Jan. 9, 1940. R. E. CONNELL 2,186,752

FLAME ARRESTER

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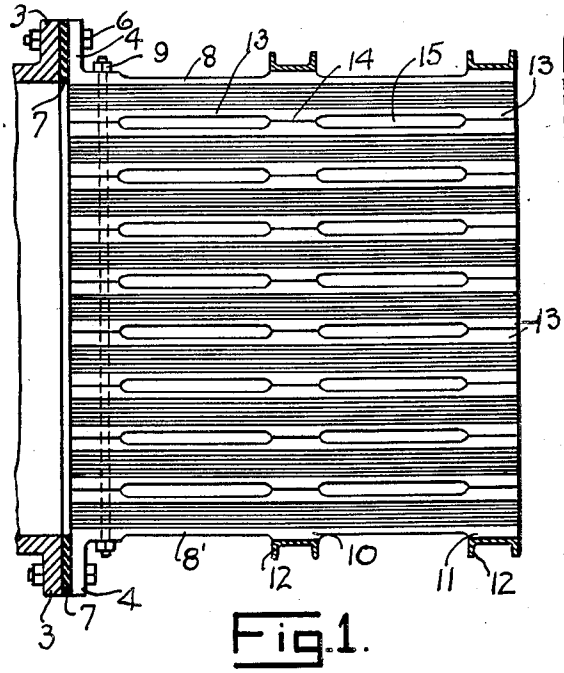


Fig. 1.

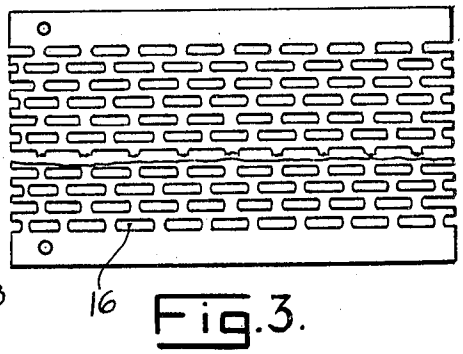


Fig. 3.

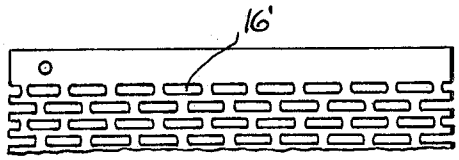


Fig. 4.

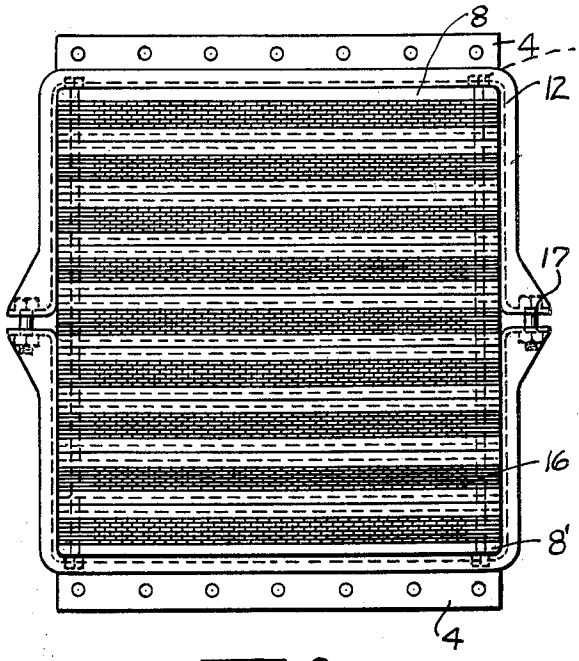


Fig. 2.

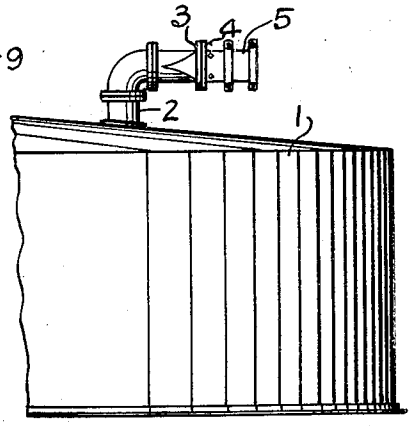


Fig. 5.

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FLAME ARRESTER

Robert E. Connell, Houston, Tex.

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14 Claims. (Cl. 220—88)

My invention relates to flame arresters and while it has a general application it is adapted particularly for use on containers or storage tanks in which petroleum or petroleum distillates are stored.

Where inflammable liquids are stored in tanks subjected to heat from the sun and in which the container and its contents are alternately heated and cooled by atmospheric changes it is necessary to provide a vent for the tank through which the vapors from the interior may pass. However, as these vapors are inflammable and are subjected to ignition through lightning or other similar sources it is necessary to provide means to prevent the flames from passing into the tank so as to ignite the contents thereof.

Various types of flame arresters have been adapted for this purpose, none of which appear to be entirely reliable for the reason that either the flame or the heat therefrom is not reliably prevented from eventually passing through into the tank to either ignite the contents or effect an explosion. The escaping vapors from the tank are usually ignited at the outlet end of the flame arrester and either find their way through the arrester or continue to burn at that point until the body of the arrester is heated because of the heat being gradually conducted back into the tank so as to ignite the gases on the interior thereof.

It is an object of my invention to provide a flame arrester which will prevent the passing of both the heat and flames at the outlet end of the device through to the interior of the tank.

I desire to provide means for cooling the passages from the interior of the tank to the outlet end of the arrester so that the heat is dissipated before it reaches the interior of the device and in this manner the interior of the device never reaches the point of combustion of the gases or vapors.

I have as a further object to provide air conducting flues transversely through the arrester in such manner that cooling of the body of the device is automatically accomplished depending upon the amount of heat to be dissipated.

In the drawing herewith, Fig. 1 is a top plan view partly in section through the frame work of the device, showing the arrangement of the component parts of my device.

Fig. 2 is a front end elevation of the flame arresting device.

Fig. 3 is a broken detail in plan view of one of the plates employed in making up the passage for the vapors.

Fig. 4 is a broken end of a similar plate adapted to cooperate with the plate shown in Fig. 3.

Fig. 5 is a broken detail showing a tank or container with my flame arrester mounted thereon.

In making up my flame arrester I contemplate providing a series of units which may be spaced apart to provide for isolated air passages between the separate units making up the complete device.

In Fig. 1 is shown an assembled structure which is adapted to be attached to an opening leading to the tank. With reference to Fig. 5, it will be seen that the tank 1 has a vent pipe 2 thereon bent so as to provide a horizontally disposed outlet opening at 3, which is of rectangular shape. The margin of this opening is flanged to provide a connection with the flanges 4 upon the flame arrester designated generally as 5.

In Fig. 1 it will be seen that the flanges 4 are connected with the flange 3 of the opening by means of through bolts 6. Between the flanged connections 3 and 4 I preferably place a gasket 7, so that a seal may be made between the flame arrester and the vent opening.

The flanges 4 are formed upon end members 8 and it is to be noted that there are two end members 8 and 8' of practically identical construction. These members extend along each side of the arrester, which is of rectangular shape, and have openings therein adjacent the inner end to receive through bolts 9, by means of which these members 8 and 8' and the intermediate units are assembled tightly together. At an intermediate point the members are each thickened slightly at 10 and again at the outer end 11 to provide a supporting seat for clamping pieces 12.

Between the two end members 8 and 8' are a series of spacers 13. These spacers are in pairs and of identical construction and are adapted to contact with each other at the outer and inner ends and at an intermediate point 14. They are formed with recesses between these contact points, thus providing vertically extending flues 15 for air circulation between the spacers forming each pair. These flues 15 dissipate the heat being conducted by the arrester and permit it to be carried away by a convection circulation through the arrester.

The pairs of spacers 13 are in turn spaced apart to form separate areas extending longitudinally of the flame arrester through which the vapors may pass. These areas are formed into tortuous passages by providing therein a set of plates having through openings in adjacent foraminated

plates. With reference particularly to Figs. 3 and 4 it will be noted that these plates may be of sheet metal of the desired thickness with openings 16 punched or stamped therein at spaced intervals with the openings staggered or offset relative to each other. Each plate may be arranged so that the openings will be offset relative to the openings 16' in the adjacent plate when adjacent plates are aligned together and each set may be made up of as many plates as desired, and I have shown six plates in each unit, as will be seen from Fig. 2, although it is to be noted that this number may be varied materially. It will be seen that when these plates are mounted side by side to fill the area between adjacent spacers so that the gas or air passing through the flame arrester will enter through certain of the openings 16 in one plate and be deflected or curved through adjacent openings in adjacent plates, and is thus compelled to flow in a tortuous path through the plates from one to another and longitudinally thereof until the said gases have passed the full length of the arrester.

The sets when assembled as shown in Fig. 1 are clamped together by the clamping members 12, which are shown best in Fig. 2. These clamps comprise two cooperating U-shaped members adapted to surround approximately one-half of the assembled device. The adjacent ends of the two U-shaped members are extended outwardly and have registering openings therein to receive the clamping bolts 17 as seen in Fig. 2. It will be seen therefore that the units are connected together at the outer end and at an intermediate point by these clamping bands but they are held more rigidly together adjacent the end of the flame arrester by through bolts 8.

It is to be noted that this flame arrester is made up of separate units which can be easily and quickly assembled to form the arrester or dismantle for repair or cleaning, and when clamped together in assembled relation they form a compact device which may be attached to the vent in the storage tank and is then ready for use.

In operation the vapors from the tank and the air from the outside pass alternately back and forth through the flame arrester as the interior of the tank is warmed or cooled, it being obvious that when the contents of the tank are heated there will be a flow of the gases and vapors outwardly through the tortuous passages of the plates 16 but when the tank is then cooled there will be a similar flow of air from the outside inwardly through the arrester. If the gases and vapors from the tank are ignited at the outlet end of the arrester during the time when the gases are passing outwardly they may be simply burned at the outlet end and no subsequent explosion may take place, thus the vapors may be ignited and continue to burn at the outlet end of the device, but the flame cannot follow through the device to ignite the contents of the tank because of the tortuous path it would be required to follow due to the arrangement of the openings 16 and 16' in the arrester plates.

As the flame burns on, the outlet end, the arrester will be heated by the burning gases and this heat will tend to be conducted longitudinally of the plates inwardly of the arrester, and when the plates are sufficiently heated for their full length the inner end of the arrester might be heated to the critical temperature or flash point of the gases or contents of the tank. I avoid this, however, by dissipating the heat from the plates by the air circulating flues 15 extending vertically and transversely of the body of the arrester. There will be a circulation upwardly of the air through these flues or passages immediately when they are heated because the air in the openings 15 will rise to maintain a circulation by convection. This circulation will keep the plates cool so that heat will not be conducted the full length of the plates and the device is so designed and proportioned that there will be no time when the inner end of the arrester will approach the critical or explosive temperature. I am thus enabled to entirely prevent the danger arising from the burning gases or the heat conducted through the arrester which would eventually ignite the gases at the inner end of the arrester. At no time will the device be heated up to such a point that ignition may take place because the flues 15 are independent of the breather passages 16 in the foraminated plates. In this manner the fluids flow in and out of the tank depending upon the expansion and contraction thereof but the sets of plates are in turn cooled because of the flues 15 so that if there is an ignition the heat will be dissipated by this independent flow of air by convection through the flues 15.

What is claimed as new is:

1. A flame arrester comprising a plurality of adjacent units having longitudinal fluid passages therethrough, imperforate spacers for each of said units, means to clamp said units and spacers together, and means for cooling said units including air circulating flues between said spacers and independent of said passages.

2. A flame arrester comprising a plurality of adjacent units having longitudinal fluid passages therethrough, imperforate spacers for each of said units, means to clamp said units together, and opposed bosses on said spacers to provide independent air passages between said units whereby said units are cooled.

3. A flame arrester comprising a plurality of adjacent units having longitudinal fluid passages therethrough, said units each including adjacent contacting plates forming said passages and having openings in staggered arrangement to deflect the flow of fluid therein, imperforate spacers for each of said units, means to clamp said units together, and vertically arranged air circulating flues independent of said passages and between said spacers.

4. A flame arrester comprising a series of adjacent units having tortuous passages longitudinally thereof, means to space said units apart to provide transverse air passages between them so that air may flow therethrough to cool the units, and means to hold said units in assembled relation.

5. A flame arrester including a plurality of perforated plates the openings in each of which are offset from the openings in adjacent plates to form breather passages, and vertically arranged flues extending transversely of said passages and independent of said passages to cool said plates.

6. A flame arrester including plates assembled in parallel arrangement, with fluid passages longitudinally thereof, and vertical air conducting flues in said arrester and transversely of said passages to cool said plates by convection circulation.

7. A flame arrester having passages therethrough adapted to confine the flame to the surface thereof and to dissipate the heat of the flame to prevent explosion, including a body made up

of plates, tortuous passages through said arrester, and independent ventilating flues transversely of said passages to dissipate the heat conducted through said body.

8. A flame arrester comprising a series of adjacent units having tortuous passages longitudinally thereof, means to space said units apart to provide transverse air passages from atmosphere to atmosphere between them so as to cool the units and means to hold said units in assembled relation.

9. A flame arrester comprising a plurality of arrester sections each of said sections comprising a plurality of plates contacting each other in face-to-face relation and each plate being provided with series of perforations, each series of perforations of adjacent plates being staggered and in partial overlying position relative to adjacent plates, whereby a sinuous passage is provided longitudinally of said sections.

10. A flame arrester comprising a plurality of arrester sections each of said sections comprising a plurality of plates positioned in face-to-face relation contacting each other, each plate being provided with series of elongated perforations, each series of perforations of adjacent plates being staggered and in partial overlying relation whereby a sinuous passage is provided longitudinally of said sections.

11. A flame arrester including a series of units each made up of a body having passages therethru, side members on each of said units, the side members of adjacent bodies having vertical raised portions whereby vertical passages are provided between said members to provide air circulation between said units, and means to clamp said units detachably together.

12. A flame arrester including a plurality of groups of plates grooved to form substantially horizontal gas passageways; and spacers between said groups and forming therewith substantially vertical cooling passageways communicating with the atmosphere.

13. A flame arrester including a plurality of groups of plates forming gas passageways; and spacers between said groups and arranged to provide therewith substantially vertical cooling fluid passageways separate from said gas passageways.

14. A flame arrester having substantially horizontal gas passageways, and separate non-communicating substantially vertical cooling passageways communicating with the atmosphere.

ROBERT E. CONNELL.