Aug. 21, 1928. 1,681,698

S. H. BROOKS

FLAME ARRESTER

Filed Sept. 16, 1926

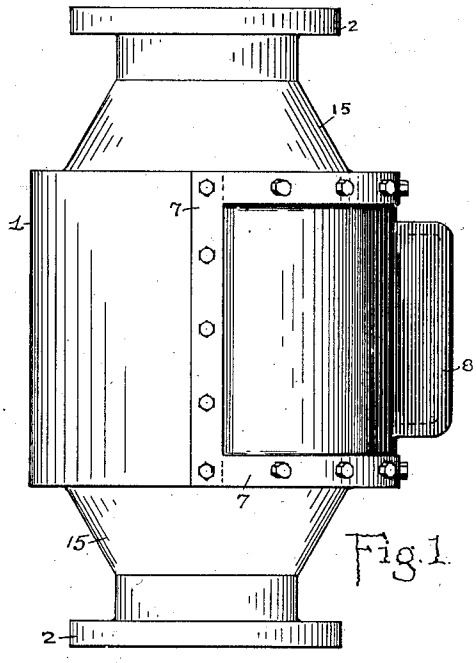


Fig.1.

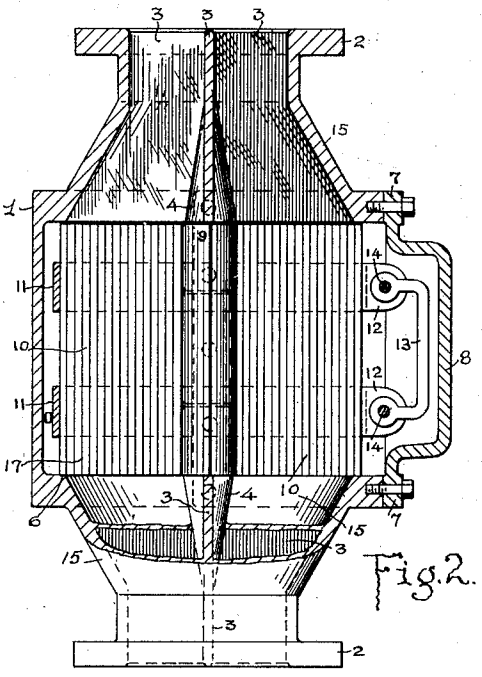


Fig.2.

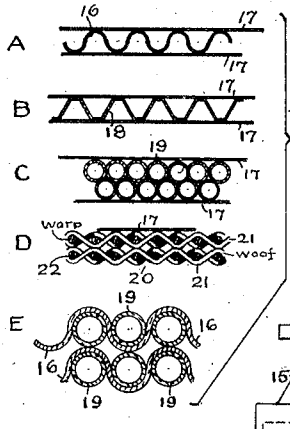


Fig.3.

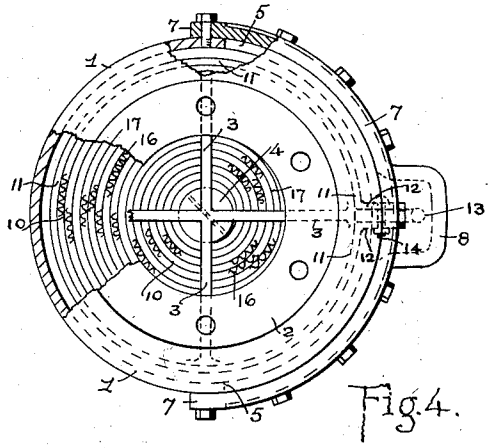


Fig.4.

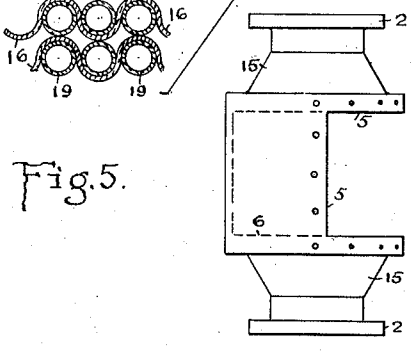


Fig.5.

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UNITED STATES PATENT OFFICE.

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FLAME ARRESTER.

Application filed September 16, 1926. Serial No. 135,797.

My invention relates to improvements in flame arresters and it more especially consists of the features pointed out in the annexed claims.

The purpose of my invention is to protect tanks of all kinds in which inflammable materials are stored against disruption etc., through the contact of flame with their contents; that is simple in the construction of all the cooperating parts and in its steps of operation; that is easily put into practice; and that is thoroughly effective in preventing the traverse of flame through safety or ordinary vents etc. into tanks or containers.

With these and other ends in view, I illustrate in the accompanying drawing such instances of adaptation as will disclose the broad underlying principles without limiting myself to the specific details shown thereon and described herein.

Figure 1 is a side elevation of a protective device ready for direct attachment to a storage tank or to a safety vent.

Fig. 2 is a cross section of Fig. 1 showing parts broken away.

Fig. 3 is an enlarged section of several types of flame resistors.

Fig. 4 is a top plan view of Fig. 2 showing parts broken away.

Fig. 5 is a side elevation of an arrester casing with the arrester unit and its cover removed.

In practically carrying out my invention I have found that so-called flame arresters used to prevent back-fire in internal combustion engines are entirely inadequate to prevent the passage of flame in large capacity pipes, tanks, etc. It has been demonstrated through exhaustive and extended tests that my process and apparatus effectually protect storage tanks against explosion etc. through the admission of flame to any inflammable vapors that are given off by its contents.

I have not so far been able to determine the exact law on which the theory of my process depends, suffice it to say there appears to be a cooperative relation between the length of the restricted or capillary passages and the cross sectional area of the pipe to which they are connected; or the relation between the number of the passages and the heat dissipating factor of the aggregate cross sectional areas of the resistor walls compared with that of the capillary passages; or, in addition, the relation of the aggregate mass of the walls to the gross area of the passages and these factors to the length of the passages comparable with the net area of the passages which is greater than the opening of the pipe to which the safety device is attached.

Enough actual proof has however been secured in actual practice to establish the fact that my process and apparatus do actually arrest flames in the largest capacity installations to the great satisfaction of the users and the safe guarding of valuable property in the shape of tanks and their contents.

In the flame arrester exemplified in the accompanying drawing, I show a casing 1 provided with conical ends 15 which terminate in standard attaching flanges 2. The conical ends are in open relation to the vent pipe of a storage tank or any safety vent attached to a tank (not shown). It is well known that vapors are given off from stored inflammable liquids, which to prevent abnormal tank pressures for safety reasons are led out through cooperating safety devices. Such devices however only deal with pressures of a positive and negative value, the latter being designated a vacuum and they do not guard the contents against explosion when an external flame is conveyed to the interior of the tank.

I have found that superior results are secured by dividing the flanged and conical extension passageways to the arrester body 1 into four channels by means of the radial partitions 3. These partitions are joined together by slightly tapered centers 4, which at their inner end are about the same diameter as the core 9 of the resistor or tube bank 10. This avoids any dead ends of the core 9. The casing 1 is cut away at 5, as shown in Figs. 4 and 5, to admit the resistor unit which when positioned will rest on the seat 6 and the partitions 3 which terminate on the same plane as the seat 6. The arrester is reversible, so that either one of the flanges 2 may be positioned toward the tank which is to be protected.

The opening 5 of the casing 1 is closed by a curved cover 7 which is secured by bolts or in any other way. It has a hollow extension 8 to accommodate the handle 13 of the tube bank 10. The resistors may be assembled around a central core 9 and are held in place as a unit by bands 11. These bands terminate

in adjacently positioned ears 12. Between a pair of ears 12 of each band 11 a handle 13 is placed where it is held in place by the clamping bolts 14 which securely clamp all the parts together, so that the tube bank becomes a single unit. It may be inserted into the casing with either end uppermost. Any desired form of stop may be cast onto the inside of the casing to define the working position of the tube bank so that the only passage from one end to the other of the arrester will be through the assembled resistors and not to one side of the group. The unit is positioned singly in the opening 5 both at its top and bottom.

I may use any desired type of resistor. Several variants are instanced in Fig. 3 wherein A represents a plate, formed into rounded corrugations or flutings 16, placed between plain separating sheets 17. At B angular corrugations 18 are formed on the fluted sheet which is also placed between separating sheets 17. Both of these types have small area capillary passages formed between the flutings and their separating sheets. In Figs. 2 and 3 a tube bank having such separating sheets is exemplified. When so used the core 9 may be split, as shown in dotted lines in Fig. 4 and in full lines in Fig. 2, so as to receive a starting edge of a pair of separating sheets. The two halves of the core may be held together to clamp the sheets in any suitable manner. Subsequently the sheets with a fluted sheet between are wound spirally around the core to the desired diameter where they are held in unitary assembled relation by the bands 11. The capillary passageways extend parallel to the axis of the unit.

Two other types of resistors are shown at C and D of Fig. 3. At C a series of capillary tubes 19 are grouped in side by side relation. Such an arrangement of tubes may be used with separating sheets similar to the sheets 17 shown in A and B. By assembling one or more layers of the tubes loosely between such sheets they may be wound on a core in the same manner as types A and B, or they may be assembled in any desired way to suit the exigencies of manufacture. In order to constitute a removable unit any one of the types shown, or any alternative forms, will be held by bands 11 or in any other removable manner as a unit. The type D comprises wire netting 20 with warp wires 22 running lengthwise of the unit, and woof wires 21 woven crosswise. If desired the relation of the warp and woof may be transposed. In any event a single mesh combined with separating plates, if desired, may be wound around a core 9 to the desired diameter and held by bands 11. The types C and D are shown with two layers each but without separating sheets 17 between them, which may however be so used if desired. Another type of resistor is shown at E, Fig. 3, in which types A and C are combined so that capillary tubes 19 of type C are positioned in the corrugations 16 of the type A.

The traverse of flame through a tube bank is arrested because its heat is absorbed by the large aggregate cross sectional area of the resistor materials which lower the temperature transmitted through the interstices to the other end of the tube bank below the ignition point of the inflammable vapors present at the other end of the device.

What I claim is:

1. In flame arresters, a suitable cylindrical casing having an opening on one side, reduced diameter connecting flanges having a passageway therethrough of conical shape leading to the interior of the casing, radial partitions across such passageways, a removable flame arrester unit, a seat for the same in the casing, bands encircling the arrester unit, a handle secured to said bands, and a cover for the casing opening.

2. In flame arresters, a suitable hollow casing having an opening on one side, conical terminations of the casing connected to openings enclosing passageways leading to the interior, attaching flanges formed at the ends of such terminations, a plurality of radial partitions in the conical extensions of the casing adapted to divide the openings into separate passageways, a removable tube bank unit comprising a plurality of isolated members forming restricted passageways extending lengthwise of the unit, means for holding the members in assembled relation, and means for closing the side opening of the casing.

3. In flame arresters, a suitable hollow casing having an opening at one side, attachable extensions to the casing, a plurality of radial partitions in the extensions forming separate passageways therethrough, a removable arrester unit placed through the opening of the casing and positioned between the extensions, and a cover for enclosing the unit in the casing.

4. In flame arresters, an open ended casing having a hollow center with limit seats opposite the openings and an opening at one side, a removable arrester unit positioned between the seats, a cover for the side opening of the casing, means for providing a plurality of restricted small passageways lengthwise of the unit, and means for providing a plurality of unrestricted large passageways in the end openings of the casing all the passageways being interconnected lengthwise of the arrester.

5. In flame arresters, a tube bank unit comprising a large number of small restricted parallel passageways formed of a spirally wound flame resisting element secured to a center core the same constituting a removable unit, an enclosed casing for the same, and a plurality of large unrestricted passageways formed in said casing at both ends of the unit

in direct communication with the restricted passageways.

6. In flame arresters, a tube bank unit comprising a center core, a spirally wound flame resisting element secured to the core said element being formed with a plurality of restricted parallel arranged passageways of small individual cross section, means for holding the flame restricting element with the convolutions in close engagement with each other, and means for facilitating the easy manual handling of the unit.

In testimony whereof I affix my signature.

STEPHEN H. BROOKS.