July 22, 1930. O. V. GREENE 1,771,173

FILTER CASING CONSTRUCTION

Filed April 25, 1925

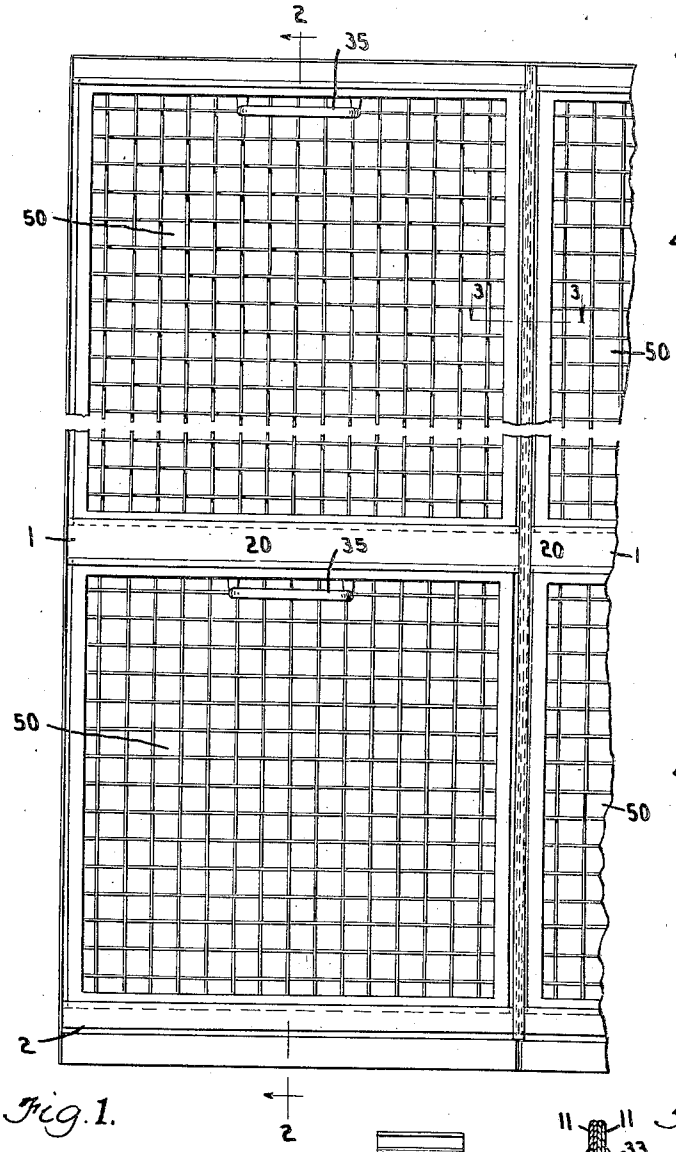


Fig. 1.

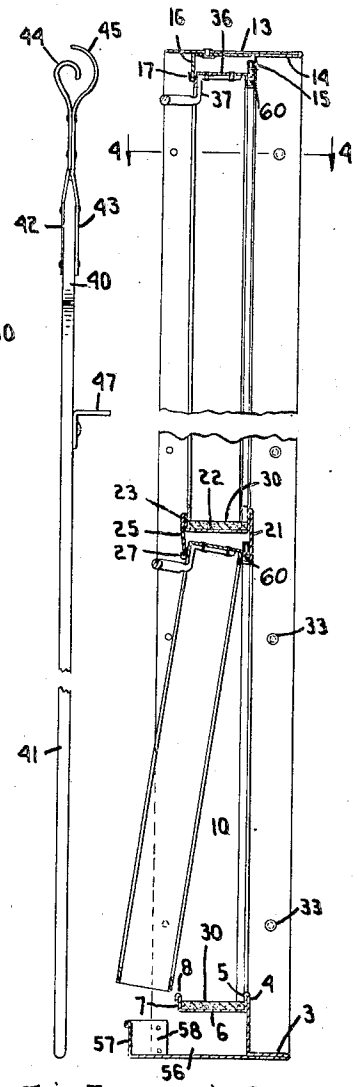


Fig. 2.

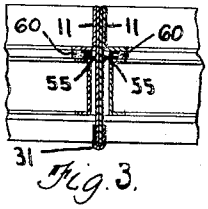


Fig. 3.

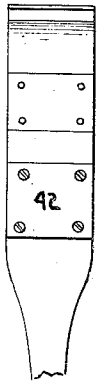


Fig. 6.

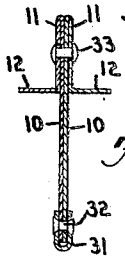


Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE

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FILTER-CASING CONSTRUCTION

Application filed April 25, 1925. Serial No. 25,789.

The present invention relates to air or gas filters employing a viscous coated filtering medium and more particularly to the construction of the frames for holding the filter elements. The present construction provides multiple shelf compartment frames which may be put together or erected on the job into an integral rigid unit when set up. The construction is such that the joints or meeting portions of the frames are completely sealed against air leakage when erected and provision is made for the easy removal and replacement of the filter element even in case of multiple compartment filters which are too high to be normally reached by an operator without the use of a ladder or platform. The construction also provides means for holding the filter elements or units in position in the compartments, such holding means eliminating special locking equipment but providing for a tight air seal between the filter element and the frame. Provision has also been made for allowing any oil or other liquid to drain from the filter elements and such liquid is collected and held in suitable pans formed integrally with the frames. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawing:—

Fig. 1 is a broken front elevational view of an air filter showing portions of several compartments and portions of two frame units as finally erected into a single filter unit; Fig. 2 is a vertical sectional view taken on the line 2—2 of Fig. 1; Fig. 3 is a sectional view on the line 3—3 of Fig. 1; Fig. 4 is a horizontal sectional view on the line 4—4 of Fig. 2; Fig. 5 is a side elevational view of the element handling device; and Fig. 6 is a front elevational view of the upper portion of such device.

The present filter consists of one or more frame units 1, each unit of which is normally one element wide and as many elements high as is called for by the specifications for the completed filter and each frame unit is made up of sheet metal of which the bottom member 2 has its rear edge 3 rebent along the frame portion and then extending at right angles thereto to form a sealing flange 4 across the bottom of the frame, this right angled portion 4 being rebent downwardly along itself as at 5 and then being extended forwardly parallel to the bottom of the member and then upwardly to form a filter holding shelf 6 or the like, the forward flanged side 7 of the shelf having its top rebent or rolled to form a stiffened edge 8.

The side members of the frame 10 are formed in a similar manner, the rear portion of each member being bent along itself as at 11 and then turned at right angles to form an interior flange 12 along the inner side wall of the frame. At the top, the frame member 13 has the same rebent portion 14 with a downwardly extending flange 15, these flanges 4, 12 and 15 being united together at their corners. Attached to the top portion of the frame is an angle member 16 having its inwardly extending side rebent upon itself or rolled to form a stiffened front edge 17, this member being spaced forwardly of the rebent flange 15 a distance to receive and retain a filter element. The frame compartments are formed by inserting between the side frame members 10 horizontal cross members 20 which as best shown in Fig. 2 consist of a piece of sheet metal having a vertical portion 21 at the rear and then being rebent to lie therealong and then extending horizontally as at 22 and then upwardly as at 23 to form a trough or flanged shelf for the filter element 50 to rest upon, the front edge 25 being rebent and extending downwardly and having a stiffened or rolled lower edge 27 to form a receiving or retaining portion for the upper side of the lower filter element.

These horizontal cross partitions or shelves are rigidly and integrally secured to the frame either by being spot welded thereto or in any other suitable manner and the back wall 21 of each horizontal partition forms a

flange which is integrally united to the side wall flanges 12 of the side frame members so as to form with the top or bottom flanges 4 and 15 a complete inwardly extending sealing flange around the interior of each compartment. On the sides and across the top of each of the compartments, resilient packing strips 60, or the like, are attached to the sealing flange on the front side thereof and extend forwardly a sufficient distance so that when the filter element is placed into position in the compartment, the frame thereof is forced tightly against these strips so as to form an air-tight seal completely around the frame of the filter element 60 except at the bottom. On the bottom of each trough or shelf is mounted a sealing member or mat 30 of cork, linoleum or similar material so that when the filter element 50 is placed in position, the lower face thereof will make the tight seal on the mat.

In fastening two adjacent frame units 1 together to form an integral multiple shelf compartment frame, the side members 10 are placed in contact with each other and a U strip 31 is mounted over the two adjacent front edges as best shown in Figs. 3 and 4. This U strip 31 is riveted in place by means of a series of rivets 32 passing through aligned apertures in the side frame members and in the U strip, these rivets, as best shown in Fig. 4, being countersunk so as not to limit the open space in front of the frame member, thus allowing room for the insertion of the filter elements without interference. The rear portions of the side frame members back of the sealing flange are also secured together by a series of rivets 33 passing through aligned apertures formed in the frame members as best shown in Fig. 4 but these rivets may be of any desired type as space back of the sealing flanges is not of importance. Where it is possible to erect several frames into a unit in the shop, the frames may be either riveted together as shown or welded and the U strip 31 also welded in place along the front edges.

The filter elements 50 themselves are merely rectangular metal frames open at the bottom, in which the filtering devices themselves are placed. These filtering devices consisting of layers or sheets of filtering medium are spaced apart and adapted to having their bottom edges sealed when the elements are in place in their compartments. Each element is provided at the top with a handle 35, these handles being attached to the top 36 of the filter element frame and having a drop portion 37 extending downwardly at the front of the frame with the handle proper extending horizontally forward below the lower frame edge. In Fig. 2, in the lower compartment a filter element 50 is shown in the position of insertion or removal from the compartment. The filter element frame is of less height than the distance between the shelves but is of greater height than the distance between the edges 8 and 27 of retaining flanges of one compartment. The filter element is inserted into position back of the upper retaining flange by being moved upwardly so as to clear the edge of the lower shelf retaining flange and then by being moved inwardly and lowered in the position as shown in the upper broken unit in Fig. 2. In this position, it will be noted that the element 50 is snugly mounted in the pocket between the front edge 8 of the shelf retaining flange at the bottom and the downwardly extending retaining flange 16 at the top and no other locking devices are provided, the troughs or shelves being of the correct width to allow the filter element frame to be forced into position against the resilient packing strips. In removing the filter element, the reverse of the preceding steps are used, the frame being lifted vertically and then pivoted in the space in the horizontal partition member or top so as to be swung outwardly free from the holding shelf flange and then dropped downwardly and completely removed from its compartment.

In order to facilitate the handling of filter elements where the frames are a number of elements high, a handling pole 40 is provided which, as shown, consists of a handle member 41 formed of wood or any suitable material at the top of which are mounted two curved strips, 42 and 43, the outer or left hand strip 42 as shown in Fig. 5 having its end curved into a hook member 44, the other strip 43 having its end 45 also curved but spaced away from and above the first member. In removing a filter element from its compartment, this device is hooked over the filter element handle and by pushing upwardly on the handle, the filter element frame may be moved upwardly in its compartment and because of the positioning of the filter element handle, upward movement will pivot the filter element outwardly at the bottom as soon as it is released from the trough. In placing a filter element in position with this handling device, the device is hooked over the handle and the element is first moved upwardly and then the positioning device is moved inwardly toward the frame and the handle portion of the device is provided with an angle iron or other block 47 which will contact with the front face of the filter element so that it may be pivoted inwardly into its normal vertical position and then the element may be pulled down into the trough by means of the hook portion 44. By using such handling device, an operator is enabled to easily remove and replace frames in the higher compartments of a completed filter unit and thus it is unnecessary to use a ladder or platform in order to reach the upper compartments of the filter.

Each horizontal partition member or shelf

is cut away at the inside corners next to the sealing flange as best shown at 55 in Fig. 3 to provide drain openings for any oil or liquid which drains off of the filter element and the bottom member of each frame provides an oil pan 56 below the element holding shelf as best shown in Fig. 2, this pan being formed by having the bottom frame member formed with an upturned front edge 57 which is spaced below the holding shelf, thus forming a pan or trough for oil or liquid below the holding shelf in the frame. the entire holding shelf and oil pan being formed from a single sheet of metal bent to shape and having its ends 58 secured to the side frame members so as to form a liquid tight joint.

The present frame construction in so far as it provides the continuous interiorly extending sealing flange around each compartment is similar to the filter frame shown in my copending application for United States Letters Patent, Serial No. 16,393, filed Mar. 8, 1925, but the present construction by providing the horizontal partition members or shelves and the holding shelf at the bottom as well as the downwardly extending front flange at the top, eliminates the necessity for special locking devices or special means for holding the elements in place. The holding flanges 7, 16 and 25 are themselves not attached at their ends to the side frame members and thus have sufficient resiliency so that the filter elements proper may be forced between these flanges and the sealing flange, thus allowing the element to fit tightly against the packing strip and to be held thereagainst by the resiliency in these holding flanges.

These compartment frames may be built in any height, furnishing as many compartments vertically as may be required in the finished unit and each frame unit provides its own oil drip pan at the bottom and is so formed that it may be connected along its sides to adjacent frame members, the connecting means being so arranged that when the units are mounted together and connected by means of the U strips and the rivets, a rigid integral unit is provided. The width of the filter elements themselves is so nearly the width between the walls of the side frame members that the rivets which are used in the field to connect the several frame units together must be placed in counter sunk holes to allow room enough for the insertion of the elements. Thus a frame is provided which can not be erected by the use of bolts or removable fastening devices which would allow for interchange of frames and thus form a structure which is not firmly and securely fastened together into a single filter unit as erected. The partition members or shelves are formed of a single piece of metal bent to shape and the vertical extending portions at the front and rear which are rebent along themselves for a portion of their extent give a very stiff rigid structure and one which will support heavy filter elements without bending. The filter elements themselves may be readily changed and this even where they extend vertically to a considerable height and this allows the finished filter unit to meet almost any specifications inasmuch as the filter units at the top of the complete filter are as readily accessible for cleaning and removal as the lower elements.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In combination with interchangeable filter elements a multi-shelf filter frame comprising side members having an interiorly extending flange spaced between their edges, a bottom member and a top member with similarly spaced flanges, and a shelf member attached to said side members and provided with flanges on both top and bottom, said flanges on said top and bottom members and on said self member being secured to said flanges on said side members to form a continuous interiorly extending sealing flange in each compartment, said bottom member being provided with a drip pan for the collection of liquid.

2. In combination with interchangeable filter elements a multi-shelf filter frame comprising side members each having an interiorly extending flange spaced between their edges, a bottom member and a top member with similarly spaced flanges, and a shelf member attached to said side members and provided with flanges on both top and bottom, said flanges on said top and bottom members and on said shelf member being secured to said flanges on said side members to form a continuous interiorly extending sealing flange in each compartment, said bottom member being provided with a drip pan, said shelf member and said bottom member having an opening to allow liquid to draw into said drip pan.

3. In combination with interchangeable filter elements a multi-shelf filter frame comprising side members each having an interiorly extending flange spaced between their edges, a bottom member and a top member with similarly spaced flanges, and a plurality of shelf members attached to said side members and adapted to divide said frame into a series of compartments and provided with flanges on both top and bottom, said flanges on said top and bottom members and on said shelf members being secured to said

flanges on said side members to form a continuous interiorly extending sealing flange in each compartment.

4. In combination with interchangeable filter elements a multi-shelf filter frame comprising side members each having an interiorly extending flange spaced between their edges, a bottom member and a top member with similarly spaced flanges, and a plurality of shelf members attached to said side members and adapted to divide said frame into a series of compartments and provided with flanges on both top and bottom, said flanges on said top and bottom members and on said shelf members being secured to said flanges on said side members to form a continuous interiorly extending sealing flange in each compartment, said bottom member being provided with a drip pan, said shelf members and said bottom having an opening to allow liquid to drain into said drip pan.

5. In combination with interchangeable filter elements a multi-shelf filter frame comprising frame units each consisting of a rectangular frame divided by shelves into a series of compartments adapted to receive filter elements, and means for uniting said frame units into a rigid unitary non-leaking structure, comprising U-strips adapted to fit over and encase adjacent side members of said frame units.

6. In combination with interchangeable filter elements a multi-shelf filter frame comprising frame units each consisting of a rectangular frame divided by shelves into a series of compartments adapted to receive filter elements, said frame units having flat side members adapted to fit against each other, and means for uniting adjacent frame units into a single rigid unitary non-leaking structure consisting of U-shaped strips adapted to fit over the front edges of adjacent side members, and means for permanently securing said strips in place and said frame members together.

7. In combination with interchangeable filter elements a multi-shelf filter frame comprising frame units each consisting of a rectangular frame divided by shelves into a series of compartments adapted to receive filter elements, said frame units having flat side members adapted to fit against each other, and means for uniting adjacent frame units into a single rigid unitary non-leaking structure consisting of U-shaped strips adapted to fit over the front edges of adjacent side members, means for permanently securing said strips in place and said frame members together, and other means for permanently securing said side members together near their rear edges.

8. In combination with interchangeable filter elements a multi-shelf filter frame comprising frame units each consisting of a rectangular frame divided by shelves into a series of compartments adapted to receive filter elements, said frame units having flat side members adapted to fit against each other, and means for uniting adjacent frame units into a single rigid unitary non-leaking structure consisting of U-shaped strips adapted to fit over the front edges of adjacent side members, said strips and said side members having aligned aperatures, and rivets passed through such apertures and headed to permanently secure said frame units together and said strips thereon to prevent air leakage, and other rivets passed through said side members near the rear edges thereof.

9. In combination with interchangeable filter elements a multi-shelf filter frame comprising two side members formed with interiorly extending flanges between front and rear edges, a bottom member having a drip pan and an element holding trough and providing a similar inwardly extending flange, a top member having two spaced inwardly extending flanges, and a shelf member having an element holding trough on its upper side and two downwardly extending spaced flanges on its lower side, said side member flanges and said flanges on said other members in alignment therewith being united together to form a continuous sealing flange around each compartment.

10. In combination with interchangeable filter elements a multi-shelf filter frame comprising two side members formed with interiorly extending flanges between front and rear edges, a bottom member having a drip pan and an element holding trough and providing a similar inwardly extending flange, a top member having two spaced inwardly extending flanges, a shelf member having an element holding trough on its upper side and two downwardly extending spaced flanges on its lower side, said side member flanges and said flanges on said other members in alignment therewith being united together to form a continuous sealing flange around each compartment, said forwardly placed inwardly extending flanges on said top member and said shelf member forming with said trough, holding means for securing a filter element in each compartment.

11. In an air and gas filter, the combination of a rectangular frame having an interiorly extending sealing flange, a holding trough at the bottom, and a downwardly extending flange at the top spaced forwardly of said sealing flange, and a rectangular filter element, adapted to be removably mounted in said frame, said element being of less height than the height of said frame so as to be movable vertically between said top flanges to allow the element to clear said trough for removal and insertion.

12. In an air and gas filter, the combination of a rectangular filter frame having an

interiorly extending sealing flange, a forwardly placed upwardly extending flange at the bottom forming a holding trough, a forwardly placed downwardly extending flange at the top, and a rectangular filter element, adapted to snugly fit between said two flanges at the top and bottom of said frame, said element being of less height than the height of said frame so as to be movable vertically therein, said frame being of greater height than the distance between the interior edges of said two front flanges so as to be held in place in said frame.

13. In an air and gas filter, the combination of a rectangular filter frame having an interiorly extending sealing flange, holding flanges on opposed sides of said frame spaced from said sealing flange, and a rectangular filter element adapted to fit snugly between said two holding flanges and said sealing flange, said element being of less length than the length of said frame to be movable therein, but being of greater length than the distance between the opposed interior edges of said holding flanges so as to be held in place in said frame thereby.

14. In an air and gas filter, the combination of a rectangular filter frame having an interiorly extending sealing flange, holding flanges on opposed sides of said frame spaced from said sealing flange, and a rectangular filter element adapted to fit snugly between said two holding flanges and said sealing flange, said element being of less length than the length of said frame to be movable therein, but being of greater length than the distance between the opposed interior edges of said holding flanges so as to be held in place in said frame thereby, said holding flanges being resilient to allow said element to be forced between said flanges and said sealing flange to form a tight seal with the latter.

15. In an air and gas filter, the combination of a multi-shelf filter frame comprising two side members formed with interiorly extending flanges between front and rear edges, a bottom member having a drip pan and an element holding trough and providing a similar inwardly extending flange, a top member having two spaced inwardly extending flanges, a shelf member having an element holding trough on its upper side and two downwardly extending spaced flanges on its lower side, said side member flanges and said flanges on said other members in alignment therewith being united together to form a continuous sealing flange around each compartment, said forwardly placed inwardly extending flanges on said top member and said shelf member forming with said trough, holding means for securing a filter element in each compartment, and a rectangular filter element for each compartment adapted to be removably mounted therein between said holding means and said sealing flange.

16. In an air and gas filter, the combination of a multi-shelf filter frame comprising two side members formed with interiorly extending flanges between front and rear edges, a bottom member having a drip pan and an element holding trough and providing a similar inwardly extending flange, a top member having two spaced inwardly extending flanges, a shelf member having an element holding trough on its upper side and two downwardly extending spaced flanges on its lower side, said side member flanges and said flanges on said other members in alignment therewith being united together to form a continuous sealing flange around each compartment, said forwardly placed inwardly extending flanges on said top member and said shelf member forming with said trough, holding means for securing a filter element in each compartment, a rectangular filter element for each compartment adapted to be removably mounted therein between said holding means and said sealing flange, a handle mounted on each filter element and spaced adjacent to but below the upper edge thereof.

Signed by me, this 23rd day of April, 1925.

OSCAR V. GREENE.