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Pipe branch piece for downpipes

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ABSTRACT

A pipe branch piece (1) for a downpipe in which sewage in the form of a sewage layer (W) can be guided on a wall (11, 20) in a fall direction (F) comprises an upper downpipe section (2) having an inlet opening (3), a diverting section (4) adjoined to the upper downpipe section (2), and a lower downpipe section (5) adjoined to the diverting section (4) and having an outlet opening (6), as well as at least one supply pipe section (7), which in the region of the diverting section (4) opens out into the pipe branch piece (1), wherein the diverting section (4) comprises at least one diverting region (8) and a flow region (12) having a wall (11). The diverting region (8) comprises a diverting surface (10), running along a flow curve or flow line (M) and of curved configuration, for the bundling of the sewage as a jet (S), which flow curve or flow line (M) runs at a first angle (β) with respect to the fall direction (F) and at a second angle (α) with respect to a plane (E) extending through the fall direction (F), wherein, as a result of the two angles (β, α), the curved diverting surface (10), with its flow curve or flow line (M), is directed substantially tangentially to the wall (11) of the flow region (12).
The following statement is a full description of this invention, including the best method of performing it known to me/us:
The present invention relates to a pipe branch piece for downpipes according to the preamble to Claim 1.

A pipe branch piece of this type is known from the prior art. For example, CH 418 067 shows such a pipe branch piece.

The Applicant also markets a pipe branch piece under the name Geberit Sovent, which is in the form of a fitting which provides a cost-effective and technically sophisticated solution for feeding sewage into sewage downpipes in multi-storey buildings, such as, for example, in tower blocks.

The use of the product Geberit Sovent, and also of pipe branch pieces according to CH 418 067, has produced very good results. However, the demands with respect to discharge capacity, fall height, and the size requirements for such pipe pieces, have since risen.

In particular, an underpressure in the supply pipe is meant to be largely prevented during operation. The underpressure is generated by the sewage that flows in the downpipe and, particularly in the case of large fall heights, can become so great that sewage is sucked out of the siphon present in the supply pipe. Hence the siphon no longer acts as a sealing element
between the downpipe and the corresponding sewage outflows, such as a toilet outflow, etc.

The formation of the underpressure can be reduced, for example, by the arrangement of brake elements or guide elements, which in the region of the supply pipe brake or reroute the sewage flowing in the fall direction. This has an adverse effect, however, on the capacity or volume flow of the pipe branch piece, which results in the need to use pipe branch pieces with larger pipe diameters in order to obtain a comparable capacity. This is, in turn, undesirable, since greater installation space is then necessary.

It will be clearly understood that any reference herein to background material or information, or to a prior publication, does not constitute an admission that any material, information or publication forms part of the common general knowledge in the art, or is otherwise admissible prior art, whether in Australia or in any other country.

REPRESENTATION OF THE INVENTION

It is an object of the invention to overcome or at least alleviate one or more of the above problems and/or provide the consumer with a useful or commercial choice. Preferably an object of the invention is to define a pipe branch piece which overcomes the drawbacks from the prior art. More preferably an object of the invention is to provide a pipe branch piece whose capacity is increased while the overall size remains the same, or whose capacity is kept constant while the overall size is reduced.
An object of the invention is achieved by the pipe branch piece according to Claim 1. According to this, a pipe branch piece for a downpipe in which sewage in the form of a sewage layer can be guided on a wall in a fall direction comprises an upper downpipe section having an inlet opening, a diverting section adjoined to the upper downpipe section, and a lower downpipe section adjoined to the diverting section and having an outlet opening, as well as at least one supply pipe section, which in the region of the diverting section opens out into the pipe branch piece. The diverting section comprises at least one diverting region and a flow region having a wall. The diverting region comprises a diverting surface, running along a flow curve or flow line and configured curved around the flow curve or flow line, for the bundling of the sewage as a jet. The flow curve or flow line runs at a first angle with respect to the fall direction and at a second angle with respect to a plane extending through the fall direction. As a result of the two angles, the curved diverting surface, with its flow curve or flow line, is directed substantially tangentially to the wall of the flow region.

As a result of the tangential diversion, the flow resistance, viewed over the pipe branch piece, becomes smaller. Furthermore, no negative underpressures are generated in the region of the supply pipe section. Thus, if the pipe diameter remains the same, a greater capacity can be obtained, or, if the capacity remains the same, a smaller pipe diameter can be chosen.

Preferably, the curved diverting surface has the form of a channel, which extends along the flow curve or flow line. The channel here bundles the sewage into
the said jet and then leads this tangentially to the wall of the flow region.

Particularly preferably, the diverting region has the form of a pipe bend, wherein the pipe bend provides a channel extending along the flow curve or flow line. As a result of a pipe bend, a particularly simple structure can be created.

Preferably, the diverting surface or channel is concavely configured.

The flow curve or flow line can be configured in the region of the diverting surface as a rectilinear axis or as a curved line.

Preferably, a curve extends through the centre points of the pipe sections of the pipe branch piece, wherein the curve, in the region of the upper downpipe section, in parts of the flow region and of the lower downpipe section, lies in the aforesaid plane, and wherein the curve, in the region of the diverting region, is deflected laterally from the plane with respect to the fall direction. The above-described tangential impingement can thus likewise be obtained.

Preferably, a flow divider, viewed in the fall direction, is arranged in front of the diverting section, wherein the sewage layer can be broken with the flow divider. The flow divider reroutes the sewage preferably directly to the diverting section.

Preferably, the diverting region, viewed in the fall direction, is arranged immediately after the upper downpipe section, and/or the flow region is arranged immediately after the diverting region, and/or the
lower downpipe section is arranged immediately after the flow region.

Preferably, the supply pipe section boasts a mouth region in which the supply pipe, via the supply pipe section, opens out into the pipe branch piece, wherein the mouth region is separated from the flow region by a partition, so that sewage is prevented from passing out of the flow region into the mouth region.

Preferredly, between the flow region and the supply pipe section is arranged a vent duct, via which pressure differences between flow region and mouth region can be equalized.

Further advantageous embodiments are identified in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are described below with reference to the drawing, which embodiments serve merely for illustrative purposes and should not be construed restrictively. In the drawing:

Fig. 1 shows a side view of a pipe branch piece according to one embodiment of the present invention;

Fig. 2 shows a view of the pipe branch piece according to Figure 1 from the front;

Fig. 3 shows a perspective representation of the pipe branch piece according to Figure 1 in the flow-through state;

Fig. 4 shows a view of the pipe branch piece according to Figure 1 in the flow-through state from the side;
Fig. 5 shows a detailed view of Figure 4 from the rear;
Fig. 6 shows a view of the pipe branch piece according to Figure 1 in the flow-through state from above; and
Fig. 7 shows a sectional view along the line VII-VII of Figure 1 in the flow-through state.

DESCRIPTION OF PREFERRED EMBODIMENTS

Figures 1 and 2 show a pipe branch piece 1 for use in sewage downpipes in multi-storey buildings. The pipe branch piece 1 serves for the connection of a sewage supply pipe from one storey into the downpipe which extends from storey to storey, generally over the whole of the height of the building. The supply pipe is hence connected by the pipe branch piece 1 to the downpipe.

The pipe branch piece 1 comprises an upper downpipe section 2 having an inlet opening 3, a diverting section 4 adjoined to the upper downpipe section 2, and a lower downpipe section 5 adjoined to the diverting section 4 and having an outlet opening 6, as well as at least one supply pipe section 7, via which additional sewage is conducted into the downpipe. The upper downpipe section 2, the diverting section 4 and the lower downpipe section 5 are surrounded by a wall 11, 20. The upper downpipe section 2 of the pipe branch piece 1 is connected to an upper downpipe (not represented here), and the lower downpipe section 5 is connected to a lower downpipe (likewise not represented here). The supply pipe section 7 is in this case connected to the sewage pipes of, for example, a flat in a multi-storey building and is there sealed off from the pipe system by a siphon, as
has been explained in the introduction. The connection between the pipe branch piece 1 and the downpipe or the supply pipe is preferably effected via an integral connection, such as a weld joint.

In Figure 3, a schematic representation with the sewage is shown. The downpipes are arranged such that the centre axis lies in the vertical V. Hence the sewage flows in the vertical V in a fall direction F and forms on the wall 20 of the downpipe, and in part also in the downpipe sections 2, 3, a circumferential cylindrical sewage film or sewage layer W. In this context, it should be mentioned that sewage, which is substantially composed of water and solids, does not significantly differ from water with respect to flow effects.

In the central region of the downpipe stands an air column L, which extends in the downpipe between two pipe branch pieces 1. Due to the flowing motion of the sewage layer W, the air column L is set in pulsating motion, too great a pulsation having an adverse effect upon the efficiency of the pipe branch piece 1.

The diameter of the downpipe should be dimensioned such that, when the volume flow is at a maximum, the sewage flows off as a sewage layer W, the air column L also being present.

The sewage is conducted from the upper downpipe via the inlet opening 3 into the pipe branch piece 1 in the fall direction F, which substantially corresponds to the vertical V. The sewage hereupon passes through the upper downpipe section 2 and is diverted by the diverting section 4 according to the description below. In the region of the diverting section 4,
additional sewage is introduced into the downpipe via the supply pipe section 7. After having passed through the diverting section 4, the diverted sewage mixes with the additional sewage and leaves the pipe branch piece 1 via the lower downpipe section 5 or the outlet opening 6 in the direction of the lower downpipe. Due to the flow characteristic, a sewage layer $W$ and an air column $L$ is then also created in the lower downpipe as soon as the sewage has covered a certain distance.

The diverting section 4 here comprises a diverting region 8, which diverts the sewage $W$ from the fall direction $F$, and a flow region 12, which, viewed in the fall direction $F$, is arranged after the diverting region 8. The flow region 12 is preferably arranged immediately after the diverting region 8, i.e. directly adjoining the diverting region 8, whilst the diverting region 8 immediately or directly adjoins to the upper downpipe section 2. The flow region 12 then opens out directly into the lower downpipe section 5, with the result that the lower downpipe section 12 is arranged immediately after the flow region 12.

The diverting region 8 comprises a diverting surface 10, running along a flow curve or flow line $M$ and configured curved around the flow curve or flow line $M$, for the bundling of the sewage as a jet $S$. The curvature of the diverting surface 10 is here chosen such that the sewage layer $W$ is bundled by the diverting surface 10 substantially as a jet $S$ and again leaves the diverting surface 10 as a jet $S$. In the direction of the flow curve or flow line $M$, the flow curve or flow line $M$ can also be referred to as the centre axis of the curvature of the diverting surface 10.
In Figures 4 and 6, it is shown that the diverting surface 10, viewed in the fall direction F, stands at a first angle $\beta$ with respect to the fall direction F. It can also be said that the diverting surface 10 stands, in a plane E extending through the fall direction F, at the angle $\beta$ to the fall direction F. In Figure 4, the plane E is parallel to the surface of the drawing sheet. The plane E extends substantially through the centre axis of the upper down pipe section of the upper downpipe section 2 and of the lower downpipe section 5. The diverting surface 10, viewed in the direction of the fall direction F, runs at a second angle $\alpha$ with respect to the plane E. This can be recognized in Figure 6.

The first angle $\beta$ is chosen preferably within the range from $90^\circ$ to $175^\circ$, in particular within the range from $125^\circ$ to $155^\circ$, particularly preferably $140^\circ$. The second angle $\alpha$ is chosen preferably within the range from $0^\circ$ to $45^\circ$, in particular within the range from $10^\circ$ to $30^\circ$, particularly preferably $19^\circ$.

The curved diverting surface 10 is thus directed with its centre axis M substantially tangential to the wall 11 of the flow region 12. The sewage jet S thus impinges substantially tangentially on the wall 11 of the flow region 12. Due to the tangential impingement, the sewage jet S is guided along a flow curve through the flow region 12 and set in rotation around a curve 23 running, with respect to the wall 11, centrally through the flow region 12. The sewage jet S flows along the wall 11 through the flow region 12. It can hence be said that the sewage flows along the wall 11 helically in the fall direction F.
The curve 23 is placed substantially through all centre points of the pipe sections of the pipe branch piece. In Figures 4 and 5, the curve can be clearly recognized. With respect to the curve 23, it can also be said that this, in the region of the upper downpipe section 2, in parts of the flow region 12 and of the lower downpipe section 5, is part of the plane E or lies in the plane E or spans the plane E. The flow direction of the sewage is deflected by the diverting surface 8 laterally to the plane E and to the curve 23, so that the sewage is conducted tangentially to the wall 11 and thus the rotation around the curve 23 is attainable. This deflection 19 is shown in Figure 5. Hence the sewage rotates after having been diverted around the curve 23. The maximum deflection 19 is preferably found in the region of the end 21 of the diverting region 8.

Preferredly, the flow line or the flow curve is a curve which is smooth in the mathematical sense, so that the sewage undergoes, as far as possible, a turbulence-free diversion.

In other words, it can be said that the diverting region 8 is configured such that the sewage is divertible with respect to the fall direction F. The diversion is here such that the sewage impinges as a sewage jet tangentially on the wall 11 of the flow region 12. Due to the tangential impingement, the sewage jet is set in rotation around the line 23 running centrally through the flow region 12, and can be guided as a rotating flow along the wall 11 through the flow region 12.

The described rotation of the sewage has the advantage that a heavy braking of the sewage, and thus a
reduction in capacity, can be avoided. The rotation of the sewage along the wall 11 thus has the advantage that, if the diameter of the downpipe remains constant, a greater volume flow is attainable, or the diameter can be reduced if the volume flow remains constant. The rotation also enables an air column L to extend from the upper downpipe section 2 down to the lower downpipe section 5. An interruption of the air column by sewage does not therefore arise and the capacity is not negatively influenced. As a result of the continuous air column, no underpressure is generated in the system and thus no emptying of the siphons in the supply pipes can arise. Moreover, no stagnation zones with further negative effects, such as the pulsation of the air column, can be formed.

With reference to Figures 3 to 7, the guidance of the sewage through the pipe branch piece 1 is now explained in greater detail. After the passage through the upper downpipe section 2, the sewage flows through the diverting section 4 and then leaves the pipe branch piece 1 through the lower downpipe section 5. In the diverting section 4, which is found directly between the upper downpipe section 2 and the lower downpipe section 5, the sewage is diverted through the diverting region 8 with the diverting surface 10 such that the sewage impinges as a jet $S$ tangentially on the curved wall 11 of the flow region 12. After this, the water passes as a helical flow through the flow region 12 and then flows into the lower downpipe section 5.

In Figure 4, it can clearly be recognized that the sewage, after the diversion through the diverting region 8, is guided on the wall 11 opposite the supply pipe section 7 in the fall direction $F$. The same is
shown also in Figure 6. The guidance of the sewage opposite the supply pipe section 7 has the advantage that the sewage can be guided continuously on a wall, which makes the rotation continue without interruption.

In Figure 7 is shown a sectional representation along the sectional line VII-VII in Figure 1. This consequently concerns the lower region of the diverting section 4, directed towards the lower downpipe section 5.

The transition between the flow region 12 and the lower downpipe section 5 is preferably configured such that the sewage flows tangentially into the lower downpipe section 5. The lower section 15 hence stands immediately in front of the mouth into the lower downpipe section 5, tangentially to the wall 20 of the lower downpipe section. In the further course of a sewage pipe connected to the lower downpipe section 5, the rotation, due to flow effects, then in turn becomes a wall flow W. The tangential flow against the lower downpipe section has the advantage that no stagnation zone for the sewage can be formed in the lower downpipe section. Trials have shown that, in the case of the formation of a stagnation zone by the off-flowing water, a strong underpressure can be generated in the region of the supply pipe.

Preferably, the curved diverting surface 10 has the form of a channel 24, wherein the channel extends substantially along the centre axis M.

The diverting region 8 has, in particular, the form of a pipe bend 9, wherein the channel 24 or the diverting surface 10 is then provided by the pipe bend 9. The
pipe bend 9 is bent substantially by the angle \( \beta \) and is deflected with respect to the plane \( E \) by the angle \( \alpha \) to the fall direction \( F \). In the case of the pipe bend, the centre axis \( M \) is configured as a curved axis, the curvature substantially corresponding to the centre radius of the pipe bend. It can thus be said with respect to the centre axis \( M \) of the diverting surface 10 that this can be configured as a rectilinear axis or as a curved axis. In the curved variant, the flow losses are somewhat lower.

The diverting surface 10 or the channel 24 is configured preferably concavely with respect to the interior of the pipe branch piece, so that the water jet can be provided in a simple manner.

In the present embodiment, a flow divider 18 is arranged, viewed in the fall direction \( F \), in front of the diverting section 4, the sewage layer \( W \) being able to be broken with the flow divider 18. After the sewage layer \( W \) has been broken, the sewage then flows to the diverting region 8, where the water jet \( S \) is formed by the diverting surface 10. The flow divider 18 is preferably arranged such that the entire sewage quantity is rerouted to the diverting region 8. Furthermore, the flow divider 18 also has the advantage that, by breaking the film flow, the pulsation of the air column \( L \), and thus the generation of pressure differences in the pipe branch piece, is able to be reduced.

As already mentioned above, the flow region 12 is directly connected to the lower downpipe section 5, in which the sewage then flows out of the flow region.
Furthermore, the flow region 12 can stand with a section 25 of the wall 11 angled or inclined at an angle \( \gamma \) to the fall direction \( F \) or to the vertical \( V \). This is shown in Figure 4. Viewed from the vertical \( V \), the wall 11 is here inclined in the direction of the first diverting region 8. Preferably the angle \( \gamma \) is within the range from 2° to 12° with respect to the vertical \( V \).

The at least one supply pipe section 7 is here arranged such that this opens out into the pipe branch section 1 substantially at the level of the second diverting region 8. In the present embodiment, six supply pipe sections 7 in total are available. In this case, three supply pipe sections 7 of large diameter and three further supply pipe sections 7 of smaller diameter are respectively arranged in a T-shape, wherein the supply pipe sections 7 are here arranged at an angle of 90° to one another. Viewed in the fall direction \( F \), the group of large-diameter supply pipe sections 7 is preferably arranged above the group of small-diameter supply pipe sections 7.

The supply pipe section 7 conducts sewage to the pipe branch piece, wherein the sewage emerges into the pipe branch piece 1 via a mouth region 13. The mouth region 13 is separated by a partition 14 from the flow region 12, so that through-flowing sewage is prevented from passing out of the flow region 12 into the mouth region 13. Between the first diverting region 8 and the partition 14, it is also possible to arrange a vent duct 16 in the partition 14, wherein an air pressure equalization can take place between the flow region 12 and the mouth region 13, as is represented with the arrow 17. With this pressure equalization, a flow-induced pressure pulsation in the system is
prevented or severely reduced, so that the danger of the formation of underpressure in the supply pipes 7 is substantially reduced.

In Figure 5, the preferable arrangement of the vent duct 16 is shown. Preferably, the vent duct 16 is arranged, with respect to the fall direction $F$, laterally to the diverting surface 10, which has the advantage that the through-flowing sewage cannot flow through the vent duct 16 into the mouth region 13.

The equalization of the pressure difference has the advantage that, as a result of continuous equalization, large pressure differences at the various places cannot even be generated.

The pipe branch piece is preferably produced from a plastic by means of a plastic blow forming method and is configured in one piece.

Preferred diameters of the pipe branch piece are 110 mm and 160 mm. Trials have shown that, with the diversion according to the present invention, the same capacity can be obtained with a smaller diameter.

By way of summary, it can be said that with the helical guidance of the sewage through the pipe branch piece the flow losses can be reduced, whereby the capacity can be improved.
<table>
<thead>
<tr>
<th>Reference Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
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</tr>
<tr>
<td>2</td>
<td>upper downpipe section</td>
</tr>
<tr>
<td>3</td>
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<tr>
<td>4</td>
<td>diverting section</td>
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<td>5</td>
<td>lower downpipe section</td>
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<tr>
<td>6</td>
<td>outlet opening</td>
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<td>7</td>
<td>supply pipe section</td>
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<td>8</td>
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<tr>
<td>12</td>
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<td>γ</td>
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1. Pipe branch piece for a downpipe in which sewage in the form of a sewage layer can be guided on a wall in a fall direction, comprising an upper downpipe section having an inlet opening, a diverting section adjoined to the upper downpipe section, and a lower downpipe section adjoined to the diverting section and having an outlet opening, as well as at least one supply pipe section, which in the region of the diverting section opens out into the pipe branch piece, wherein the diverting section comprises at least one diverting region and at least one flow region having a wall wherein the diverting region comprises a diverting surface, running along a flow curve or flow line and configured partially curved around the flow curve or flow line, for the bundling of the sewage as a jet, which flow curve or flow line runs at a first angle (β) with respect to the fall direction and at a second angle (α) with respect to a plane extending through the fall direction, wherein, as a result of the two angles (β, α), the curved diverting surface, with its flow curve or flow line, is directed substantially tangentially to the wall of the flow region,

wherein the supply pipe section has a mouth region in which the supply pipe, via the supply pipe section, opens out into the pipe branch piece, wherein the mouth region is separated from the flow region by a partition, so that sewage is prevented from passing out of the flow region into the mouth region,

wherein between the flow region and the supply pipe section is arranged a vent duct, via which pressure differences between flow region and mouth region can be equalized, and

wherein the vent duct and the diverting region, viewed in the fall direction, are arranged laterally...
offset from one another, so that sewage can be prevented from passing through the duct.

2. Pipe branch piece according to Claim 1, wherein the curved diverting surface has the form of a channel, which extends along the flow curve or flow line.

3. Pipe branch piece according to Claim 1 or 2, wherein the diverting region has the form of a pipe bend, wherein the pipe bend provides a channel extending along the flow curve or flow line.

4. Pipe branch piece according to one of the preceding claims, wherein the diverting surface or channel is concavely configured.

5. Pipe branch piece according to one of the preceding claims, wherein the flow curve or flow line is configured in the region of the diverting surface as a rectilinear axis or as a curved line.

6. Pipe branch piece according to one of the preceding claims wherein a curve extends through centre points of the pipe sections of the pipe branch piece, wherein the curve, in the region of the upper downpipe section, in parts of the flow region and of the lower downpipe section, lies in the plane, and wherein the curve, in the region of the diverting region, is deflected laterally from the plane with respect to the fall direction.

7. Pipe branch piece according to one of the preceding claims, wherein the diverting region, viewed in the fall direction, is arranged immediately after the upper downpipe section, and/or wherein the flow region is arranged immediately after the diverting
region, and/or wherein the lower downpipe section is arranged immediately after the flow region.

8. Pipe branch piece according to one of the preceding claims, wherein a flow divider, viewed in the fall direction, is arranged in front of the diverting section, wherein the sewage layer can be broken with the flow divider.

9. Pipe branch piece according to one of the preceding claims, wherein an inclined section of the wall in the flow region stands at an angle (γ) within the range from 2° to 12° to the fall direction.

10. Pipe branch piece according to one of the preceding claims, wherein the wall, immediately after the inclined section, is at least in sections configured curved, in particular about an axis standing perpendicular to the fall direction.

11. Pipe branch piece according to one of the preceding claims, wherein the first angle (β) is within the range from 90° to 175°, in particular within the range from 125° to 155°, particularly preferably 140°, and/or wherein the second angle (α) is within the range from 0° to 45°, in particular within the range from 10° to 30°, particularly preferably 19°.
FIG. 3