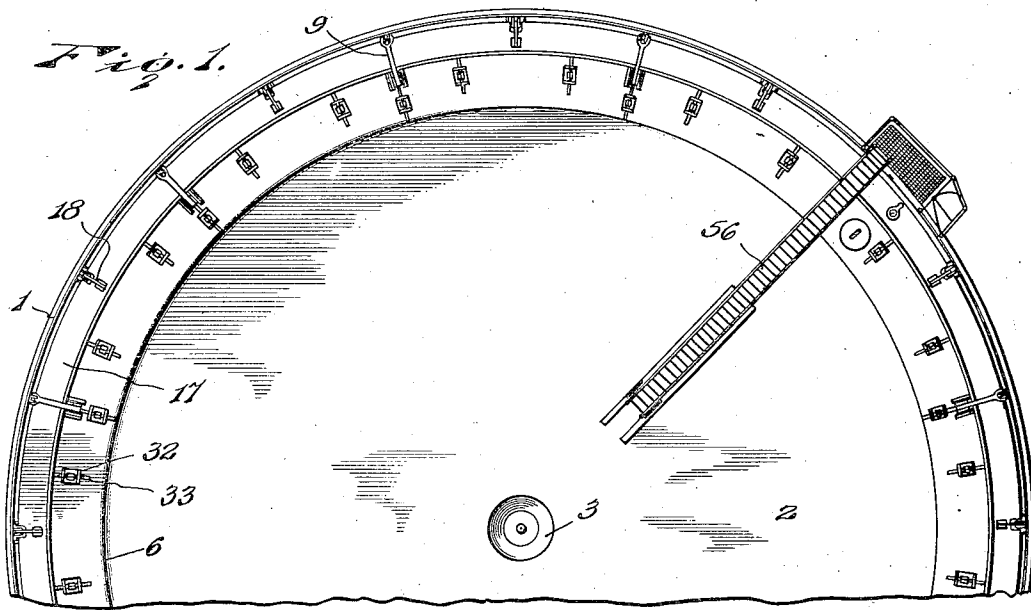
J. C. INBODEN ET AL

2,056,857

STORAGE TANK

Filed July 19, 1934

3 Sheets-Sheet 1



Inventors
J. C. Inboden.
C. E. Johnson.

By *Lacey Lacey* Attorneys

Oct. 6, 1936.

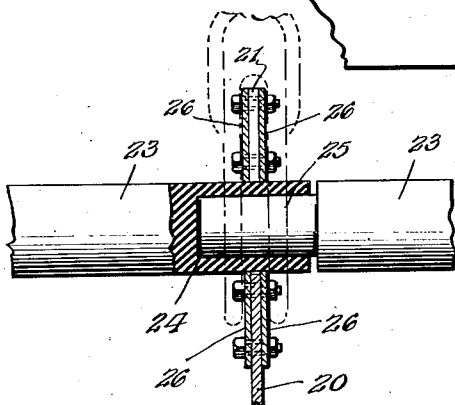
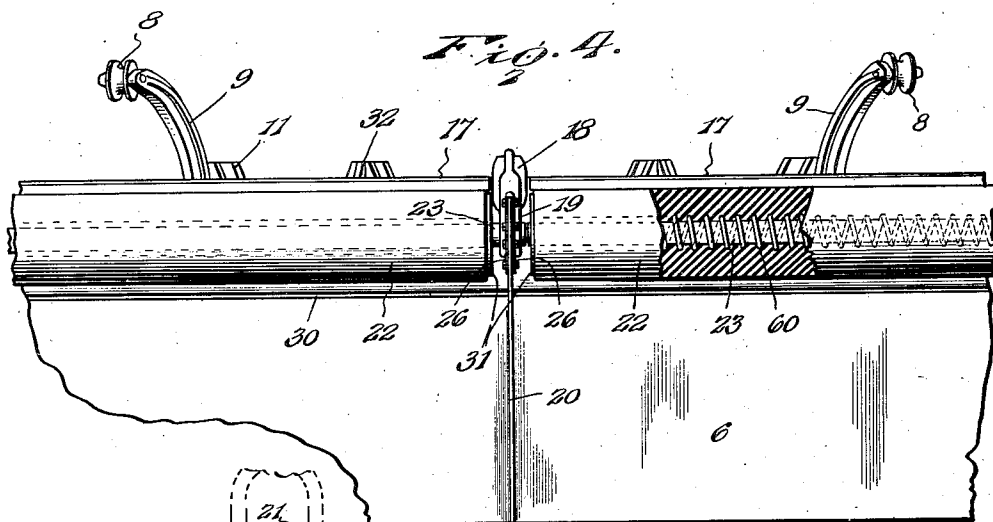
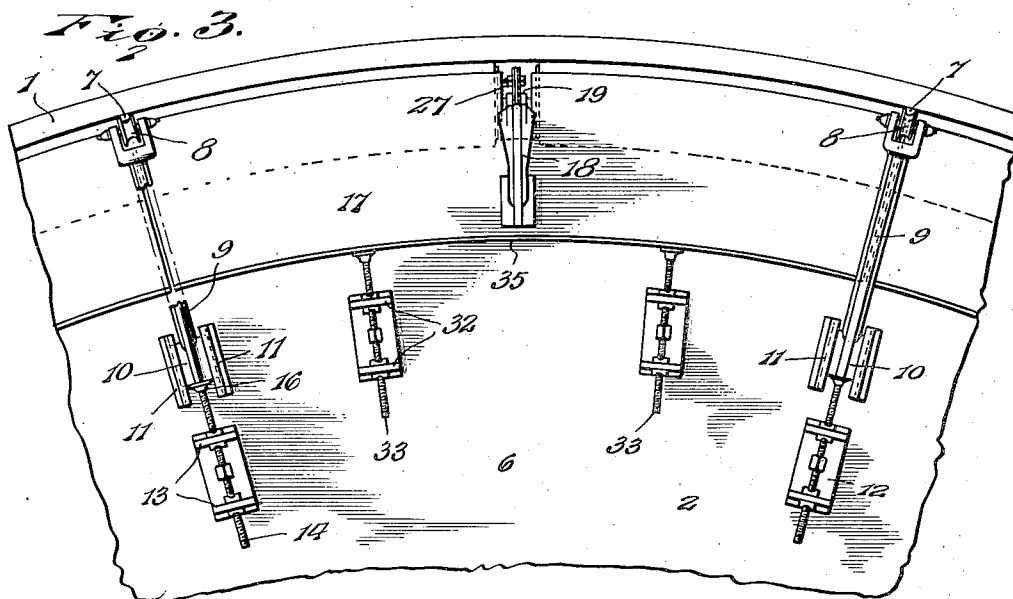
J. C. INBODEN ET AL

2,056,857

STORAGE TANK

Filed July 19, 1934

3 Sheets-Sheet 2



Inventors
J. C. Inboden.
C. E. Johnson.

334
Lacey & Lacey, Attorneys

Oct. 6, 1936.

J. C. INBODEN ET AL

2,056,857

STORAGE TANK

Filed July 19, 1934

3 Sheets-Sheet 3

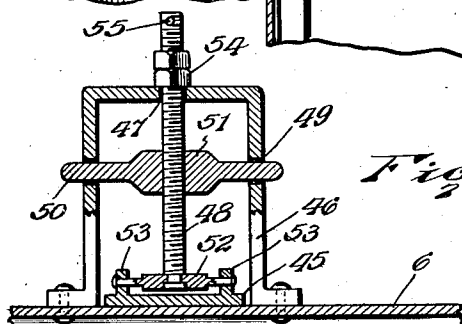
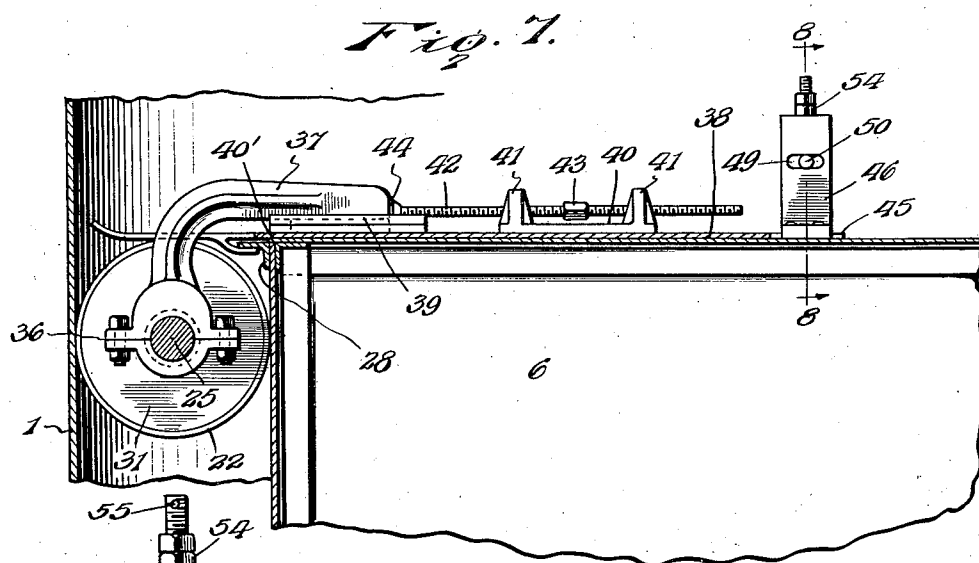
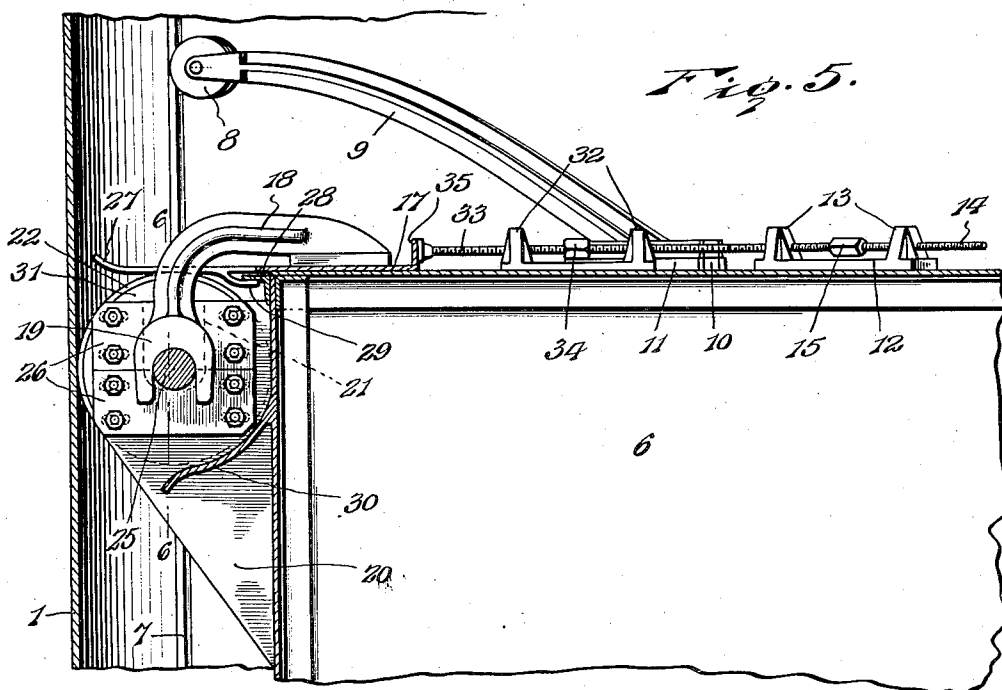


Fig. 8.

Inventors
J. C. Inboden.
C. E. Johnson.

By

Lacey & Lacey,

Attorneys

UNITED STATES PATENT OFFICE

2,056,857

STORAGE TANK

John C. Inboden and Cole E. Johnson,
Canandaigua, N. Y.

Application July 19, 1934, Serial No. 736,121

9 Claims. (Cl. 220—26)

This invention relates to storage tanks for holding a supply of oil and volatile liquids. In all such tanks it has been a problem to minimize evaporation from the surface of the stored liquid and various means have been provided to counteract this evaporation, one means being the provision of a roof which rests directly upon the surface of the liquid and rises and falls within the shell of the tank as the level of the liquid varies following an inflow of liquid into the tank and a drawing off of the same from the tank. It has been found that, notwithstanding the success of these floating roofs, there is still considerable leakage around the edge of the roof, and the present invention seeks to provide an improved floating or pontoon roof which will rise and fall readily within the shell as the level of the liquid varies and also provide means whereby the leakage or evaporation around the edge of the roof will be very materially minimized, if not entirely prevented. The invention is illustrated in the accompanying drawings and will be hereinafter first fully described and then more particularly defined in the appended claims.

25 In the drawings:

Figure 1 is a plan view of a portion of a storage tank embodying our invention.

Figure 2 is a vertical section of the same.

30 Figure 3 is an enlarged plan view of a portion of the tank.

Figure 4 is an elevation, partly broken away and in section, of a portion of the tank on a larger scale.

35 Figure 5 is an enlarged detail section through an upper corner of the tank.

Figure 6 is an enlarged detail section on the line 6—6 of Figure 5.

Figure 7 is a view similar to Figure 5 but showing a variation.

40 Figure 8 is an enlarged detail section on the line 8—8 of Figure 7.

The shell 1 of the tank is of the usual cylindrical construction and is generally of a large capacity, frequently being one hundred feet in diameter. The roof 2, according to our invention, is inclined from its periphery toward its center, as shown clearly in Figure 2, and is provided at its center with a sump 3 into which rain water will flow so that it will be collected and may be carried to a point of discharge instead of overflowing the edge of the roof and mingling with the oil stored in the tank. The outlet from the sump 3 consists of a pipe 4 formed in a plurality of sections connected by hinge joints and having its upper open end secured in the sump, as

will be understood. The lower end of the pipe is connected by a hinge joint to an outlet pipe 5 which extends through the side of the shell and may be carried to a sewer or other convenient point of discharge. It will be seen at once that this construction permits the discharge pipe to flex or straighten accordingly as the roof moves upwardly or downwardly and provides a positive outlet for the collected water.

The roof carries, at its periphery, a pontoon 6 which extends around the entire periphery of the roof and may be divided internally by partitions or bulkheads into a plurality of air chambers so that the buoyancy of the roof will be maintained even though, through some accident, a wall of the pontoon may be punctured or otherwise damaged so as to destroy its efficiency at the point of damage. The pontoon, of course, follows the circular contour of the roof and extends close to the side of the shell. Upon the inner side of the shell are tracks or vertical guides 7 which may be of any preferred form and which are engaged by rollers 8 at the upper ends of arms 9 which are mounted upon the pontoon and extend upwardly and outwardly therefrom toward the shell. This arrangement keeps the roof to a vertical path as it rises or falls and the tracks may be extended the full height of the shell or they may be provided only in the upper portion thereof through the normal range of movement of the roof. The arms 9 rise from base members 10 which are slidably engaged in and held by cleats or similar guides 11 on the upper side of the roof, and they are disposed on radii of the roof, as will be readily understood upon reference to the drawings. Radially aligned with each arm 9 and the guides 11, a plate 12 is secured upon the roof and provided with bearing lugs 13 at its ends, as best shown in Figure 5, an adjusting screw 14 being inserted through the bearing lugs and having threaded engagement therewith, and a handle member 15, of any approved design, being fitted upon the screw between the bearing lugs, as clearly shown in Figures 3 and 5. The outer end of the screw has a swiveled connection, as shown at 16, with the base member 10 so that the base member and the arm will be caused to travel lengthwise of the guides 11 in one or the opposite direction according to the direction in which the screw is turned. The rollers may be thus readily disengaged from the tracks if, for any reason, such action may be desired, or they may be caused to engage the tracks with any desired friction, or to compensate for wear.

A cover plate 17 is provided upon the pontoon 6 and is disposed at the margin of the pontoon and of arcuate formation so as to conform to the shell and the roof. This cover plate is formed in a series of arcuate sections, as shown in Figure 3, and upon each section is secured a bracket 18 which extends radially outward from the plate and the roof and is bifurcated or forked in its outer end portion and turned downwardly so as to extend into the space between the shell and the side of the pontoon, the extremities of the bracket or arm being formed into open bottom yokes, as shown at 19. At intervals, upon the outer side of the pontoon, are bulkheads or plates 20 which extend radially from the pontoon and are disposed at intervals corresponding to the location of the arms or brackets 18, the upper ends of these plates or bulkheads being provided with open-ended slots or notches 21 extending through the upper edges of the plates, as will be understood upon reference to Figure 6 and the dotted lines in Figure 5. Between the shell and the pontoon, we mount elongated sealing rollers 22 of rubber or other material providing an elastic surface which are so arranged as to bear against the inner surface of the shell and thereby cut off evaporation at the points of contact between the shell and the rollers. The rollers are also so adjusted that there will be just enough clearance between them and the pontoon to avoid actual contact so that, as the roof moves upwardly or downwardly, the rollers will rotate and not slide upon the shell, the very slight clearance between the rollers and the pontoon minimizing evaporation at that point. The rollers are, of course, made in sections extending circumferentially about the pontoon and, as they are of soft rubber or similar material, they will readily adapt themselves to the curvature of the shell as the travel of the roof presents different portions of the roller surfaces to the shell. The rubber bodies of the rollers are mounted upon metal cores or shafts 23 which are also formed in sections corresponding to the several sections of the rubber rollers and each shaft, or section thereof, is provided at one end with a socket, indicated at 24 in Figure 6, and at its opposite end with a reduced stud 25 to engage in the socket in the meeting end of an adjacent section so that the shafts or cores will be firmly supported and will, in turn, support the rubber rollers. To minimize wear upon the inner surfaces of the rubber rollers and to resist excessive flexibility therein, the rollers are provided with metallic elements, such as a spiral steel rod 60, embedded in the rubber body and presented to and encircling the core or shaft 23. The rollers are thus provided with metal centers to run on the supporting cores and rotation of the rollers is facilitated. The meeting ends of the shaft sections are engaged in the notches 21 in the bulkhead plates 20, as shown in Figure 6, and may readily slide in said notches or bearings. To reinforce the plates around the bearings and to more firmly support the shafts, plates 26 are bolted to the sides of the plates 20 above and below the shaft and are constructed with notches in their meeting edges so that they will fit around the shaft. The shaft is thus firmly supported and prevented from rising out of the notch or slots 21. The cover plate 17 projects beyond the side of the pontoon so as to extend over the rubber rollers and protect the same from the weather and is provided in its margin with radial slots or openings 27 to accommodate

the brackets 18, as shown and as will be understood. A flange 28 is provided on the outer side of the pontoon at the top of the same and the cover plate is provided on its underside with hooks or lugs 29 which are adapted to engage under this flange 28, as shown in Figure 5, so that the cover will be held to the pontoon at all times. An apron or sealing plate 30 is provided on the outer wall of the pontoon and extends downwardly and outwardly under the adjacent rollers, as shown in Figure 5, so that it will constitute a seal to further minimize evaporation between the rollers and the roof. The ends of the rubber rollers are protected against disintegration by metal collars or plates 31 which are carried by the ends of the spiral 60 or other bushing in contact with the ends of the rollers, as will be understood upon reference to Figure 4. The spiral constitutes a sleeve or bushing in the roller and the collars or disks 31 rotate with it and the roller upon the shaft 23. The roller, the bushing and the disks are mounted as a unit upon the core or shaft. Mounted upon the upper side of the pontoon at suitable intervals are radially disposed blocks having upstanding lugs 32 at or adjacent their ends and inserted through and having threaded engagement with said lugs are adjusting screws 33. The adjusting screws are provided with handle members 34 between the lugs and their outer ends are swiveled to upstanding flanges 35 at the inner edge of the cover plate 17 so that by turning the adjusting screws in the proper direction the rubber rollers may be moved toward or from the shell of the tank, as will be understood. The bulkhead plates 20 are provided with horizontal slots, as indicated by dotted lines in Figure 5, and the plates 26 may thus be set closer to or farther from the shell in an obvious manner so that it is possible to accomplish an approximate adjustment by properly setting the bolts which secure the plates 26 to the sides of the bulkhead plates 20 and then a fine adjustment may be effected by manipulating the screws 33 and the proper contact between the rollers and the shell thus accurately attained.

In Figures 7 and 8, we have shown a variation in the mounting of the rollers which may be preferred in some instances. The rollers and the shafts or cores which carry the rollers are the same in this form of the invention as in the first-described form, but the bulkhead plates 20 and the apron or sealing plate 30 are omitted, the shafts or cores being mounted in split bearings 36 at the ends of arms 37 which correspond to the arms or brackets 18, except that they are not secured upon the cover plate 38 but are mounted slidably at their inner ends in tracks or guides 39 provided on the cover plate at the edge of the same. The pontoon is equipped with the flange 28, as before, but the cover plate has its marginal portion connected with its main portion by a hinge, as indicated at 40', at the outer ends of the tracks 39 so that vertical adjustment of the roller may be effected by swinging the main portion of the cover upwardly. Mounted upon the cover plate in radial alignment with the guides 39 is a block 40 having upstanding lugs 41 at its ends and an adjusting screw 42 is inserted through and has threaded engagement with said lugs, and a handle member 43 is secured upon the screw between the lugs. The outer end of the screw has a swiveled connection with the bracket 37, as indicated at 44, so that, by properly rotating the screw 42, the bracket

37 and the rollers may be adjusted radially toward or from the shell to effect the proper contact therewith. The cover plate is also provided at intervals at its inner edge with tongues or extensions 45 which pass between the side members of an arch-like frame 46 secured upon the top of the pontoon. This frame 46 is provided with a slot 47 in its upper end to accommodate the upper end portion of a screw 48 and is also provided in its sides with openings 49 to receive the ends of trunnions 50 at the ends of an axle 51 through which the screw 48 passes and with which it has threaded engagement, as shown clearly in Figure 8. The lower end of this screw is swiveled in a rocker 52 which has its ends pivoted in lugs 53, at the sides of the tongue 45 and mounted on the screw, above the frame 46, are nuts 54 whereby the screw may be locked in any position to which it may be adjusted. In the upper extremity of the screw 48 is an opening 55 through which a turning pin may be inserted to effect rotation of the screw. The axle 51 and the rocker 52 serve to maintain the screw in the proper engagement with the frame and the cover plate, while the slot 47, in the top of the frame accommodates the rocking movement which the screw will have as it is moved upwardly or downwardly. By loosening the nuts 54 and then inserting the proper turning pin in the opening 55, the screw may be rotated and, as it rotates, it will ride up or down through the axle 51 to raise or lower the cover plate and thus effect a vertical adjustment of the rollers 22. The varying angular position of the adjusting screw will be accommodated by the rocking of the axle 51 in the sides of the frame 46 and the pivotal turning movement of the rocker 52 in the lugs 53 so that there will be no binding or bending of any of the parts.

From the foregoing description, taken in connection with the accompanying drawings, it will be seen that we have provided a very simple and easily manipulated means whereby the evaporation around the edge of the pontoon roof will be very effectually minimized, if not entirely overcome. The several parts are simple in construction and may be provided in such numbers as may be deemed necessary or desirable under any given circumstances.

The tank, of course, is provided with the usual walk or runway 56 whereby workmen may have access to the roof whenever it is necessary to inspect or adjust any of the parts of the same or to make repairs, or for any other reason access to the roof may be desired.

Having thus described the invention, we claim:

1. In a storage tank, the combination of a shell, a pontoon roof therein, vertical tracks on the shell, radially disposed guides on the roof, arms extending upwardly and outwardly from the roof and having their lower inner ends slidably engaged in said guides, rollers at the outer ends of the arms to run upon the tracks on the shell, and adjusting screws mounted on the roof in radial alinement with the arms and having swivel

engagement with lower ends of the arms whereby to adjust them radially on the roof.

2. In a storage tank, the combination with a shell and a pontoon roof therein, of flexible sealing rollers disposed between the shell and the roof adjacent each other and constituting a seal for the roof, cover plates on the roof extending over the rollers, and means on the cover plates for supporting the rollers and adjusting them to maintain contact with the shell.

3. In a storage tank, the combination with a shell and a pontoon roof therein, of a cover plate on the roof projecting beyond the side of the same, sealing rollers disposed between the roof and the shell adjacent each other and constituting a seal for the roof, bulkhead plates on the roof supporting said rollers, and means on the cover plates for adjusting the rollers into contact with the shell.

4. In a storage tank, the combination of a shell, a pontoon roof therein, sealing rollers disposed between the roof and the shell adjacent each other and constituting a seal for the roof, a cover plate on the roof, brackets mounted on the cover plate and providing bearings for the rollers, and means for effecting adjustment of the rollers to maintain contact with the shell.

5. In a storage tank, the combination with a shell and a pontoon roof therein, of sealing rollers disposed between the roof and the shell adjacent each other and constituting a seal for the roof, a cover plate on the roof, means on the cover plate for supporting the rollers, and means for effecting vertical and horizontal adjustment of the rollers.

6. In a storage tank, the combination with a shell and a pontoon roof therein, of flexible sealing rollers extending circumferentially about the pontoon and held in contact with the shell and disposed adjacent each other to form a seal between the roof and shell.

7. In a storage tank, the combination with a shell and a pontoon roof therein, of sealing rollers extending between the roof and shell circumferentially thereof adjacent each other to constitute a seal between the roof and shell and consisting of metal cores, and flexible bodies mounted on the cores and in contact with the shell.

8. In a storage tank, the combination with a shell and a floating roof therein, sealing rollers carried by the roof and extending circumferentially about the same adjacent each other to constitute a seal between the roof and shell, and means on the roof for adjusting the rollers to maintain them in contact with the shell.

9. In a storage tank, the combination with a shell and a pontoon roof therein, of brackets mounted on the roof, means for adjusting said brackets radially of the roof, and sealing rollers disposed at ends of the brackets adjacent each other to constitute a seal between the roof and shell, said rollers extending circumferentially about the roof and held by the brackets in contact with the shell.

JOHN C. INBODEN.
COLE E. JOHNSON.