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# DRAINAGE COLLECTING PIPE

The present invention relates to an improvement in a drainage collecting pipe interposed between two vertical drainpipes in a single pipeline drain system used in a high or medium height multiple dwelling house or the like to receive drainage and other waste water.

The single pipeline drain system comprises a plurality of vertical drainpipes connected together into a single drain pipeline extending from a top floor downwardly to receive drainage and other waste water from living quarters on each floor through sideways branch pipes. A portion for receiving drainage coming in through sideways branch pipes at each floor comprises a drainage collecting pipe interposed between the vertical drainpipes, and this collecting pipe has a greater diameter than the vertical drain pipes and includes open coupling portions projecting from a peripheral wall thereof to which the sideways branch pipes are connected. This single pipeline drain system has a problem of great air pressure variations and drain noise occurring to a progressively increasing degree as the drainage descends along the vertical drainpipes from top to lower floors.

Steps heretofore taken to solve this problem comprise, for example, constricting at least a lower half of the

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large diameter collecting pipe in a tapered shape as distinct from a simple cylindrical configuration, provision of baffles at the portions coupled to the sideways branch pipes, and provision of means to control drainage flows in the collecting pipe. In this connection, the present applicant has proposed a large diameter collecting pipe comprising helical baffle means protruding from its inner peripheral wall and extending from an upper end to a lower end, with a width gradually narrowing downwardly (which is disclosed in Japanese Patent Publication 57-18015). However, the improvements proposed to date are inadequate to prevent a rise in the air pressure inside the pipes, slow down drainage flow speeds, and suppress noise, and may even give rise to new problems of backflow to a watertight position leading from a toilet or the like and clogging occurring in the collecting pipe.

The present invention intends to solve the above unsolved problems, to realize effective reduction of variations in air pressure inside the pipes and of noise, and to permit drainage to flow downwardly under a stable air pressure smoothly and swiftly. More particularly, the present invention provides means to deflect drainage falling from a vertical drainpipe to a limited one side of the collecting pipe to thereby decelerate the speed of the drainage, means to guide drainage entering from a

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sideways branch pipe or pipes to a peripheral side  
opposed to the peripheral side along which the drainage  
from the vertical drainpipe flows to thereby avoid mutual  
interference between the vertical drainage and the sideways  
5 drainage and to prevent a rise in the air pressure and a  
backflow to the sideways branch pipe or pipes, and a  
constricted bottom portion of the collecting pipe having  
a protruding inclined baffle or baffles to prevent clogging  
and to reduce drain noise. Therefore, a collecting pipe  
10 according to the present invention is characterized by  
comprising open coupling portions at respective axial ends  
thereof for coupling to vertical drain pipes, and a collect-  
ing portion extending between the open coupling portions  
and having a large diameter than the vertical drainpipes,  
15 the collecting portion including a deflecting and decelerat-  
ing chamber, a collecting chamber, and a vortex chamber  
arranged in the aforesaid order along a pipe axis, the  
deflecting and decelerating chamber including a partition  
plate for deflecting drainage falling from the open coupling  
20 portion at a top end to one side in the collecting chamber,  
the collecting chamber being in communication at the other  
side with at least one branch pipe coupling portion, the  
vortex chamber being surrounded by a sloping peripheral  
wall to be tapered from top to bottom and including at least  
25 one baffle protruding from the sloping peripheral wall and

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inclined relative to the pipe axis to whirl drainage falling from the collecting chamber.

More particularly, the collecting pipe of this invention comprises the deflecting and decelerating chamber  
5 defined by the partition plate along one peripheral side in an upper portion of the collecting pipe, a collecting chamber immediately downstream of the deflecting and decelerating chamber for collecting vertical streams of drainage, branch pipe coupling portions provided on a peripheral side  
10 opposed to the deflecting and decelerating chamber, the sloping peripheral wall of the vortex chamber disposed at a lowermost portion of the collecting pipe, and the baffles protruding from the sloping peripheral wall and inclined relative to the pipe axis, and these features realize  
15 reliably and easily that the speed of drainage entering from the upper drainpipe is reduced, that mutual interference between the vertical drainage flow and the sideways drainage flow is prevented by deflecting the vertical flow to one side, thereby minimizing variations in air pressure inside  
20 the pipe and preventing backflow splashing water, that a smooth confluence is obtained in the collecting chamber, that the drainage flows spiraling down from the vortex chamber without stagnating therein, that the air pressure is stabilized by a continuous formation of air core, and  
25 that discharge speed is quickened and noise is reduced

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positively. The invention solves the problems of drain piping, in particular the single pipeline drain system for continuously and concentratedly discharging drainage from each floor of a multi-storey building, by markedly  
5 decreasing variations in the air pressure in the pipes and drain noise.

The invention will now be described in greater detail with reference to the accompanying drawings, in which;

Fig. 1 is a front view in vertical section of a  
10 collecting pipe according to the present invention,

Fig. 2 is a front view of a collecting pipe of the type comprising plural parts according to the present invention,

Fig. 3 is a sectional view taken on line III-III of  
15 Fig. 2,

Fig. 4 is a sectional view taken on line IV-IV of Fig. 3,

Fig. 5 is a sectional view taken on line V-V of Fig. 3,

20 Fig. 6 is a sectional view taken on line VI-VI of Fig. 3,

Fig. 7 is a sectional view taken one line VII-VII of Fig. 3,

Fig. 8 is a sectional view taken on line VIII-VIII of  
25 Fig. 3,

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Fig. 9, is a plan view of a flange of a lower part of the collecting pipe shown in Fig. 3,

Fig. 10 is a side view in section of a connection between upper and lower parts of the collecting pipe  
5 shown in Fig. 3,

Fig. 11 is a graph showing test results of air pressure variations in the pipe according to the present invention and in a prior art pipe,

Fig. 12 is a side view of an upper part of a modified  
10 embodiment of the present invention,

Fig. 13 is a sectional view taken on line XIII-XIII of Fig. 12,

Fig. 14 is a sectional view taken on line XIV-XIV of Fig. 13,

15 Fig. 15 is a side view in vertical section of an upper part of another embodiment of the present invention, and

Fig. 16 is a side view in section of a collecting pipe according to the prior art.

20 Fig. 1 shows a drainage collecting pipe 3 according to a first embodiment of the present invention. The collecting pipe 3 is interposed between an upper vertical drainpipe 1 and a lower vertical drainpipe 2, and includes open coupling portions 4 and 5 at respective vertical ends  
25 thereof connected to the two drainpipes 1 and 2 by known

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watertight coupling structures, respectively. The collecting pipe 3 comprises a body portion having a greater diameter than the drainpipes 1 and 2. In this embodiment the collecting pipe 3 comprises a large diameter cylindrical portion 3a extending from an upper position continuous with the top open coupling portion 4 to an intermediate position thereof, and a tapered portion converging downwardly from the intermediate position to the bottom open coupling portion 5, with gently sloping peripheral inner wall 3b as shown. A lip-like partition plate 6 depends from a side of a peripheral inner wall at a lower end of the top open coupling portion 4 and extends in the cylindrical portion 3a towards an axis X of the pipes, whereby a deflecting and decelerating chamber 7 is formed to deflect and decelerate drainage falling from the upper drainpipe 1 towards a side of a peripheral wall of the cylindrical portion 3a as indicated by an arrow A. The deflecting and decelerating chamber 7 occupies substantially an upper whole of the cylindrical portion 3a, which is determined by the length of the depending partition plate 6. A portion immediately below the deflecting and decelerating chamber 7 constitutes a collecting chamber 8 where the drainage deflected and decelerated by the partition plate 6 joins drainage from a sideways branch pipe connected to a peripheral position of the cylindrical portion 3a.



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More particularly, the collecting pipe 3 includes at least one protruding open coupling portion 10 connected to the sideways branch pipe 9 leading from a toilet or other waste source, the coupling portion 10 being provided  
5 on a peripheral wall of the collecting chamber 8 opposed to the drainage deflected to one side of the collecting chamber 8 after flowing along the partition plate 6 and through the deflecting and decelerating chamber 7 or on a peripheral wall of the collecting chamber 8 furthest from  
10 such drainage flows. While the illustrated example includes one coupling portion 10, a plurality of such coupling portions may be provided as desired, one above the other and projecting in different directions, by enlarging the axial dimension of the cylindrical portion 3a and  
15 the axial dimension of the collecting chamber 8. The portion immediately below the collecting chamber 8 and surrounded by the gently sloping peripheral wall 3b constitutes a vortex chamber 11 through which the drainage from the drainpipe 1 and the drainage from the sideways branch  
20 pipe 9, after joining each other in the collecting chamber 8, fall confluent to flow into the lower drainpipe 2 by way of the bottom coupling portion 5. The vortex chamber 11 includes a plurality of baffles 12 protruding from the inner wall or sloping peripheral wall 3b, whereby the  
25 confluence of the drainage from the upper drainpipe 1

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indicated by the arrow A and the drainage from the side-  
ways branch pipe 9 indicated by an arrow B spirals round  
the pipe axis X down the lower drainpipe 2 as indicated by  
an arrow C. More particularly, these baffles 12 are  
5 arranged at equal intervals around the sloping peripheral  
wall 3b, and each of the baffles 12 comprises a plate  
having an approximately trapezoidal shape and inclined  
relative to the pipe axis X. Each baffle 12 extends  
along the vertical direction of the sloping peripheral wall  
10 3b, with a width gradually narrowing from top to bottom.  
The sideways branch pipe 9 and the coupling portion 10 are  
interconnected by a known watertight coupling structure.

While the collecting pipe 3 according to the first  
embodiment as shown in Fig. 1 has an integral construction  
15 from the top open coupling portion 4 to the bottom open  
coupling portion 5, the collecting pipe 3 of this invention  
may comprise plural parts assembled one on top of the  
other. This modification or a second embodiment will now  
be described with reference to Figs. 2 to 10. The collect-  
20 ing pipe 13, whose entirety is shown in Figs. 2 and 3 and  
fragments are shown in Figs. 4 to 9, comprises an upper  
pipe part 13 having a top open coupling portion 4 and lower  
pipe part 14 having a bottom open coupling portion 5, the  
two pipe parts 13 and 14 being rigidly interconnected end  
25 to end by a flange connection 15. As shown in detail in



Fig. 10, a socket 14a is defined at the top of the lower pipe part 14 to receive a lower end of the upper pipe part 13, and a flange 14b is formed to extend radially from the socket 14a. The two pipe parts 13 and 14 are

5 rigidly connected by inserting the lower end of the upper pipe part 13 into the socket 14a, placing a sealing element 16 such as of rubber between a periphery of the lower end of the upper pipe part 13 and the flange 14b, bringing a

10 separate flange 17 into engagement with the sealing element 16, which flange 17 has been fitted on the upper pipe part 13 in advance, and fastening the two flanges 14b and 17 together by tightening bolts 18 and nuts 19. This coupling structure of course is not limited to the illustrated example but is variable in many different ways.

15 The collecting pipe 3 comprising upper and lower parts 13 and 14 as described includes a body portion continuous from the top open coupling portion 4 to the bottom open coupling portion 5 which constitutes a drainage collecting portion having a greater diameter than the drainpipes 1 and 2.

20 The upper pipe part 13 includes a partition plate 6 curved somewhat into a letter S shape in the illustrated example. The partition plate 6 extends from a lower end of the top coupling portion 4 to form a deflecting and decelerating chamber 7 along one side of the collecting pipe 3 as in the

25 first embodiment. As shown, a peripheral wall, approxi-

imately halfway around, of the upper pipe part 13 bendingly projects as at 13a in opposed relationship with the shape of the partition plate 6. The partition plate 6 has such a length as to extend into a lower portion of the upper pipe part 13. A collecting chamber 8 is defined to extend from the upper pipe part 13 to the lower pipe part 14, and more particularly from an open lower end of the upper pipe part 13 beginning at the lower end of the partition plate 6 to an open upper end of the lower pipe part 14.

10 In communication with this collecting chamber, there is formed a pre-collecting chamber 8a in a space upstream thereof and formed a pre-collecting chamber 8a in a space upstream thereof and opposed to the deflecting and decelerating chamber 7 across the partition plate 6. This pre-

15 collecting chamber 8a is formed also in the foregoing first embodiment as a portion 8a in the back of the partition plate 6. In the second embodiment, however, the pre-collecting chamber 8a is formed in a clearly defined large space owing to the shape of the partition plate 6.

20 The features of the second embodiment that the long collecting chamber 8 is provided utilizing the coupling portion between the upper and lower pipe parts 13 and 14 and that the pre-collecting chamber 8a is clearly defined by the shape of the partition plate 6, permit a plurality of

25 branch pipe coupling portions 10a and 10b to be provided



one above the other as shown in Figs. 2 to 6.

In particular, the pre-collecting chamber 8a behind the partition plate 6 is in communication with three upper branch pipe coupling portions 10a projecting in different directions from the periphery of the upper pipe part 13, and the collecting chamber 8 is in communication with one lower branch pipe coupling portion 10b projecting from the periphery of the lower pipe part 14. These upper and lower branch pipe coupling portions 10a and 10b may be utilized to admit various kinds of waste water and discharges of the miscellaneous nature from many different directions. For example, the upper branch pipe coupling portions 10a may be coupling to sideways pipes leading from toilets, and the lower branch pipe coupling portion 10b may be coupled to a sideways pipe leading from a kitchen or other waste source, or vice versa. The lower pipe part 14 includes a vortex chamber 11 extending from a lower end of the collecting chamber 8 at the top open end of the pipe part 14 to the bottom open coupling portion 5, the vortex chamber 11 being surrounded by gently sloping peripheral wall 3b. As shown in Figs. 3 and 5, the vortex chamber 11 includes a plurality of baffles 12 protruding from the sloping peripheral wall 3b and arranged at equal intervals therearound, the baffles 12 being inclined relative to the pipe axis X as in the first embodiment to turn confluent

streams falling from the collecting chamber 8 into whirling streams. These baffles 12 become narrower from top to bottom as shown.

In the example shown in Fig. 3, the baffles 12 extend  
5 continuously from the sloping peripheral wall 3b to the open coupling portion 5, but the baffles 12 may be provided only on the sloping peripheral wall 3b, from the collecting chamber 8 to the sloping peripheral wall 3b, or continuously from the collecting chamber 8 through the sloping peripheral  
10 wall 3b to the open coupling portion 5.

The collecting pipe 3 according to this invention is used, as conventional collecting pipes of this type, by mounting between vertical drainpipes, one for each storey, in a pipeline extending from top to bottom of a building.  
15 The collecting pipe 3 receives waste water from toilets, kitchens and other waste sources in one of the storeys flowing in by way of sideways branch pipes, and permits the waste water or drainage to join drainage falling through the vertical drainpipe and to drain continuously downwardly.  
20 The top of such a drainpipe system is open to the ambient and the bottom end thereof leads to a suitable sewage disposal pool.

With the collecting pipe 3 of the foregoing embodiment, the drainage falling from the upper drainpipe 1 enters the  
25 top open coupling portion 4 and is guided by the partition



plate 6 into the deflecting and decelerating chamber 7.

Thus, the drainage flows downwardly along one side of the pipe periphery having the large diameter portion 3a, deflected thereto by the shape of partition plate 8.

- 5 To be more particularly, the partition plate 6 acts to deflect the drainage falling vertically through the upper drainpipe 1 instead of permitting the drainage to flow straight down through an entire area of the large diameter portion. The deflecting action of the partition plate 6
- 10 is effective to slow down the drainage flow speed to thereby avoid a rise in air pressure within the pipe. The partition plate 6 is also effective to prevent the downwardly flowing drainage from directly contacting and interfering with drainage entering from the sideways
- 15 branch pipes 9 to thereby, again, avoiding a rise in air pressure within the pipe. Further, there occurs no back-flow of the drainage into the sideways branch pipes 9, but instead the drainage joins the drainage entering the collecting chamber 8 from the sideways branch pipes 9 through the
- 20 coupling portions 10a and 10b smoothly and quietly. In the collecting chamber 8, therefore, the drainage from the upper drainage 1 and the drainage entering from the sideways branch pipes 9 join one another in a side by side fashion, causing little turbulence due to mutual interference
- 25 and little variation in the air pressure inside the pipe.

The drainages thus join one another smoothly and without much noise, and flow together downwardly into the vortex chamber 11 disposed at the lowermost position of the collecting pipe 3. The vortex chamber 11 has a sectional configuration constricted downwardly by the gently sloping peripheral wall 3b, and includes a plurality of baffles 12 inclined relative to the pipe axis and projecting at equal intervals from the sloping peripheral wall 3b. Therefore, the confluence of drainage tends to be most close together in the vortex chamber 11, and here the confluence is subjected to the action of the baffles 12 to thereby flow down spiraling about the pipe axis. The confluence of drainage then flows down smoothly and free from elongging, into the lower drainpipe 2 in a most optimal manner.

At this time the spiraling flow caused by the baffles 12 forms an air core extending vertically along the pipe axis to thereby realize a stable drain without varying the air pressure inside the pipe and without causing much drain noise. Since the baffles 12 are arranged to project from the sloping peripheral wall 3b, a proper inclination angle thereof relative to the pipe axis is effective to prevent stagnation of the drainage in the vortex chamber 11 and to permit quick and reliable discharge of the drainage therefrom. The gentle sloping of the peripheral wall 3b is effective to prevent clogging and to stabilize the air

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pressure as already noted.

Thus, the collecting pipe 3 of the present invention ensures smooth downflow of drainage, minimizing and stabilizing the air pressure inside the pipe and involving  
5 little noise. Referring to Fig. 16 showing a different collecting pipe 3 for comparison purposes, this construction comprises a straight, large diameter cylindrical portion extending from top to bottom, with baffles 12 projecting in this large diameter portion, and a cylindrical vortex  
10 chamber 11 including these baffles 12 and directly connected to an open coupling portion 5 through a tapered portion 3b'. Because of this construction, drainage put to a vortex flow may stagnate at the tapered portion 3b' while whirling round. In contrast, the present invention provides the  
15 vortex chamber 11 with the sloping peripheral wall 3b as described, and with the baffles 12 on the sloping peripheral wall 3b, whereby the drainage flows whirling down into the lower drainpipe 2 without stagnating. Fig. 11 shows drain test results. The tests were carried out on single drain  
20 pipe systems in a eleven-storey building utilizing the collecting pipes of the present invention and conventional collecting pipes. In the tests, drain water was continuously run from the eleventh floor in an amount of 330 l/min. The graph shows variations in the air pressure inside the  
25 pipes from the first to eighth floors, in which curves Y

and Y' indicate variations where the collecting pipes of the present invention are used and curves Z and Z' indicate variations where the conventional collecting pipes are used. In the graph, the righthand side of the center column indicating the floors is for +P values and the  
5 lefthand side is -P values of the air pressure variations (both being mm Aq values), and tolerance limits are set at  $\pm 25$  mm Aq. As seen, the collecting pipes of the present invention has proved superior to the conventional collecting  
10 pipe, and particularly superior when used in lower floors.

Figs. 12 to 14 show a further embodiment of the present invention comprising a modified partition plate 6. Since this embodiment includes a lower pipe part identical to the lower pipe part of Fig. 2, a description hereinafter will  
15 be limited to a portion corresponding to the upper pipe part of the collecting pipe 3 shown in Fig. 2. In this embodiment, a portion of the collecting pipe 3 is formed to project inwardly as at 103, and a narrow bifurcate partition plate 6 extends from an upper face 103a of the projecting  
20 portion 103 diagonally downwardly along inner peripheries of the collecting pipe 3. The partition plate 6 has two arms spaced apart from each other by a distance  $l$  slightly greater than a minimum inside diameter  $d$  of the open coupling portion 4, as shown in Fig. 14. The two arms of  
25 the partition plate 6 terminate as at 6a which is short of



a peripheral point 103b lying in the direction in which the partition plate 6 extends. The projecting portion 103 and the partition plate 6 act to deflect drainage falling from the upper drainpipe towards the peripheral point 103b of the collecting pipe 3. The construction comprising the projecting portion 103 and the partition plate eliminates obstacles from the central part of the collecting pipe 3, thereby securing a large flow area for drainage and air inside the collecting pipe 3 and reducing variations in the air pressure therein.

Fig. 15 shows another embodiment of the present invention, in which only an upper pipe part of the collecting pipe is shown as the embodiment of Figs. 12 to 14, and in which a projecting portion 103 and a partition plate 6 are provided as in the preceding embodiment. The collecting pipe 3 in this embodiment, as distinct from those in the preceding embodiments, includes no branch pipe coupling portion 10a. It will be appreciated that the present invention is also applicable to such a construction as including no branch pipe coupling portion.



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CLAIMS

1. A drainage collecting pipe comprising open coupling portions at respective axial ends thereof for coupling to vertical drainpipes, and a collecting portion extending between said open coupling portions and having a large  
5 diameter than said vertical drainpipes, said collecting portion including a deflecting and decelerating chamber, a collecting chamber, and a vortex chamber arranged in the aforesaid order along a pipe axis, said deflecting and decelerating chamber including a partition plate for  
10 deflecting drainage falling from said open coupling portion at a top end to one side in said collecting chamber, said collecting chamber being in communication at the other side with at least one branch pipe coupling portion, said vortex chamber being surrounded by a sloping peripheral wall to be  
15 tapered from top to bottom and including at least one baffle protruding from said sloping peripheral wall and inclined relative to the pipe axis to whirl drainage falling from said collecting chamber.

2. A drainage collecting pipe as claimed in claim 1 wherein said collecting chamber comprises two parts arranged in



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the direction of the pipe axis and bolted together, each  
of said parts being in communication with at least one branch  
5 pipe coupling portion.

3. A drainage collecting pipe as claimed in claim 2 wherein  
said baffle has a width gradually reducing from top to  
bottom.

4. A drainage collecting pipe as claimed in claim 3 wherein  
said partition plate extends from one side wall in a  
bifurcate form in plan view diagonally downwardly along  
peripheral walls of said collecting pipe.

5. A drainage collecting pipe as claimed in claim 4 wherein  
said bifurcate partition plate has arms spaced apart by a



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distance slightly greater than a minimum inside diameter of said open coupling portion.

6. A drainage collecting pipe, substantially as herein-  
before described with reference to the accompanying drawings.

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