May 9, 1933. E. H. JONES 1,907,976

FLAME ARRESTER AND SAFETY RELIEF FOR VAPOR LINES

Filed Jan. 9, 1929

Fig. 1.

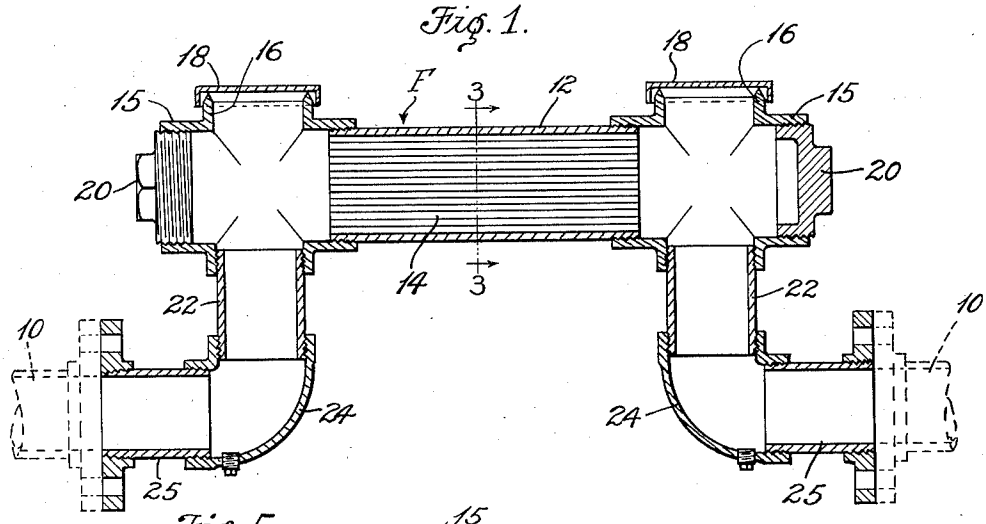


Fig. 5.

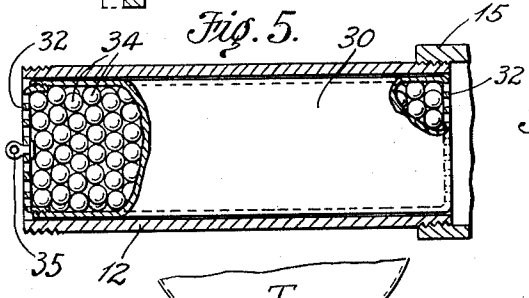


Fig. 2.

Fig. 3.

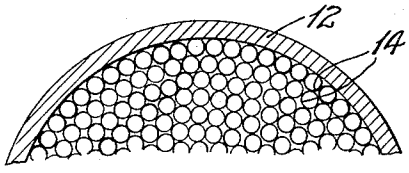
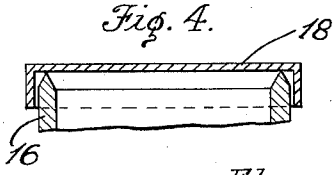


Fig. 4.



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UNITED STATES PATENT OFFICE

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FLAME ARRESTER AND SAFETY RELIEF FOR VAPOR LINES

Application filed January 9, 1929. Serial No. 331,260.

This invention relates to devices to prevent the propagation of flame through vapor lines and to relieve excessive pressures therein resulting for example from explosions, the invention being applicable especially to vapor lines connected with storage tanks and other apparatus adapted to the handling of petroleum and petroleum products.

It has become a common practice to connect petroleum storage tanks with lines by means of which vapors developing in the tanks may be withdrawn for the two-fold purpose of recovering the valuable contents of the vapors and of eliminating fire hazard by removal of the vapors from the vicinity of the tank. However, one difficulty has been found in the fact that if a fire or an explosion occurs in one tank the flame or the compression waves may be transmitted to other tanks by way of the vapor lines.

The object of the present invention, therefore, is to provide in the vapor connections leading from various tanks or other apparatus, means adapted to prevent spread of flame from one tank to another or through the main vapor draw-off line.

The invention in its broad aspect resides in a device for use on vapor lines connecting tanks and the like, which device comprises a valve adapted to open readily upon the development of a predetermined pressure for the relief of such pressure as might develop by explosion, in conjunction with an improved device which will cool products of explosion or burning gases, and by frictional resistance or the like will dampen the compression waves, to an extent sufficient to prevent the propagation of flame or pressure to other parts of the apparatus. Therefore the relief valve should be placed in advance of the cooling and resistance device, in order that the pressure confined by the latter may actuate said valve. In a preferred form the pressure relief may be simply a weighted cap or disc normally retained in position by gravity, and the device for preventing propagation of flame and compression waves may be a bank of small tubes closely packed in a nipple or section of pipe forming a part of the draw-off line.

In the accompanying drawing wherein a preferred embodiment of the invention is shown for purposes of illustration,

Fig. 1 is a vertical section through the flame arrester and relief device hereof;

Fig. 2 is a plan view indicating how the devices are connected with a plurality of storage tanks and with a lead-off line;

Fig. 3 is a fragmentary cross sectional detail as indicated by line 3—3 of Fig. 1;

Fig. 4 is an enlarged vertical sectional detail of the gravity pressure relief valve; and

Fig. 5 is a detail of a modified cooling and resisting element.

Fig. 2 discloses a pair of petroleum storage tanks T with which a lead-off line L communicates through the medium of connections 10 and the arresters of the present invention indicated generally at F. Each arrester comprises a metal shell or section of tubing 12 which is horizontally disposed when in operation and is packed with a large number of small tubes 14 (for example, one-eighth inch or one-tenth inch inside diameter) extending longitudinally therethrough, these tubes preferably being forced into the nipple in sufficient number to fill the same and retain themselves simply by friction. To each end of the nipple 12 there is threadedly connected a four-way union 15, one of the outlets of each union being directed upward and terminating in the form of a knife edge 16 upon which there rests a cap or disc 18 adapted to be lifted for relief of pressure upon the development of any predetermined maximum pressure, for example, one-half pound per square inch, whereby pressure from an explosion will be promptly released to the atmosphere. The line L will usually be under slight suction of the vapor gathering system. The end outlet of each union 15 is conveniently closed with a plug 20 which may be removed for inspection or to clean out the tubes 14, and the under or lower outlet of each union 15 receives a connection 22 leading to an L 24 provided with suitable fittings 25 for mounting the device between the connections 10.

In this manner an arrester F as just described is positioned between each storage

tank T and the draw-off line L, and a relief valve 18 is disposed between each storage tank T and the respective tube bank 14. In normal operation the vapors from a tank T are drawn through one of the connections 10 into one of the unions 15, thence through the tube bank 14 contained within the section 12, and thence through the other union 15 and connection 10 to the line L where the vapors are removed to any device in which desired disposition is made. Under these conditions the vapor flow is light and the small tubes offer no objectionable resistance. However, should an explosion occur in one of the tanks T the respective tube bank 14 will by reason of the very small passages offer a material resistance to rapid dissipation of the suddenly increased pressure so that the confined gas will displace the nearest valve cap 18 thereby venting the explosion or burning gases to the atmosphere. Also the bank of tubes 14 will act to absorb and conduct away large amounts of heat to be radiated by section 12, thus decreasing the temperature of hot gases to such extent that the propagation of flame will be prevented and the possibility of extending a flame of explosion to the line L or to other tanks in the system will be eliminated. Inasmuch as one of the flame arresters F is provided for each tank T, each tank is in reality protected from explosion in the other tank by two of the arresters, and if it were possible for the flame to pass from one tank through the respective arrester into the line L arresters on the other tanks would insure checking of travel of flame to such other tanks. Additionally a relief valve is positioned before and after each bank of tubes so that the pressure is relieved whether it comes from one direction or the other. Also this acts as a safety to insure discharge if one of the relief valves becomes stuck for any reason.

In Fig. 5 there is shown another device capable of providing desirably small passages in the cooling and resisting section. Here a cylindrical cartridge 30 having perforated heads 32 is filled with metal balls 34 of suitable heating-absorbing capacity and of a size (e. g. one-fourth inch in diameter) to form small passages which together with their tortuous trend will offer sufficient resistance to rapid travel of gases. One head 32 should be removable and may be provided with an eye 35 for engagement by a hook or other tool to pull the cartridge into position in the shell 12 where it will be held by friction and to withdraw the same for replacement thereof or for cleaning of the balls.

The specific embodiment herein disclosed is not to be considered as a limitation but merely illustrative of the generic invention, since many modifications may be made within the scope of the accompanying claims by those skilled in the art.

I claim:

1. A safety device for vapor lines comprising a housing containing means providing a large number of small passages offering material resistance to rapid travel of gases, an inlet connection for the housing, an outlet connection for the housing, and a pressure relief value positioned adjacent the inlet to the housing and in line with the direction of flow of gases as they approach the housing.

2. A safety device for vapor lines comprising a housing containing heat dissipating and flame arresting means providing a large number of small passages adapted to offer material resistance to rapid travel of gases therethrough, a gas inlet connection for the housing, a gas outlet connection for said housing, and a pressure relief valve connected with said housing and in line with the direction of flow of gases.

3. A construction according to claim 2 wherein the pressure relief valve is positioned adjacent the housing inlet.

4. A construction according to claim 1 and a second pressure relief valve connected with the housing outlet.

5. A safety device for vapor lines comprising a shell, a large number of small tubes disposed in said shell to provide small passages for resisting rapid travel of gases therethrough, said shell and tubes being of heat conducting material for cooling hot gases, an inlet and an outlet for said shell and a movable pressure relief valve located adjacent the inlet to said shell and having its direction of opening in line with the direction of the path of the gases adjacent the shell.

Signed at Los Angeles, in the county of Los Angeles and State of California, this 4th day of January, A. D. 1929.

ELMER H. JONES.