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(54) **Slotted pipe with fire seal drainage system and its use**

Schlitzrohr mit Feuerschutzabschlussentwässerungssystem und dessen Verwendung

Tuyau à fentes avec système de drainage d'étanchéité coupe-feu et son utilisation

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Description

Technical Field

[0001] The invention relates to the construction of drainage system formed by slotted pipes, wherein at least one slotted pipe has a fireproof seal that prevents the spread of fire in a concrete precast slotted pipe system used to drain water from paved roads.

Background Art

[0002] At present, the fireproof seals in slotted pipe systems are implemented in two technical alternatives:

The first solution is a fireproof seal, also described in Utility Model No. CZ 14467 (U1) named "Safety Slotted Pipe," shown in Fig. 1. It was created using an atypical piece with a recessed inner chamber divided into two sections with either a removable or fixed partition. Its lower edge extends below the lower edge of the inlet and outlet. The inner exacerbated chamber is filled with water. The element is manufactured without an inlet slot and with a full cover to prevent oxygen from entering and prevent flame over-flashing. The inflowing burning liquid will flow downward via gravity into the inner chamber, i.e. to the part in front of the partition. Essentially, gases are burning that evaporate from the surface of the liquid and mix with oxygen. After reaching a certain temperature this mixture will start to burn, which will heat the surface of the liquid and accelerates its evaporation. The intensity of the burning depends on the amount of oxygen, temperature and evaporation rate from the free liquid surface. In the area before the partition, the flame propagation process will be stopped, as its further free spread will be prevented by the partition. Due to gravitational pressure and on the basis of equalization of layers, the inflowing fluid will flow under the partition. Here it will be cooled, and on the other side of the chamber in the area behind the partition, it will be cooled sufficiently so that the mixture does not ignite. The disadvantage of the described solution is the fact that the chamber must be permanently full of water in order to ensure the functionality of the system. If a fire occurs and the chamber is not full of water then the system will not prevent the spread of a fire. Another disadvantage is the accumulation of dirt in the recess area, where due to the influence of hydraulically-impure solution the speed of flow will decrease and fine particles will be deposited, resulting in reducing the flow capacity or subsequent blockage, i.e., this space must be cleaned frequently. Another major disadvantage is the non-systemic depth of the fireproof seal. The element is distinguished from other elements of the system by greater syntactic height, as it must have space for the creation of a deep chamber. This significantly complicates assembly, and particularly in the tunnels intricate passages must be created in the underlying structures of the vaults of the primary and secondary lining. Another solution applied nowadays is a measure created in-situ, also shown in Fig. 2, where the drainage channel at the end of the fire section ends in an inflow piece and plug. Using sealed sewer pipes, the inflowing liquid is drained into a separate sewer system. A new slotted pipe drainage channel is seamlessly connected to the end of the drainage channel. This creates a system of interconnected closed channels. The disadvantage of this system is the need to build parallel sewage systems, to which, after a certain distance - e.g. 50 m, while the length of the fire zone is always decisive - downspouts from individual channels are connected. Another disadvantage is that the system is not certified, and therefore protection against flame over-flashing cannot be verified. Documents DE-A-10016099, EP-A-2189584 and DE-U-202011052123 disclose drainage systems with a fireproof seal in particular for tunnels.

Disclosure of the Invention

[0003] The specified shortcomings of the currently used solutions are eliminated by the slotted pipe with fireproof seal according to the invention that meets the following three basic objectives of the solution.

[0004] The first objective is to prevent flame spreading in the drainage system of the slotted pipes whilst maintaining the same height of the fireproof seal element as other elements of the system. The second objective is to eliminate the need to keep water in a part of the system, thus ensuring system reliability. The third objective is to provide greater hydraulic purity of the solutions by eliminating unnecessary hydraulic losses and clogging due to settling of impurities.

[0005] The basic concept of the invention is the use of fire seals in the slotted pipe systems, an element externally dimensionally identical to the slotted pipe, but without a slot and with damming of the internal flow profile via a dry pivoting flap, or by two or more flaps. Flaps create two or more fireproof areas with a lack of oxygen intake, and thereby the ability to extinguish the fire whilst cooling the burning liquid and prevent evaporation of burning gases from the fluid flowing through. The flap is pivotally connected to the element at the top of the flow profile. The swivel movement of the flap is preferably at a limited angle of a maximum of 79° in the direction of the gradient of the liquid flow.

[0006] The flap is directly attached to the wall of the upper part of the flow profile, or via another fastening element, which mediates the connection between the flap and the inner wall of the slotted pipe. The flap prevents the direct transfer of hot burning gases from the area in front of the flap into the space behind the flap, even preventing flame flashing using flap plug-segments. The ef-

fect of flame flashing in the early stage of flame spreading, which normally accompanies flame spreading in closed pipe systems, wherein the expansion of burning gas causes an increase in pressure in the pipes, does not occur in slotted pipes due to the opening of the inlet slots in all system elements, except the element with fireproof seal. This slot also leads to smooth and easy pressure equalization between the flow profile with fireproof seal with the burning liquid and the surrounding environment. The weight of the pivoting flap with optional weight is created so that the resulting pressure acting on the valve was not able, at different gradients of the slotted pipe, to overcome the force of gravity ensuring the sealing of the flap with an installed counterweight.

[0007] If liquid does not flow through the element, the flap fills the entire space of the flow profile. Usually, the initial position of the flap is in a vertical position, see e.g. Fig. 11, although it is possible that the initial position of the flap is limited by a certain angle, see Fig. 12, or it is expanded against the direction of the flow of the liquid, see Fig. 13; such a design typically requires the creation of recesses in the lower inner wall of the slotted pipe. The flow profile can thus be closed from a variety of positions, of which the above figures are proof.

[0008] When fluid starts flowing through the system it flows from the inlet and accumulates in front of the flap. With increasing level of fluid, hydrostatic pressure begins to act on the wall of the flap. It should be understood that the higher the level of the liquid, the higher the pressure exerted on the flap. After reaching a certain size and depending on the mutual differences in height of the level, the fluid pressure acting on the wall of the flap will ensure tilting of the flap in the swivel joint in the direction of fluid flow. This will create a free space between the bottom of the slotted pipe and the bottom edge of the flap, through which the liquid accumulated on the inlet side, will flow.

[0009] The bottom edge of the flap is thus constantly in contact with the liquid, which is ensured by the actual weight of the flap with counterweight and acting force of gravity. Flashing of flames on the sides of the flap is prevented by the sliding segments of the flap. This ensures that the flap will not be opened more and the flame will not spread behind the flap on the side of the outlet, even when the ignition of flammable fluid in the system, not even if the flammable liquids are ignited in the system. This is due to the fact that as specified above, the weight of the flap along with the ventilation of the slotted pipe system through openings, through which liquid flows into the system, does not allow for such a an increase in pressure in the slotted pipe that would open the flap above the liquid level. If the inflow of fluid is reduced, this will decrease the level on the inlet side, thereby reducing the horizontal force acting on the flap, gravity will rotate the flap back and the flow profile will shrink or close. The lower edge of the flaps is always in contact with the liquid and prevents the transfer of the burning gases behind the flap.

[0010] Given that in the cross-section of the flow profile of the slotted pipe generally has an oval shape, in order to achieve the objectives of this invention, it is necessary that the profile of the pipe of the fireproof seal is in a vertical position from the location of the flap, and in the area behind the flap, in the direction of its opening, in the shape of a rectangle or square, and that the tightness of all of the outer edges of the flap in contact with the inner walls of the slotted pipe is maintained. The space in which the flap moves, must, in any of its swings copy the edges of the flap, with the exception of the bottom edge, which copies the lower edge of the flap only when the flap is in a vertical position. During swings the lower edge of the flap remains below the liquid level, which ensures that burning gases cannot over-flash into the space behind the flap. This measure is evident from the attached figures 7 to 9. In other words, the principle of preventing spreading of flame via a loose gap between the wall of the element and the flap consist of cooling the gases below their ignition temperature.

[0011] Based on this invention, this is achieved through a mutual combination of minimizing the thickness of the gap between the pivoting flap and the inner wall of the pipe and maximizing the length of the gap.

[0012] It is further proposed that the flap has balancing elements for fine tuning of the swing operation depending on the expected environmental conditions.

[0013] The flap operates completely independently only through the effect of the horizontal forces caused by increasing and decreasing the flow rate of the liquid and the gravitational forces of the earth. This ensures the smooth closing and opening of the flap.

[0014] The drainage system of the slotted pipes with fireproof seal can be manufactured as single-flap and dual-flap, i.e. with a locking flap placed behind the first flap in the direction of the flow of the liquid, or multi-flap, i.e. made up of several flaps, fitted into one or more slotted pipes. Based on this invention the drainage system of the slotted pipes contains at least one element - a slotted pipe - which contains at least one fireproof seal as described above. In order to meet the objectives of this invention, there must be at least one fireproof flap based on this invention in the slotted pipe drainage sewer system.

[0015] It is suitable to close the element with the flap in the area in front of the flap and/or in the space behind the flap, i.e. to create it without an inlet slot in order to minimize the flow of air, and thus oxygen, which is a prerequisite for combustion. Optimization of the distance between the inlet openings for liquid and placement of the flaps is largely dependent upon the needs of the particular installation.

[0016] On their side and lower edges, each pivoting flap may be supplemented by other appropriate measures that increase safety. Examples include tightening their sides, additional sidewalls extending the route of burning gases, thereby cooling the gas mixture below the combustion temperature. These sidewalls are conveniently placed vertically to the side profile of the pivot-

ing flap and must allow for the free movement of the flap, and they replicate the side walls of the interior space of the slotted pipe. The possible shape of the sidewalls should allow for the largest possible area adjacent to the walls of the slotted pipe while maintaining the required momentum of the flap and tilt angle. A suitable shape of the sidewalls would be a circle or ellipse, where the side edge of the flap passes through their centre, or a lozenge, where the side edge of the flap is placed vertically to its diagonal. In any case, the sidewall should not restrict the flap with regard to its desired rotation.

[0017] For easier cleaning, the system or its individual elements - slotted pipe - may be equipped with a service opening in the area in front of the flap, behind the flap or above the flap.

The length of the fireproof seal element may be modified, i.e. manufactured in various lengths ranging from 50 cm to 20 m.

Brief Description of Drawings

[0018]

Fig. 1 shows a slotted pipe according to the existing technology with an internal recessed chamber divided into two by a partition;

Fig. 2 shows a section of sewer drainage system according to the existing technology state, where the drainage channel at the end of the fire zone ends in an inflow piece and plug; using enclosed sewer pipes, the inflowing liquid is drained into a separate sewer system;

Fig. 3 shows a slotted pipe based on this invention fitted with one fireproof seal in the form of a flap;

Fig. 4 shows a slotted pipe based on this invention fitted with two fireproof seals in the form of a flap;

Fig. 5 shows a section of a sewer drainage system including a slotted pipe fitted with a single fireproof seal;

Fig. 6 shows a section of a sewer drainage system including a slotted pipe fitted with two fireproof seals;

Fig. 7 shows a longitudinal section of the slotted pipe fitted with a flap and a service opening, and marked cross sections A and B intersecting the slotted pipe in the space behind and in front of the flap;

Fig. 8 shows cross section A in front of the flap;

Fig. 9 shows cross section B in the space behind the flap;

Fig. 10 shows examples of the shape of the flap in one axonomic view, and examples of the various side profiles of the flaps;

Fig. 11 shows a diagram of the pivoting of the flaps in a convenient design with pivoting restricted to 79°, calculated from the position of the flap in a vertical position;

Fig. 12 shows a diagram of the flap with restricted initial pivoting position;

Fig. 13 shows a diagram of the flap with expanded initial pivoting position.

Examples of Embodiment of the Invention

Example 1

[0019] Slotted pipe 1 of the sewage drainage system according to Fig. 3 is fitted with a fireproof seal made up of a pivoting flap 2, which is affixed pivotally to the upper inner wall 11 of the slotted pipe 1 by means of a rotary connection 21 so that it permits liquid flow into the slotted pipe 1, and depending on the speed and the amount of liquid, this creates pressure on the flap 2, which, as a consequence of the force exerted by the liquid and gravity pivots the flap 2 in the direction of the liquid flow. The flap prevents the burning gas from proceeding further in the direction of the liquid flow above its surface. The flap 2, in a vertical position and at any of its rotations, fills the overall space above the liquid so that it adjoins to the internal walls of the slotted pipe 1. If liquid is present, the flap 2 is at least continuously partially immersed in the liquid so that it does not pass the burning gases in the direction of the liquid flow.

Example 2

[0020] The slotted pipe 1 of the sewage drainage system according to example 1 further contains a service opening 3, which is created behind a rotary joint 21 in the direction of the flow of the liquid.

Example 3

[0021] The slotted pipe 1 of the sewage drainage system according to example 1 contains two fireproof seals in the form of the flaps 2 according to example 1.

Example 4

[0022] The slotted pipe 1 of the sewage drainage system according to example 1, where the flap 2 is fitted with a counterbalance element to fine-tune the operation of rotating flap 2 based on the expected environmental conditions.

Example 5

[0023] The slotted pipe 1 of the sewage drainage system according to example 1, where the flap 2 is affixed to the upper inner wall 11 of the slotted pipe 1 via another fastener that mediates the joint between the flap 2, rotary joint 21 and the inner wall 11 of the slotted pipe 1.

Example 6

[0024] The slotted pipe 1 of the sewage drainage system according to example 1, where the space behind the flap 2 in the direction of the flow of the liquid, in which

the flap 2 rotates, has the shape of a block if the flap 2 has a rectangular shape in the cross-section of the slotted pipe 1, or if this space has the shape of a cube wherein the flap 2 has a square shape in the cross-section of the slotted pipe 1.

Example 7

[0025] The slotted pipe 1 of the sewage drainage system according to example 1, where the side walls of the flap 2 are fitted with gaskets in order to increase the insulating properties of the flap 2 against flame flashing from the space in front of the flap 2 into the space behind flap 2.

Example 8

[0026] The slotted pipe 1 of the sewage drainage system according to example 1, where the side walls of the flap 2 are formed by sidewalls 4, affixed perpendicularly to the side walls of the flap 2 so that the sidewalls are placed vertically to the side profile of the pivoting flap 2 and allow for free rotational movement of the flap 2; in terms of shape they copy the sidewalls of the internal space of the slotted pipe 1.

Industrial Utilization

[0027] The invention is useful for preventing spreading of fire in a slotted pipe sewage system. Individual fire seals divide the system into fire sections. Normally, the length is around 50 m, depending on the projected length of fire hoses. The invention is mainly applicable in highway tunnels, airports and industrial plants where it is necessary to prevent the free spreading of a fire through the system in case of fire.

List of Reference Marks

[0028]

1 - slotted pipe

11 - upper internal wall of the slotted pipe

12 - lower internal wall of the slotted pipe

2 - pivoting flap

21 - rotary joint

3 - service opening

4 - sidewall of the flap

Claims

1. A slotted pipe with fire seal drainage system **characterized by** a fireproof seal comprising at least one pivoting flap (2) or a set of pivoting flaps (2) which are pivotally mounted to an internal wall (11) of a flow profile of the slotted pipe (1), whereby a pivot joint of each pivoting flap (2) placed on the upper internal wall (11) of the flow profile comprises a rotary joint (21) allowing for the pivotal movement of each flap (2) in the direction of the gradient of the liquid flow; each pivoting flap (2) fills the entire internal profile of the slotted pipe (1) so that in the closed position it is adjacent to all of the internal walls of the slotted pipe (1) in order to prevent, in use, burning gases from entering behind the flap (2) ; during the pivoting of the flap (2) caused, in use, by the flow of the liquid, the lower edge of the flap (2)remains placed under the surface of the liquid.

2. The slotted pipe according to claim 1, **characterized by the** fact that the slotted pipe (1) containing at least one pivoting flap (2) or a set of pivoting flaps (2) is fitted with at least one service opening (3), or a set of service openings (3).

3. The slotted pipe according to claim 1, **characterized by the** fact that that the pivoting of the flap (2) is restricted in the direction of the gradient of the liquid flow and the angle from the vertical position of the flap (2) does not exceed an angle of 79°.

4. The slotted pipe according to claim 2, **characterized by the fact that** the service opening (3) is created directly behind the rotary joint (21) in the direction of the flow of the liquid.

5. The slotted pipe according to some of the claims 1 to 4, **characterized by the fact that** the profile of the pipe has a rectangular or square cross-section behind the pivoting of the flap (2) in the direction of the flow of the liquid in which the flap (2) pivots.

6. The slotted pipe according to some of the claims 1 to 5, **characterized by the fact that** the flap (2) is fitted with a variable counterbalance element to regulate the pivoting of the flap (2) according to the gradient of the slotted pipe.

7. The slotted pipe according to some of the claims from 1 to 6 is **characterized by the fact that** the side walls of the flap (2) are fitted with gaskets to increase the insulation capabilities of the flap (2) against flame flashing from the space in front of the flap (2) to the space behind the flap (2).

8. The slotted pipe according to some of the claims from 1 to 7 is **characterized by the fact that** the

side walls of the flap (2) are formed by sidewalls (4), affixed perpendicularly to the side walls of the flap (2) so that the sidewalls (4) are placed vertically to the side profile of the pivoting flap (2) and allow for free rotational movement of the flap (2); in terms of shape they copy the sidewalls of the internal space of the slotted pipe (1).

9. The slotted pipe according to some of the claims from 1 to 8 is **characterized by the fact that** the length of the slotted pipe (1) with a pivoting flap ranges from 50cm to 20m.

10. The use of a slotted pipe in the sewer system according to any of claims 1 to 9 for the safe removal of flammable liquids via a slotted pipe with fireproof seal from paved surfaces.

Patentansprüche

1. Fugenrohr mit Brandverschluss des Abwässerungssystems, **gekennzeichnet durch** ein Brandschutzverschluss, bestehend aus mindestens einer schwenkbaren Klappe (2) oder aus einem System schwenkbarer Klappen (2), die drehbar befestigt sind an der Innenseite (11) des Durchflussprofils des Fugenrohrs (1), wobei die Drehverbindung jeder der an oberer Innenseite (11) des Durchflussprofils angebrachten Schwenkklappen (2) eine Drehverbindung (21) einschließt, die die Schwenkbewegung jeder Klappe (2) in Gefällerichtung der Flüssigkeitsströmung ermöglicht, wobei jede schwenkbare Klappe (2) das ganze Innenprofil des Fugenrohrs (1) derart ausfüllt, dass sie in geschlossener Stellung an allen Innenwänden des Fugenrohrs (1) so anliegt, dass sie bei Gebrauch Undurchlässigkeit von brennbaren Gasen hinter die Klappe (2) sicherstellt, wobei bei Ausschwenken der Klappe (2) während Gebrauch die untere Kante der Klappe (2) durch das Wirken der Flüssigkeitsströmung unter dem Pegel der Flüssigkeit liegen bleibt.

2. Fugenrohr gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das Fugenrohr (1), das mindestens eine Schwenkbare Klappe (2) oder ein System schwenkbarer Klappen (2) enthält, mit mindestens einer Service Öffnung (3) oder einem System von Service Öffnungen (3) versehen ist.

3. Fugenrohr gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das Ausschwenken der Klappe (2) beschränkt ist in Gefällerichtung der Flüssigkeitsströmung und der Winkel von senkrechter Stellung der Klappe (2) nicht einen Winkel von 79° überschreitet.

4. Fugenrohr gemäß Anspruch 2, **dadurch gekennzeichnet, dass** die Service Öffnung (3) unmittelbar nach der Drehverbindung (21) in Richtung der Flüssigkeitsströmung ausgestaltet ist.

5. Fugenrohr gemäß eines der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** das Rohrprofil hinter der schwenkbaren Klappe (2) in Richtung der Flüssigkeitsströmung, in der die Klappe (2) ausschwenkt, einen rechteckigen oder quadratischen Querschnitt hat.

6. Fugenrohr gemäß eines der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** die Klappe (2) mit variablem Trimmelement zur Regelung der Schwenkung der Klappe (2) je nach Gefälle des Fugenrohrs versehen ist.

7. Fugenrohr gemäß eines der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** die Seitenwände der Klappe (2) mit Dichteinsätzen zur Erhöhung der Isolierfähigkeiten der Klappe (2) gegen Überspringen des Feuers aus dem Raum vor der Klappe (2) in den Raum hinter der Klappe (2) versehen sind.

8. Fugenrohr gemäß eines der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** die Seitenwände der Klappe (2) mit Seitenplatten (4) versehen sind, die derart senkrecht zu den Seitenwänden der Klappe (2) befestigt sind, dass die Seitenplatten (4) senkrecht zum Seitenprofil der schwenkbaren Klappe (2) angebracht sind, und freie Bewegung der Klappe (2) erlauben, wobei sie formmäßig bei senkrechter Stellung der Klappe (2) und auch bei ihren Drehungen die Seitenwände des inneren Durchflussprofils des Fugenrohrs (1) kopieren.

9. Fugenrohr gemäß eines der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** die Länge des Fugenrohrs (1) mit schwenkbarer Klappe sich in einem Bereich von 50cm bis 20m bewegt.

10. Anwendung des Fugenrohrs im Kanalisationssystem gemäß Kombinationen beliebiger der Ansprüche 1 bis 9 zur sicheren Abführung brennbarer Flüssigkeiten von befestigten Flächen mittels eines Fugenrohrs mit Brandschutzverschluss.

Revendications

1. Tuyau à fente avec fermeture coupe-feu du système de drainage **caractérisé par** une fermeture coupe-feu constituée d'au moins un volet pivotant (2) ou d'un système de volets pivotants (2) qui sont articulés au niveau de la paroi intérieure (11) du profil d'écoulement du tuyau à fente (1) où la connexion pivotante de chacun des volets pivotants (2) montés sur la paroi intérieure supérieure (11) du profil

d'écoulement comprend une articulation pivotante (21) permettant le mouvement pivotant de chaque volet (2) dans la direction du flux du liquide, chaque volet pivotant (2) remplissant en même temps tout le profil intérieur du tuyau à fente (1) de sorte qu'en position fermée, il est adjacent aux parois intérieures du tuyau à fente (1) de telle sorte que lors de l'utilisation, il empêche aux gaz brûlants de passer derrière le volet (2). Pendant l'utilisation, le bord inférieur du volet (2) reste lors de l'oscillation du volet (2) sous le niveau du liquide sous l'effet du flux de liquide.

2. Tuyau à fente, selon la revendication 1, **caractérisé en ce que** le tuyau à fente (1) comprenant au moins un volet pivotant (2) ou un système de volets pivotants (2) est pourvu d'au moins une ouverture de service (3) ou un système d'ouvertures de service (3).

3. Tuyau à fente, selon la revendication 1, **caractérisé en ce que** l'oscillation du volet (2) est limitée dans le sens du flux du liquide et l'angle par rapport à la position verticale du volet (2) ne dépasse pas l'angle de 79°.

4. Tuyau à fente selon la revendication 2, **caractérisé en ce que** l'ouverture de service (3) est formée immédiatement derrière l'articulation pivotante (21) dans le sens du flux du liquide.

5. Tuyau à fente selon une des revendications 1 à 4, **caractérisé en ce que** le profil du tuyau, derrière le volet pivotant (2) dans les sens du flux du liquide où le volet (2) pivote, est rectangulaire ou carré.

6. Tuyau à fente selon une des revendications 1 à 5, **caractérisé en ce que** le volet (2) est muni d'un contrepoids variable pour régler l'oscillation du volet (2) selon la pente du tuyau à fente.

7. Tuyau à fente selon une des revendications 1 à 6, **caractérisé en ce que** les parois latérales du volet (2) sont pourvues de joints d'étanchéité pour augmenter les propriétés isolantes du volet (2) contre la propagation du feu de l'espace devant le volet (2) dans l'espace derrière le volet (2).

8. Tuyau à fente selon une des revendications 1 à 7, **caractérisé en ce que** les parois latérales du volet (2) sont pourvues de renforts (4) fixés perpendiculairement au profil latéral du volet pivotant (2) et permettent un mouvement libre de pivotement du volet (2). Par leur forme, les renforts copient lés parois intérieures du profil d'écoulement du tuyau à fente (1) lorsque le volet (2) est en position verticale ou pivote.

9. Tuyau à fente selon une des revendications 1 à 8, **caractérisé en ce que** la longueur du tuyau à fente (1) avec volet pivotant varie entre 50 cm et 20 m.

10. Utilisation du tuyau à fente dans le système d'égout selon les combinaisons de toute revendication de 1 à 9 pour un écoulement sûr des liquides inflammables par le tuyau à fente avec fermeture coupe-feu en surfaces renforcées.

Fig. 1

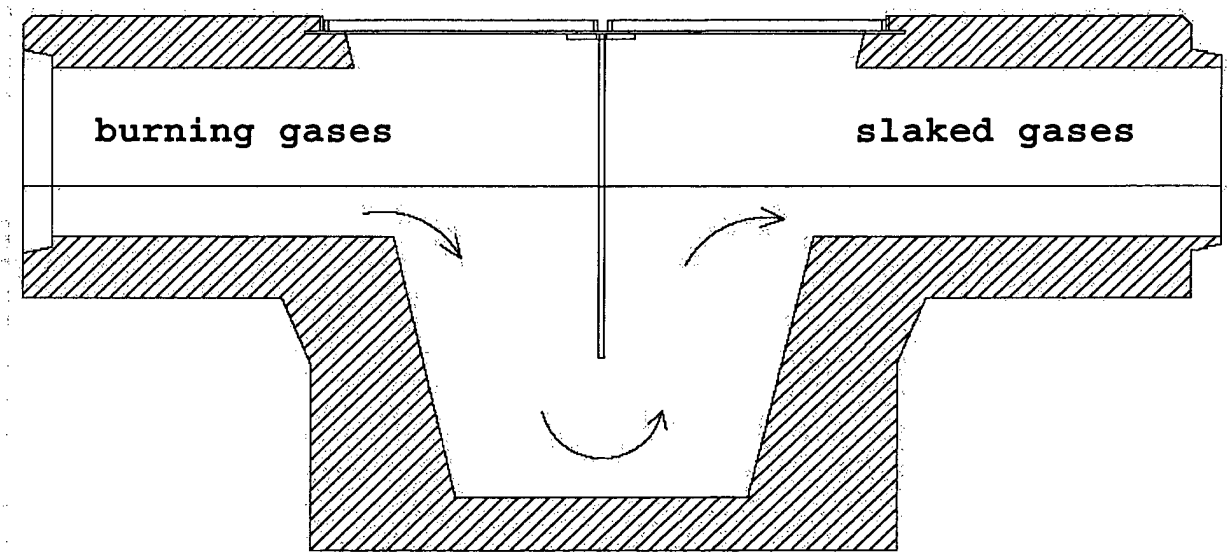


Fig. 2

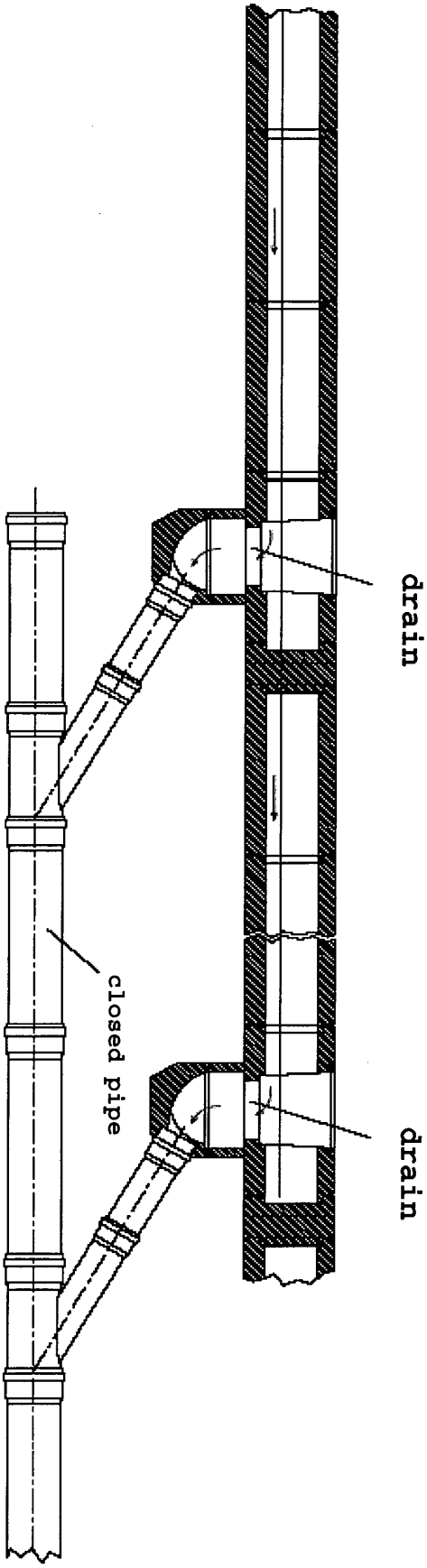


Fig. 3

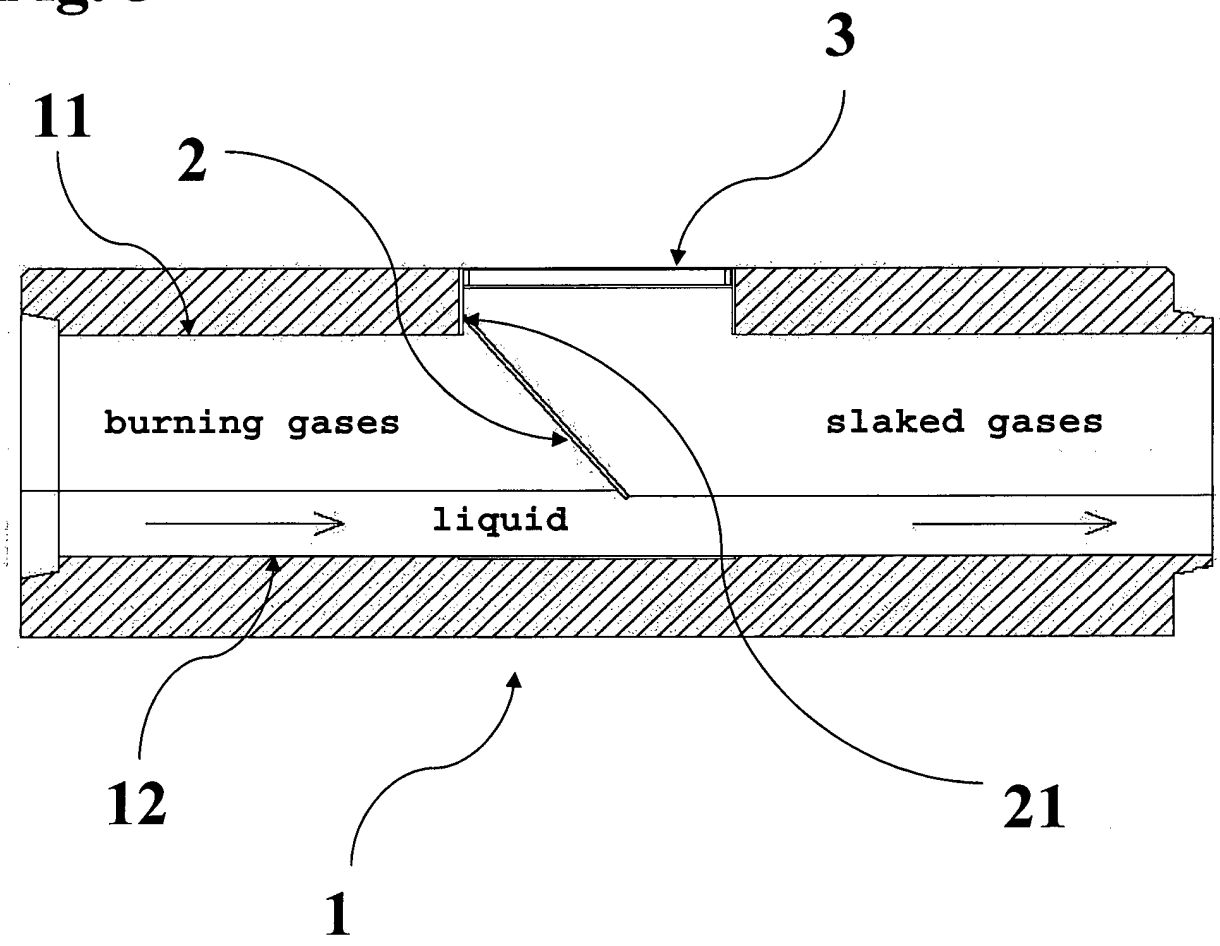
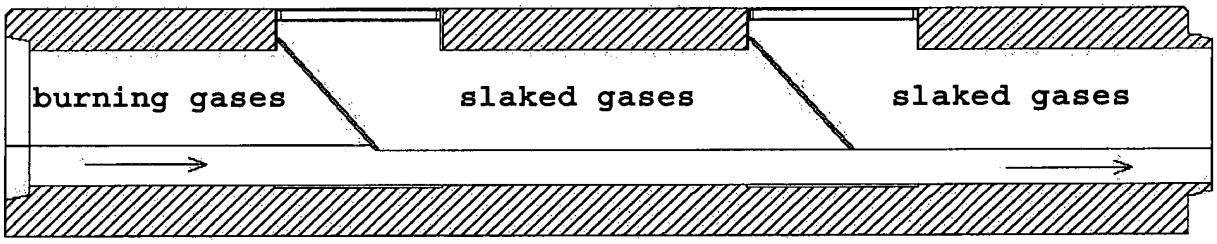

3
11
2
burning gases
slaked gases
liquid
12
21
1

Fig. 4


burning gases
slaked gases
slaked gases

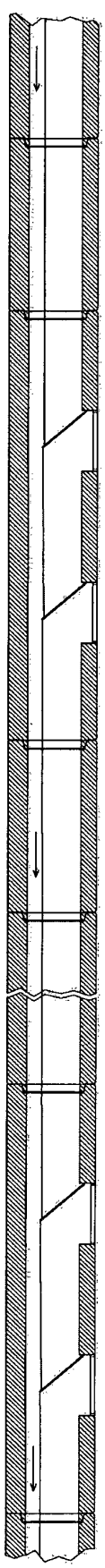


Fig. 6

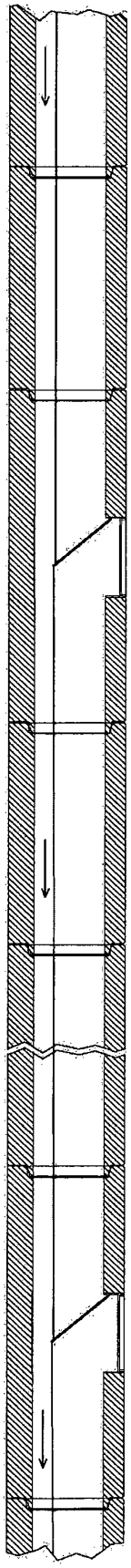


Fig. 5

Fig. 7

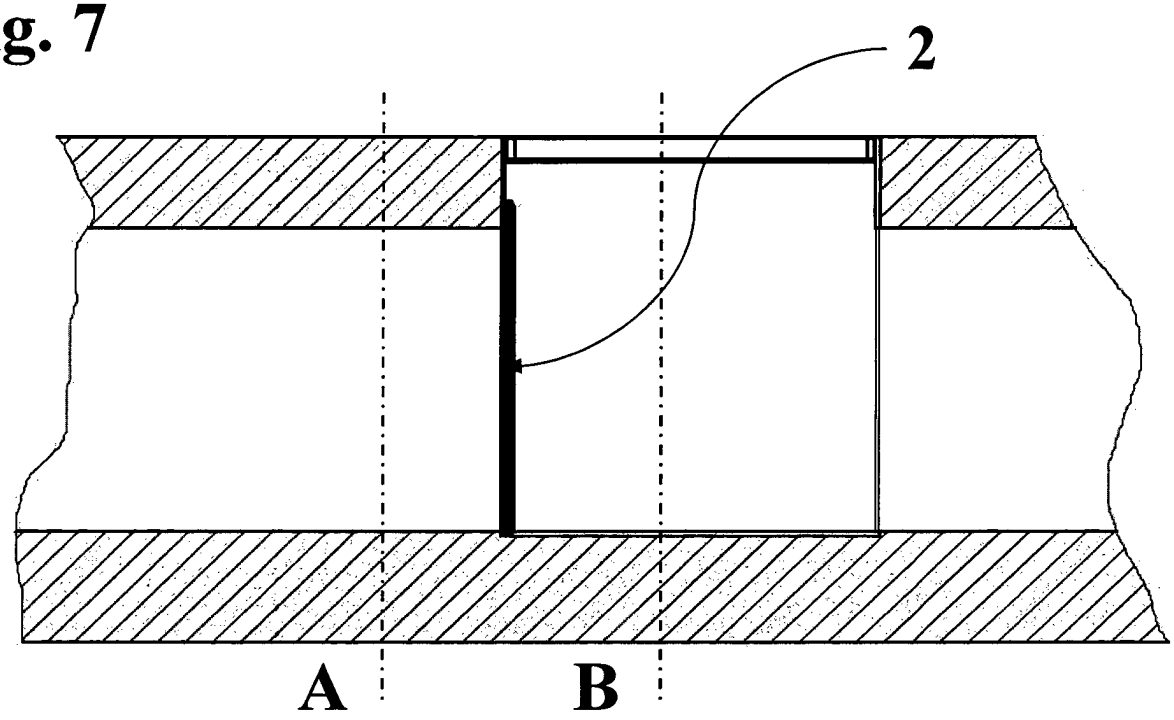


Fig. 8

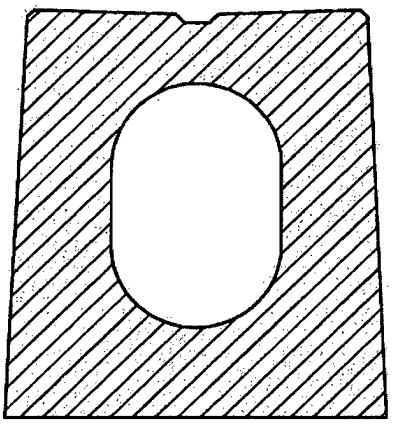


Fig. 9

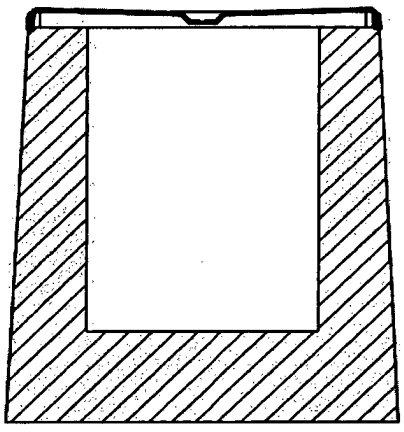


Fig. 10

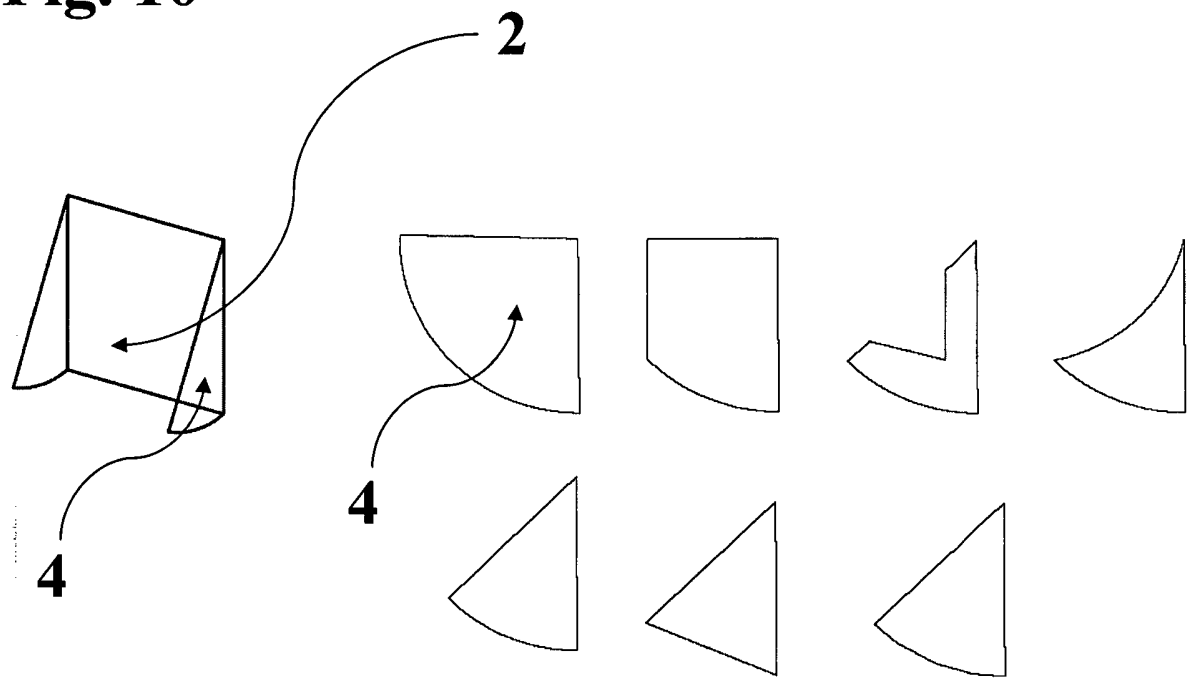


Fig. 11

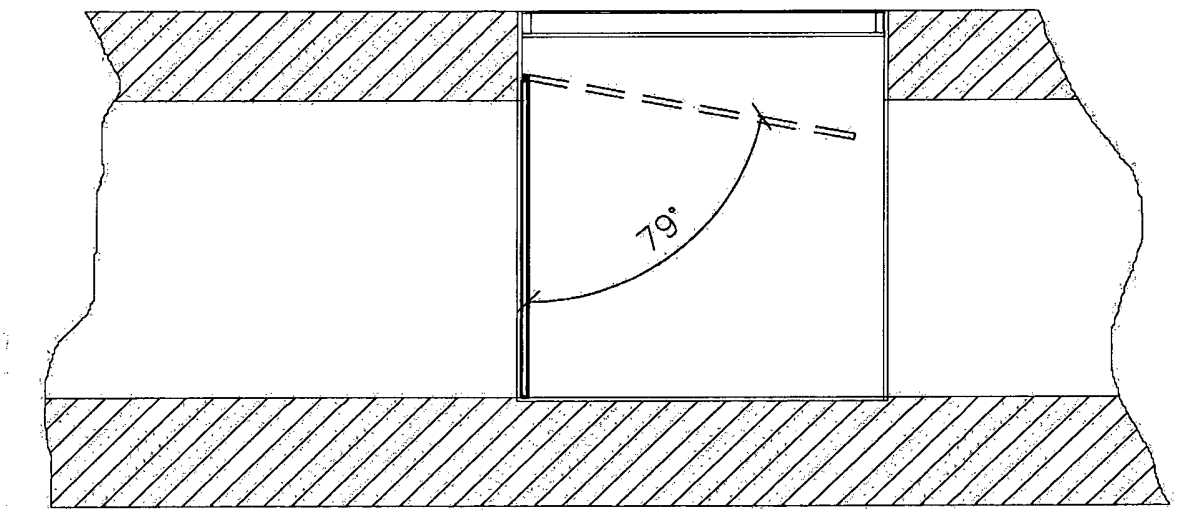


Fig. 12

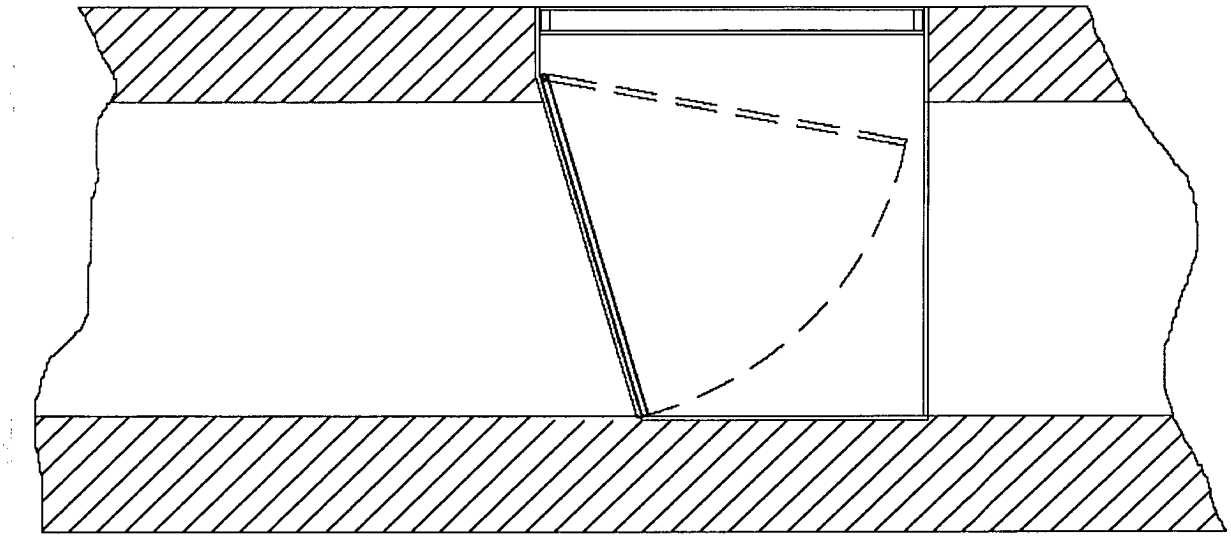
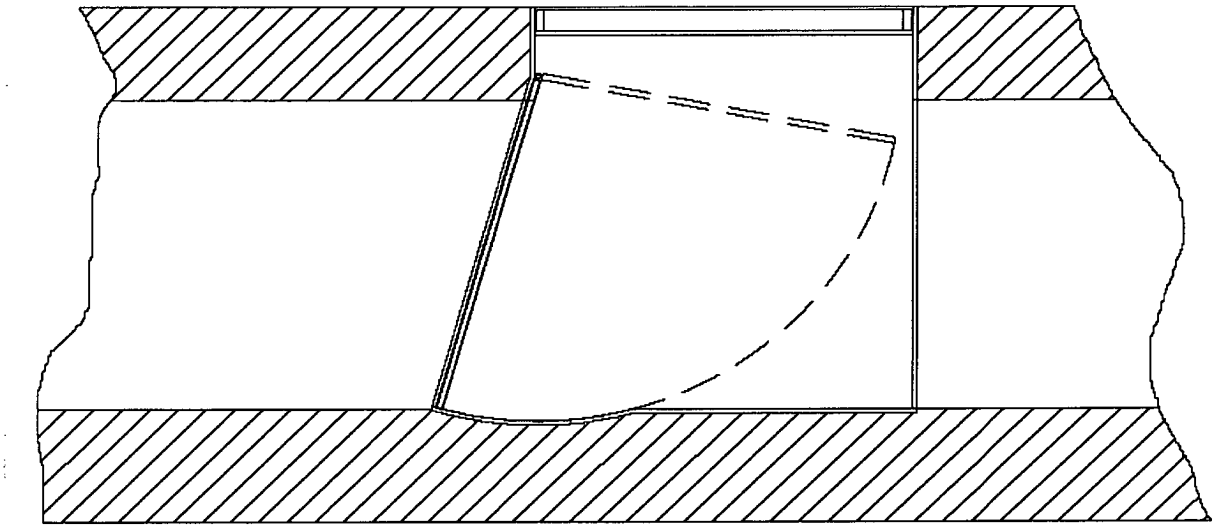


Fig. 13



REFERENCES CITED IN THE DESCRIPTION

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