CLAIMS

1. A process for forming an opening in a pipe 1, comprising:

a step of enclosing a portion of the pipe 1 with a case 20, wherein a cutter 32 having a milling-shaped tool as a cutting tool 3 is attached to the case 20;

a skin formation step of cutting an outer surface 13 of the pipe 1 with the cutting tool 3 arranged in the case 20, thereby forming a groove G on the pipe 1, the groove G having a bottom that is formed as a skin 1S;

a removal step of removing shavings T produced from the cutting; and

a step of thrusting through the skin 1S to form the opening 10, after performing the skin formation step and the removal step.

2. The process according to claim 1, wherein the skin formation step is performed by revolving the cutting tool 3 in a circumferential direction R of the pipe 1 together with the case 20 while rotating the milling-shaped cutting tool 3 about a central axis 30 of the tool, thereby forming the groove G having the bottom, the groove G being elongated in the circumferential direction R.

3. The process according to claim 2, further comprising an insertion step of inserting a gate valve body 4 into the pipe 1 through the opening 10.

4. A process for forming an opening in a pipe 1, comprising:

a step of attaching a rotating unit 2 around the pipe 1, the rotating unit 2 being rotatable in a circumferential direction R of the pipe 1, wherein a cutter 32 having a milling-shaped cutting tool 3 is attached to the rotating unit;

a skin formation step of revolving the cutting tool 3 in the circumferential direction R of the pipe 1 together with the rotating unit 2 while rotating the milling-shaped cutting tool 3 about a central axis 30 of the tool, thereby cutting an outer surface 13 of the pipe 1 to form a groove G on the pipe 1, the groove G being elongated in the circumferential direction R and having a bottom that is formed as a skin 1S;

a removal step of removing shavings T produced from the cutting; and

a step of thrusting through the skin 1S to form the opening 10, after performing the skin formation step and the removal step.

5. The process according to claim 1 or 4, further comprising a step of forming a coating 6 on a surface of the groove G on the pipe 1 after performing the skin formation step and the removal step and before the step of forming the opening 10.

6. The process according to claim 4, wherein:

the rotating unit includes a case 20 that is divided in the

circumferential direction R of the pipe 1;

in the attachment step, a portion of the pipe 1 is enclosed with the case 20, the process further comprising:

an assembly step of assembling, instead of the tool 3, a flat plate-shaped gate valve body 4 to the case 20 before the step of forming the opening 10, the gate valve body 4 being used for thrusting through the skin 1S; and

an insertion step of inserting the gate valve body 4 into the pipe 1 through the opening 10 in the step of forming the opening.

7. The process according to claim 6, wherein the gate valve body 4 includes:

a circular-shaped valve main body 40 that enters an inside of the pipe 1; a blade 41 that is provided on a distal end side of the valve main body 40 for breaking the skin 1S to form the opening 10; and

a seal portion 42 that is provided on a proximal end side, which is opposite to the distal end side, and contacts a portion of the pipe 1 around the opening 10 to shut the opening 10, wherein:

the blade 41 of the gate valve body 4 thrusts through the skin 1S, thus performing the step of forming the opening 10; and

the valve main body 40 of the gate valve body enters the pipe 1, and the seal portion 42 contacts the portion of the pipe 1 around the opening 10 and the distal end side of the valve main body 40 contacts an inner periphery surface 14 of the pipe 1, thus

performing the insertion step.

8. The process according to claim 7, wherein:

the groove G extends in the circumferential direction R of the pipe 1;

the skin 1S is formed so that a thickness of a central portion of the skin 1S in a pipe axial direction S is thinner than opposite side portions of the skin 1S in the pipe axial direction S; and

the blade 41 breaks the thin central portion, thereby performing the step of forming the opening 10.

9. The process according to claim 1, wherein the cutting tool 3 is revolved in a circumferential direction R of the pipe 1 and moved in a pipe axial direction S of the pipe 1 while rotating the milling-shaped cutting tool 3 about a central axis 30 of the tool, thereby forming the bottomed groove G in a loop shape, thus performing the skin formation step.

10. The process according to claim 9, wherein:

in the step of forming the opening 10, a loop-shaped blade 41, which coincides with the loop-shaped bottomed groove G, is used to thrust through the skin 1S, thereby forming the opening 10 to be a branch port in the pipe 1; and

the process further comprises a step of removing the loop-shaped blade.

11. A pipe construction method for obtaining a piping structure, the piping structure including a gate valve body 4 assembled into a pipe 1, the piping structure comprising:

a pipe 1 that defines a groove G extending in a circumferential direction R, the groove G having a bottom that is formed as a skin 1S;

a case 20 that encloses a portion of the pipe 1 including the groove G having the bottom;

a gate valve body 4 that is arranged in the case 20; and

a valve rod 43 that brings the gate valve body 4 closer toward the groove G and further moves the gate valve body 4 so as to thrust through the skin 1S of the bottom of the groove G to form an opening 10,

wherein the gate valve body 4 includes:

a circular-shaped valve main body 40 that enters an inside of the pipe 1;

a blade 41 that is provided on a distal end side of the valve main body 40 for breaking the skin 1S to form the opening 10; and

a seal portion 42 that is provided on a proximal end side, which is opposite to the distal end side, and contacts a portion of the pipe 1 around the opening 10 to shut the opening 10,

the pipe construction method comprising:

a step of attaching a rotating unit 2 around the pipe 1, the rotating unit 2 being rotatable in the circumferential direction R of the pipe 1, wherein a cutter 32 having a milling-shaped

cutting tool 3 is attached to the rotating unit;

a skin formation step of revolving the cutting tool 3 in a circumferential direction R of the pipe 1 together with the rotating unit while rotating the milling-shaped cutting tool 3 about a central axis 30 of the tool, thereby cutting an outer surface 13 of the pipe 1 to form the groove G on the pipe 1, the groove G being elongated in the circumferential direction R and having the bottom that is formed as the skin 1S;

a removal step of removing shavings T produced from the cutting;

a step of removing the rotating unit and the cutter 32 from the pipe 1; and

a step of attaching the case 20 accommodating the gate valve body 4 therein to the pipe 1 so that the case 20 encloses the portion of the pipe 1 including the groove G having the bottom.

12. The pipe construction method according to claim 11, wherein:

the blade 41 of the valve main body 40 is made of metal; and

with the valve main body 40 in a valve-closed state, the metal-made blade 41 contacts an inner periphery surface 14 of the pipe 1, and the seal portion 42 contacts the portion of the pipe 1 around the opening 10.

13. The process according to claim 4, further comprising:

a step of removing the rotating unit 2 and the cutter 32;

an assembly step of assembling a case 20 to the pipe 1 so that the case 20 encloses the bottomed groove G of the pipe 1, the case 20 accommodating therein a flat plate-shaped gate valve body 4 that thrusts through the skin 1S, the assembly step performed prior to the step of forming the opening 10; and

an insertion step of inserting the gate valve body 4 into the pipe 1 through the opening 10 in the step of forming the opening.