Trial decision

Invalidation No. 2014-800036

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The case of trial regarding the invalidation of Japanese Patent No. 5137153, entitled "GROUT INJECTION METHOD AND DEVICE" between the parties above has resulted in the following trial decision.

Conclusion

The correction shall be approved as the description and scope of claims attached to the written correction request.

The patent for the invention according to Claim 2 of Japanese Patent No. 5137153 shall be invalidated.

The invalidation demand for trial with respect to the patent of the invention according to Claim 1 of Japanese Patent No. 5137153 is found to be groundless.

As for the costs in connection with the trial, 1/2 shall be borne by the demandant, and 1/2 shall be borne by the demandee.

Reason

No. 1 History of the procedures

The history of the procedures of this case is as follows.

May 22, 2012:	Application of the case (Japanese Patent Application No. 2012-116912)
November 22, 2012:	Registration of establishment of the patent right (Japanese Patent No. 5137153)

March 7, 2014:	Demand for invalidation trial of the case
April 7, 2014:	Submission of a written statement of the demandee
April 10, 2014:	Notification
July 25, 2014:	Submission of a written reply for the trial case and a written correction request of the demandee
August 21, 2014:	Written refutation of the trial case of the demandant
October 16, 2014:	Notification of matters to be examined
October 16, 2014:	Submission of an application for intervention of the intervention requester
November 11, 2014:	Submission of an oral proceedings statement brief of the demandee
November 12, 2014:	Submission of an oral proceedings statement brief of the demandant
November 14, 2014:	Decision on acceptance or non-acceptance of intervention
November 26, 2014:	Submission of a written statement of the demandant
November 26, 2014:	Oral proceeding
December 9, 2014:	Submission of a written statement of the demandant
December 22, 2014:	Submission of a written statement of the demandee
May 11, 2015:	Advance notice of a trial decision

No. 2 Request for correction

1 Content of the request for correction

The request for correction dated July 25, 2014 (hereinafter, referred to as "Correction of the case") requests to correct the description and scope of claims of Japanese Patent No. 5137153 as described in the corrected description and scope of claims attached to the written correction request, and the following matters shall be details of the correction. (Underlines indicate amended portions.)

(1) Correction A

"A second division until the grout separated in the above-mentioned liquid separation board and respectively passing through discharge ports is injected into a ground from the plurality of injection ports through second injection hoses" in Claims 1 and 2 of the scope of claims, is corrected to "a second division until the grout separated in the liquid separation board and respectively passing through discharge ports <u>with the same cross-sectional area</u> is injected into a ground from the plurality of injection ports through second injection hoses."

(2) Correction B

"A second division until the grout separated in the above-mentioned liquid separation board and respectively passing through discharge ports is injected into a ground from the plurality of injection ports through second injection hoses" described in Paragraphs [0020] and [0021] in the description attached to the application, is corrected to "a second division until the grout separated in the liquid separation board and respectively passing through discharge ports <u>with the same cross-sectional area</u> is injected into a ground from the plurality of injection ports through second injection hoses."

2 Suitability of correction

(1) Regarding Correction A

A　Correction A corrects "discharge ports" in Claims 1 and 2 to "discharge ports with the same cross-sectional area," and is intended for restriction of the scope of claims for patent.
B　As it is obvious from A above, Correction A is to restrict the matters specifying the invention to a more specific concept, is not a correction that aims at altering category, target, or purpose and therefore this does not substantially enlarge or modify the scope of claims of the patent.
C　In view of the description "that is, it is divided into a first division which reaches a liquid separation board to which grout is press-fed by an injection pump through first injection hoses; and a second division until the grout separated in the liquid separation board and respectively passing through discharge ports with the same cross-sectional area is press-fed to one or more injection pipes provided with one or more injection holes through second injection hoses and the grout is injected into a ground from the injection holes, and is configured by adjusting a flow rate (discharge amount) of the grout." in Paragraph [0010] of the specification of the patent publication, Correction A is a correction within a range described in the description or drawings attached to the application.

(2) Regarding Correction B
A　In order to adjust the description of the scope of claims and the description of the detailed description of the invention along with the correction relating to Correction A, Correction B corrects "discharge ports" respectively described in Paragraphs [0020] and [0021] of the description attached to the application to "discharge ports with the same cross-sectional area."

Therefore, Correction B is intended to explain the description which is not clear.

B　In view of (1) B and C above, it is obvious that Correction B is not a correction that substantially enlarges or modifies the scope of claims of the patent, and is a correction within a range described in the description or drawings attached to the application.

(3) Summary

As described above, Correction of the case aims at matters prescribed in Patent Act Article 134-2(1) provisos No. 1 and No. 3, and complies with the provisions of Article 126(5) and (6) of the Patent Act as applied mutatis mutandis in the provisions of Article 134-2(9).　Therefore, Correction of the case shall be approved.

No. 3 The patent invention

Since the corrections are approved as the above No. 2, the inventions relating to Claims 1 and 2 of the Patent (hereinafter, referred to as "Invention 1" and "Invention 2") are recognized as follows, as specified by the matters described in Claims 1 and 2 of the corrected scope of claims attached to the written correction request of the case.

"[Claim 1]

A grout injection method which simultaneously injects grout at least through a plurality of injection holes installed in a ground,

forming a first division which reaches an inlet of discharge ports on a liquid separation board to which grout is press-fed by an injection pump through first injection hoses, and a second division until the grout separated in the liquid separation board and respectively passing through the discharge ports with the same cross-sectional area is injected into a ground from the plurality of injection ports through second injection hoses;

setting a total cross-sectional area of the plurality of injection ports to be larger than a total cross-sectional area of the discharge ports;

uniformly separating the grout from the plurality of discharge ports on the liquid-separation board, by deciding a flow rate in advance, measuring ground resistance pressure, and loading the grout flowing in the first division to have compulsive pressure higher than the measured ground resistance pressure; and

injecting the grout flowing in the second division based on the ground resistance pressure through the injection holes.

[Claim 2]

A grout injection device which simultaneously injects grout at least through a plurality of injection holes installed in a ground,

having a first division which reaches an inlet of discharge ports on a liquid separation board to which grout is fed by an injection pump through first injection hoses, and a second division until the grout separated in the liquid separation board and respectively passing through the discharge ports with the same cross-sectional area is injected into a ground from the plurality of injection ports through second injection hoses,

wherein a total cross-sectional area of the plurality of injection ports is set to be larger than a total cross-sectional area of the plurality of discharge ports,

the first division uniformly separating the grout from the plurality of discharge ports on the liquid-separation board, by deciding a flow rate in advance, measuring ground resistance pressure, and loading the flowing grout to have compulsive pressure higher than the measured ground resistance pressure, and

the second division injecting the flowing grout based on the ground resistance pressure through the injection holes."

No. 4 Allegations of the parties

1. Outline of the demandant's allegation

The damandant submitted Evidence A No. 1 to A No. 6 and alleged the following reasons for invalidation, in the written demand for trial, the written refutation of the trial case dated August 21, 2014, the oral proceedings statement brief dated November 12, 2014, the written statement dated November 26, 2014, and the written statement dated December 9, 2014.

[Reasons for invalidation]

The inventions relating to Claims 1 and 2 of the Patent are also inventions described in Evidence A No. 1, and fall under Articles 29(1)(iii) of the Patent Act, and thus the appellant should not be granted a patent for them. The inventions could have been easily provided by a person skilled in the art based on the invention described in Evidence A No. 1, or based on the inventions described in Evidence A No. 1 and Evidence A No. 2, and thus the appellant should not be granted a patent under the provisions of Article 29(2) of the Patent Act. Thus, the patent falls under Article 123(1)(ii) of the Patent Act and should be invalidated.

[Means of proof]

Evidence A No. 1: Japanese Patent No. 3663113

Evidence A No. 2: Japanese Unexamined Patent Application Publication No. 2003-27457

Evidence A No. 3: Copy of a production drawing of YR40 Sleeve Pipe by HARA KOUGYOU CO., LTD. as an example of an injection pipe of a double packer construction method

Evidence A No. 4: Notification and interim guidelines relating to construction of construction work by a chemical-injecting construction method, No. 160 issued by Ministry of Construction Secretariat Technique, July 10, 1974, copies downloaded from the homepage of Ministry of Land, Infrastructure Transport and Tourism Kyushu Regional Development Bureau

Evidence A No. 5: Geotechnical engineering/the business series 11 the prediction and actual condition of a soil improvement effect, Japanese Geotechnical Society, issued on February 15, 2000, copies of Pages 279 to 285, and 311

Evidence A No. 6: Notification and interim guidelines relating to construction of construction work by a chemical-injecting construction method,

Notification No. 110-1 issued by Ministry of Construction Technical Investigation Secretariat Technique,
April 24, 1990
No. 188-1 issued by Ministry of Construction Technical Investigation
September 18, 1990

Interim Guidelines
No. 160 issued by Ministry of Construction Secretariat Technique
July 10, 1974
(Copies downloaded from the following URL of the homepage of the Ministry of Land, Infrastructure, Transport and Tourism Kanto Regional Development Bureau:
http://www.ktr.mlit.go.jp/ktr_content/content /000007052.pdf)

Also, Evidence A No. 3 and Evidence A No. 4 have been replaced with Reference Material 1 and Reference Material 2 attached to the written refutation (see first oral proceeding record).

2 The demandee's allegation

The demandee submitted Evidence B No. 1 to B No. 5 in the written reply of the trial case dated July 26, 2014, the oral proceedings statement briefs dated November 11, 2014, and the written statement dated December 22, 2014, and demanded the decision, "The demand for trial of the case was groundless, and costs in connection with the trial shall be borne by the demandant."

[Means of proof]

Evidence B No. 1: Lasting Grout Injection Method, Sankai-Do, Inc., issued on August 18, 2000, copies of Pages 34 and 35

Evidence B No. 2: New edition An illustration grout manual, Lattice CO., LTD, issued on April 15, 1982, copies of Pages 216 and 217
Evidence B No. 3: Design/construction guidelines of a chemical-injecting construction method, Japanese Grout Association, issued in June, 1989, copies of Pages 1 to 7, 32, 33, 38, 39, and 56
Evidence B No. 4: A durable grout injection method construction guide line, Japanese Grout Association, issued in March, 2012, copies of Pages 1, 2, 14, 27, and 28
Evidence B No. 5: A correct grout injection method construction guide line-a book understanding essence-, Japan chemical-injecting association, issued on January 31, 2002, copies of Pages 350 to 355

No. 5 Judgment by the body
1 Described matters in Evidence A
(1) Evidence A No. 1
Evidence A No. 1 which was distributed prior to the application of the Patent, describes the following matters.

A "Detailed Description of the Invention
[0001]
[Field of the Invention]
The present invention relates to the ground improvement of a large amount of soil, such as ground improvement for rapid construction in liquefaction preventive construction or large-scale construction, and especially to a ground injection device and a ground injection construction method which install a plurality of injection pipelines in a ground to be improved, and simultaneously, selectively, and automatically inject an injection liquid from the plurality of injection pipelines."

B "[0012]
Then, an objection of the present invention is to provide <u>a ground injection device and a ground injection construction method using the device</u> which simultaneously and automatically injects an injection liquid with an optimal set flow rate or set pressure, when injecting the injection liquid into a target soil layer from a plurality of injection pipelines installed in a ground to improve the ground, thereby rapidly and certainly improving the ground in a wide range and improving defects existing in the above mentioned prior art. "

C "[0015]
[Embodiments of the invention]
Hereinafter, the present invention will be depicted using the attached drawings.
[0016]
Figure 1 is an explanatory view of one example of a ground injection device according to the present invention. Figure 2 is an explanatory view of another example of an injection liquid distribution part shown in Fig. 1. Figure 3 is an explanatory view of another example of an injection liquid pressurization part shown in Fig. 1. Figure 4 is an explanatory view of an annular distribution container. Figure 5 is an explanatory view of a drum-type distribution container. Figure 6 is a front view of a multistage type distribution container, and Fig. 7 is a side view of Fig. 6. Figures 8 and 9 show

examples using a multistage branch pipe. Figures 10 and 11 show examples using a plural-direction branch body. Figure 12 is an explanatory view of another example of the injection liquid distribution part shown in Fig. 1. Figure 13 is an explanatory view of further another example of the injection liquid distribution part in Fig. 1. Figure 14, 15, and Fig. 16 are explanatory views of another example of the ground injection device according to the present invention. Figure 17 shows one example of an injection pipeline of an injection part in Fig. 1, and is a cross-sectional view showing a state installed in the ground. Figure 18 shows one example of the injection pipeline equipped with a bag packer, and is a cross-sectional view showing a state installed in the ground. Figure 19 shows one example of a double-pipe double packet injection pipeline. Figure 20 shows another example of another injection pipeline, and (a), (b), and (c) are cross-sectional views respectively showing a single pipe, a double pipe, and a triple pipe. Figure 21 shows another example of the injection pipeline of the double pipe double packer. Figure 22 shows further another example of the injection pipeline, and is a cross-sectional view showing a state in which an inner pipe of the double pipe is slid upward to inject. Figure 23 shows further another example of the injection pipeline, and is a cross sectional view of the one in which the plurality of injection pipelines is provided in the injection pipe so as to open discharge ports thereof at different positions in an axial direction. Figure 24 shows one example showing a formation mode of a horizontal consolidation layer. Figure 25 shows one example showing a formation mode of a laminated consolidation layer of a consolidation layer of Fig. 24. Figure 26 is a graph showing a relationship between injection pressure and injection speed.

[0017]

The present invention device is a device which injects a ground injection liquid into a ground through a plurality of injection pipelines installed in the ground to consolidate the ground, and as shown in Fig. 1, is composed of a control part X, an injection pressurization part Y, an injection liquid distribution part Z, an injection part W, and a liquid feeding system A. When operation is manually performed, the control part X is not required. Hereinafter, an example using the control part will be specifically depicted.

[0018]

As shown in Fig. 1, an injection liquid pressurization part Y pressurizes the injection liquid from an injection liquid tank 2 with a grout pump 1, and feeds that to the injection liquid distribution part Z through the liquid feeding system A as a pressurized injection liquid. The grout pump 1 receives an instruction from an injection monitoring board X1 of the control part X, and pressurizes the injection liquid to a required pressure. Also, the pressurization part Y of Fig. 1, as shown in Fig. 3, may use a compressor 3 instead of the grout pump 1. That is, a pressurization container 4 is filled with the injection liquid 5, and the injection liquid 5 from the injection liquid tank 2 is pressurized by the actuation of the compressor 3 to be the pressurized injection liquid.

[0019]

The injection liquid distribution part Z is equipped with a plurality of branch pipes S, S...S. These branch pipes S, S...S have coupling parts SO coupled with injection pipelines 9, 9...9 at respective tip ends thereof. The coupling parts SO can change the coupling of the branch pipe S to other injection pipelines 9, 9...9 at the time when the injection of a predetermined amount is finished through the predetermined injection pipelines 9, 9...9 or when it reaches a predetermined injection pressure. The above mentioned branch pipes S, S...S are each disposed so as to extend from the distribution container 6 coupled with the pressurization part Y through the liquid feeding system A, as shown in Fig. 1, and are coupled with the injection pipelines 9 at the coupling parts SO at the tip ends. Then, the pressurized injection liquid from the pressurization part Y is distributed into respective distribution pipes S, S...S through a distribution container 6, and sent to the injection pipeline 9. The distribution container 6, not shown, may be equipped with an agitation device. Also, each distribution pipe S, S... S may be directly coupled with the liquid feeding system A from the pressurization part Y without passing through the distribution container 6. Also, in Fig. 1, by measuring the total amount of f_1, f_2...f_i, f_n, a flow rate of a liquid feeding flowmeter f0 can be grasped, and thus the liquid feeding flowmeter f0 is not necessarily required.

D "[0025]
Figures 8, 9, and 10 show an example of the injection liquid distribution part Z consisting of a multistage distribution body or a plural-direction branch body. When a large number of the branch pipes is aligned in a row in the pipe body while using the pipe body as the injection liquid distribution part Z as it is, since a pressure distribution is changed with a loss of water head in the pipe by liquid feeding from one side to the other side, flow rates to the respective branch pipes S, S...S are changed. Such a problem, as shown in Fig. 8, Fig. 9, and Fig. 10, can be improved using the injection liquid distribution part Z consisting of the multistage distribution body or the plural-direction branch body. Figure 8 and 9 show the multistage branch body, in which a plurality of branch pipes are branched off from one branch pipe to be multistage. V may be a throttle valve, or an orifice. In this way, the loss water head is equalized and the distribution of the injection liquid becomes possible under the same condition.
[0026]
Figure 10 shows the injection liquid distribution part Z which makes a multidirectional branch pipe become multistage. V_1 is an example of the minimum unit body of the multidirectional branch pipe made from plural-direction branch pipes, is a valve of a three-way channel, and makes the injection liquid simultaneously flow separately in channels in two directions, right and left. The channels in the two directions right and left may be possible by a throttle, or may be provided with an orifice.
[0027]
Figure 11 shows another example of a multidirectional branch body. V_{11}...V_{1n} are branch valves having throttle valves, and of course can serve as stop valves. If the valves are adjusted to a predetermined throttle degree; for example, if they are made to be the same throttle degree, when pressurizing and feeding an injection liquid of 60 l/minute, in the case where n of V_{1n} is 5, it separately flows in every branch at 12 l/minute.
V_{21}...V_{2n} is a valve having a flow dividing valve (flow divider) of the multidirectional branch pipe, and uses one dividing a flow into a flow rate of the same amount, even if the right and left loads on the downstream side vary in size. For example, if a load on one channel becomes larger and the flow rate intends to become smaller, the opening of the valve is automatically adjusted, and actuates so as to make the same flow rate flow in the right and left channels. Thus, if divided into any number of stages (n-stage), the

branching of the number of 2n becomes possible.
[0028]
In Fig. 1 to Fig. 2, and Fig. 4 to Fig. 7, the branch pipes S, S...S are respectively mounted with branch valves V_1, V_2...V_i, V_n and/or orifices O_1, O_2...O_i, O_n, and are further mounted with branch flowmeters f_1, f_2...fi, fn and/or branch pressure meters P1, P2...Pi, Pn if necessary. These branch pipes S, S...S communicate with the plurality of injection pipelines 9, 9...9 to be mentioned through the coupling part SO, and feed the pressurized injection liquid from the pressurization part Y to the respective injection pipelines 9, 9...9. Also, the branch flowmeters f_1 to f_n may be provided on the upstream side of the orifices O_1 to O_n, or on the upstream side of the branch valves V_1 to V_n. Also, the orifices O_1 to O_n may be provided at the branch pipes S, S...S on the upstream side of the branch valves V_1 to V_n, and may be directly provided on a wall surface of the distribution container 6 or a pipe wall of a conduit 7 of the liquid feeding system A. Also, by using the branch valves V_1 to V_n having a throttling function, it can also have an orifice function. Furthermore, by making the branch valves V_1 to V_n have a function as a stop valve, a liquid feeding valve V_0 is not necessarily required.
[0029]
On the liquid feeding system A of the pressurized injection liquid from the injection liquid pressurization part Y to the injection liquid distribution part Z, namely, the conduit 7, the liquid feeding flowmeter f_0 and/or a liquid feeding pressure meter P_0 are equipped with. Furthermore, a liquid feeding valve V_0 is provided in the conduit 7 downstream of the liquid feeding flowmeter f and/or the liquid feeding pressure meter P or upstream of the branch pipe S."

E "[0036]
Also, the above mentioned branch flowmeters f_1, f_2...f_i, and f_n are rotary flowmeters or electromagnetic flowmeters and the like, and an electrical signal outputted by a pulse is inputted in the control part X and counted. Furthermore, a flow rate in the respective branch pipes S, S...S is defined by selecting or changing calibers and openings (the throttle of the channel) of the liquid feeding valve V0 and the branch valves V_1, V_2...V_i, V_n, or calibers of the orifices O_1, O_2...O_i, O_n, or a number or calibers thereof. Also, an inverter 3 is controlled by an instruction to the injection liquid pressurization part Y from the control part X based on information from the liquid feeding flowmeter and/or the liquid feeding pressure meter, or the branch flowmeter and/or the branch pressure meter to adjust a number of rotations of the grout pump 1, control a flow rate/minute f_0 or injection pressure P_0, and control a flow rate of the branch pipe S.
[0037]
Furthermore, as shown in Fig. 2, the injection liquid distribution part Z in Fig. 1 may be one which removes the branch flowmeters f_1, f_2...f_i, and f_n and the branch pressure meters P_1, P_2...P_i, and P_n from the respective branch pipes S, S...S. Also, in Fig. 2, even without branch valves V_1 to V_n, only orifices O_1 to O_n may be sufficient as described later. Also, it is possible to provide the same function as the orifices O_1 to O_n by throttling the branch valves V_1 to V_n to adjust the opening thereof. In that case, the orifices O_1 to O_n are not required. Also, the opening of the branch valves can be adjusted with hydraulic pressure to enable remote control."

F "[0039]

As shown in Fig. 1, the injection part W is composed of the plurality of injection pipelines 9, 9...9 installed in the ground 8, is respectively coupled to the respective branch pipes S, S...S of the injection liquid distribution part Z, and injects the pressurized injection liquid from the injection liquid pressurization part Y into the ground 8 through the plurality of injection pipelines 9, 9...9 via the branch pipes S, S...S, thereby consolidating the ground 8.

[0040]

Although as the injection pipeline 9 used herein, various injection pipelines are used, if showing one example, it is as shown in Fig. 17, 18, 19, 20, 21, 22, and 23.

[0041]

The injection pipeline 9 in Fig. 17 is a bound injection pipe configured by binding a plurality of thin pipes 10, 10...10 through fixed plates 11, 11...11. The fixed plate 11 may be a binding band. The respective thin pipes 10, 10...10 have tip end discharge ports 12, 12...12 respectively opened at different positions in an axial direction, and these discharge ports 12, 12...12 are equipped with rubber sleeves 13, 13...13, and are installed in the ground 8 so as to be embedded in a sleeve grout 15 injected in an injection hole 14. The injection liquid from the discharge port 12 penetrates and is injected into the ground 8 by breaking the solidified sleeve grout 15. Also, it is not necessary to use the rubber sleeves 13 or the sleeve grout 15."

G "[0051]

Hereinafter, the ground injection construction method according to the present invention, namely the ground injection construction method which injects a ground injection liquid into a ground through a plurality of injection pipes installed in the ground, and consolidates the ground will be depicted.

[0052]

The ground injection construction method according to the present invention is carried out by using the ground injection device of the present invention. As the ground injection device, as shown in Fig. 1 for example, a device is used, which includes the injection liquid pressurization part Y pressurizing the injection liquid; the injection liquid distribution part Z which is coupled with the pressurization part Y, has the branch valves V_1, V_2...V_i, and V_n respectively communicated with the plurality of injection pipelines 9, 9...9 and the plurality of branch pipes S, S...S equipped with either one or both of the branch flowmeters f_1, f2...f_i, and f_n and the branch pressure meters P_1, P_2...P_1, and P_n according to necessary, and distributes the pressurized injection liquid from the pressurization part Y to the respective branch pipes S, S...S to feed that to the respective pipelines 9, 9...9; the liquid feeding flowmeter f_0 and/or the liquid feeding pressure meter P_0 equipped on the liquid injection system A of the pressurized injection liquid from the injection liquid pressurization part Y to the injection liquid distribution part Z; namely, the conduit 7; and the control part X configured by connecting an operation board X2, an injection recording board X3, and a data input device X4 to an injection monitoring board X1 which are respectively connected to the liquid feeding flowmeter f_0 and/or the liquid feeding pressure meter P_0, the injection pressurization part Y, the branch valves V_1, V_2...V_i, and V_n, and either one or both of the branch flowmeters f_1, f_2...f_i, and f_n and the branch pressure meters P_1, P_2...P_i, and P_n by signal circuits.

[0053]

Also, the branch valve V1'n may not necessarily be connected by a signal circuit. The throttle of the valve is set to a predetermined value in advance, and when the injection of the predetermined amount is finished, or when it reaches a predetermined pressure, by changing the coupling of the branch pipes S, S...S to other injection pipelines 9, 9...9, valve control during injection is not required.

[0054]

In the above mentioned ground injection device, as shown in Fig. 1, the injection liquid distribution part Z may be further equipped with the pressurized injection liquid distribution container 6 coupled with the liquid feeding system A (conduit 7). In that case, the respective branch pipes S, S...S, as shown in Fig. 1, are equipped so as to respectively extend from the distribution container 6, and distribute the pressurized injection liquid from the pressurization part Y into the respective branch pipes S, S...S through the distribution container 6. The distribution container 6 is effective because it can inject the pressurized injection liquid into the respective branch pipes S, S...S under the same condition. That is, if the branch pipes S, S...S are directly connected to a long conduit without passing through the distribution container 6, a pressure gradient is generated in the pipe, so that the pressurized injection liquid is difficult to jet under the same condition, and discharge amount to the respective pipes S, S...S differs. So as to prevent that, the distribution container 6 is preferably used. Also, the liquid feeding pressure meter P_0 can also be provided on the distribution container 6.

[0055]

Furthermore, the plurality of branch pipes S, S...S may be respectively equipped with the orifices O1, O_2...O_i, and O_n on the upstream side of the branch flowmeters f_1, f_2...f_i, and f_n and/or the branch pressure meters P_1, P_2...P_i, and P_n.

[0056]

The operation board X2, the injection recording board X3, and the data input device X4 of the control part X are built in the control part X and are connected to the injection monitoring board X1, or are connected to the control part X from the outside of the control part X by a signal circuit.

[0057]

By using the ground injection device mentioned above, first, required set values of the branch flowmeters f_1, f_2...f_i, and f_n and/or the branch pressure meters P_1, P_2...P_i, and P_n; namely, required set values or a limit range according to a ground state, are stored in the data input device X4 of the control part X about each of the branch pipes S, S...S.

[0058]

Next, data during injection from the liquid feeding flowmeter f_0 and/or the liquid feeding pressure meter P_0, or the branch flowmeters f_1, f_2...f_i, and f_n and/or the branch pressure meters P_1, P_2...P_i, and P_n are stored in the injection recording board X3 of the control part X sequentially for each of the branch pipes S, S...S.

[0059]

When the injection monitoring board X1 of the control part X indicates that the data of the branch flowmeters f_1, f_2...f_i, and f_n and/or the branch pressure meters P_1, P_2...P_i, and P_n reach the set values or exceed the set values and a predetermined limit range, by the operation board X2 of the control part X, the branch valves V_1, V_2...V_i, and V_n and/or the injection liquid pressurization part Y are actuated with respect to the respective branch pipes S, S...S to adjust a fed liquid, or the injection is finished by closing the branch valves V_1, V_2...V_i, and V_n, and if the branch flowmeters f_1, f_2...f_i, and f_n and/or the branch pressure meters P_1, P_2...P_i, and P_n reach the set values or exceed the set values with regard to the remaining branch pipes S, S...S, the same operation is repeated to carry out injection.

[0060]

In the above mentioned operation, manual operation is carried out if required. Also, for the branch pipe finishing the injection when reaching a predetermined amount, or for the branch pipe finishing the injection when injection pressure reaches a limit value, by switching the branch valves V_1, V_2...V_i, and V_n to a return pipeline R, the injection can be finished without stopping the pressurized injection liquid from the finished branch pipes. That is, since the pressurized injection liquid continues flowing without stopping, even if the injection partially finishes, the condition of the pressurized injection liquid does not change. Therefore, without adjusting the injection pressurization part Y, the injection is attained under the same condition until the injection of all branch pipes is completed.

[0061]

Furthermore, in this case, as shown in Fig. 16, without switching the branch valves V_1, V_2, V_3...V_i, and V_n to the return pipeline R, the coupling parts SO, SO...SO of the branch pipes S, S...S are switched from a first injection block to an injection pipeline of another injection block; namely, a second injection block, and it is also possible to continue the injection as is.

[0062]

In the ground injection construction method of the present invention, by injecting the injection liquid into an injection stage with generally the same depth through the plurality of injection pipelines 9, 9...9 installed in the ground 8 in this way, a continuous plate-like consolidation layer; namely, a first improved block in Fig. 1, is formed, and by repeating the injection, for example, a further plate-like consolidation layer; namely, a second improved block, is formed on a lower layer to form a laminated body.

[0063]

In the present invention, generally the same depth means the injection depth of injection pipe length generally the same in the horizontal direction; for example, a tunnel boring construction and the like performing injection in lateral direction. Also, in the present invention, the first improved block and the second improved block may be provided in the vertical direction as shown in Fig. 1, or may be provided in the horizontal direction as shown in Fig. 24.

[0064]

In this case, as mentioned above, the information of the liquid feeding flowmeter f_0 and the liquid feeding pressure meter P_0 is sent to the control part X, and the control part X instructs the injection liquid pressurization part Y based on the information to adjust the inverter 3 and control to attain the optimal injection rate F_0 and injection pressure P_0. That is, as shown in Fig. 1, the branch pipes S, S...S are respectively provided with the branch flowmeters f1, f2...fi, and fn or the branch pressure meters P1, P2...Pi, and Pn, the information thereof is transmitted to the control part X, and as a matter of course, it is possible to inject the pressurized injection liquid with the injection speed f0 and the injection pressure P_0 within a predetermined range. Especially, if the ground condition changes or injection is simultaneously carried out from the discharge ports in the vertical direction, it is possible to inject in the same way. Also, as in Fig. 1, if the ground condition in each block in the horizontal direction is generally the same, the injection is simultaneously carried out from the plurality of injection pipelines provided planarly at intervals to generally the same soil layer or depth by using a simple device without a branch pressure meter or a branch flowmeter, thereby enabling simple injection. In this case, average injection speed of the respective injection pipelines in the improved block is controlled, and the whole injection amount is also controlled. The injection liquid is simultaneously fed and injected from one liquid feeding part Y to the plurality of injection pipelines 9, 9...9 with the predetermined flow rate of the pressurized injection liquid or the predetermined pressure, and thus the ground 8 in a wide range can be rapidly and simply improved."

H "[0072]
Then, when constructing the ground injection using the device of Fig. 14, for example, prior to the injection in a first stage, a water injection test is performed to take out a P-q curve (curve 1) shown in Fig. 26; namely, a P (injection pressure P)-q (injection speed or flow rate 1/minute) curve. Fig. 26 is an injection pressure-flow rate (injection amount/minute) curve. In Fig. 26, the injection speed and the injection pressure are in a proportional relationship until a point O_1, and it becomes perfect infiltration injection without generating ground breakage. However, until the points O_1 to O_2, the injection speed and the injection pressure are not in the proportional relationship, although cracking is partially generated, there is no injection pressure drop at which the ground breaks and the injection liquid deviates. The injection pressure of the point O_2 is made to be limit injection pressure P_{r0} and limit water injection speed (flow rate) q_{r0}. Thus, the limit injection pressure P_{r0} and the limit injection flow rate q_{r0} (injection speed) at which the ground breaks can be known.
[0073]
Also, unlike the water injection test, when injecting a chemical liquid, the ground is strengthened as the injection progresses. In Fig. 26, those are in a linear relationship until a point F_1, and those are not a straight line, but do not break from the points F_1 to F_2. Therefore, P_{rf} at the point F_2 is made to be limit pressure and q_{rf} limit injection flow rate. Thus, the final limit injection pressure and the limit injection flow rate (injection speed) are respectively set as P_{rf} and Q_{rf}, and the injection of design injection amount (integrated injection amount) is carried out within this limit. Then, the injection is finished when the design injection amount is injected, and if the limit injection pressure is reached before the design injection amount is reached, the injection is finished at that point.
[0074]
Here, in Fig. 14, by assuming a number n of injection pipelines T as n=100, an orifice caliber=1.0 mm, and liquid feeding flowmeter f_0=150 l/minute, when injection is simultaneously carried out from discharge ports positioned on the first stage of the injection pipelines (T1 to T100), the branch pressure meter P_{11} indicates 2 kg/cm^2 (Note by the body: "2 kg/cm^2" is considered to be an error of "2 kgf/cm^2"), the branch flow meter f_{11} indicates 1.5 1/minute, and the liquid pressure meter P_0=30 kgf/cm^2. In a water permeability test before the injection in the first stage, it was q_{1r0}=5 l/minute. Also, it was q_{1r0}=5 kgf/cm^2 (Note by the body: "q_{1r0}" is considered to be an error of "P_{1r0}"). It is set to P_{1rf}=7.5 kgf/cm^2 (1.5 times P_{1r0}). Also, planned injection amount in the injection pipeline T_{11} was set as Q_{11}=100 l. The injection pressure of P_1 during the injection was within 3.0 kgf/cm^2, and the injection of 100 l was completed at average injection speed q_1=1.5 l/minute."

I "[0079]

In Fig. 14, the plurality of injection pipelines 9 configured by binding the plurality of thin pipes 10, 10...10 shown in Fig. 17 as the injection pipeline T are installed in the ground 8. Also, the branch pressure meter P1'n is provided on at least one of the branch pipes S, S...S from the distribution container 6. The injection pipelines 9, 9...9 (the injection pipelines are expressed as T in Fig. 14) are installed in the ground 8 so as to position the discharge ports 12, 12...12 at positions different in the axial direction respectively on the first to the n-th stages having different soil layers. Next, among the liquid feeding valves V_{01} to V_{0n}, only the V01 is opened, from the first distribution container 6, the discharge port 12 simultaneously feeds the injection liquid to the thin pipes 10 (T_{11} to T_{n1}) of the injection pipelines 9 (T_1 to T_n) positioned on the first state, and injects that to the first stage through the thin pipes T_{11} to T_{n1}.

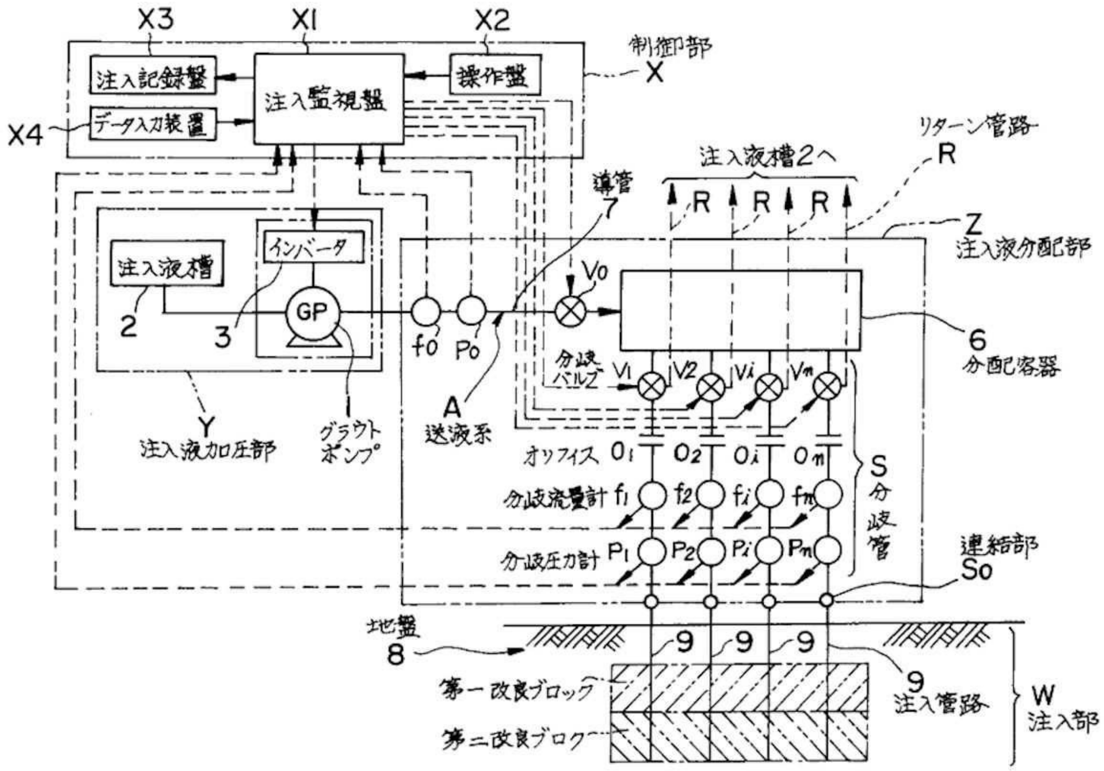
[0080]

The number of the branch pipes from each distribution container is made to be n=100, the caliber of the orifice is made to be 1.0 mm, and it is set to be the flow rate f_0 of the liquid feeding flowmeter=150 l/minute at the pressure of the liquid feeding pressure meter P_0=30 kgf/cm^2, average injection speed from the discharge port is 1.5 1/minute. By a preliminary water permeability test, if it is P_{1r0}=6 kgf/cm^2 and $q_{1r0=}$4 l/minute, and initial injection pressure P_{10} indicated by the branch pressure meter is within 6 kgf/cm^2, inter-granular permeation is carried out without breaking the ground.

[0081] If the injection is advanced, and the injection of the whole injection amount Q1=100l×100=10000l of the discharge port of n(=100) on the first stage can be injected within the limit injection pressure P_{1f} (set as =1.5×P_{1r0}), the liquid feeding valve V_{01} is closed to finish the injection of the first stage, and only the liquid feeding valve V_{02} is opened to shift to the injection of the second stage."

J Fig. 1 and Fig. 26 are as follows.

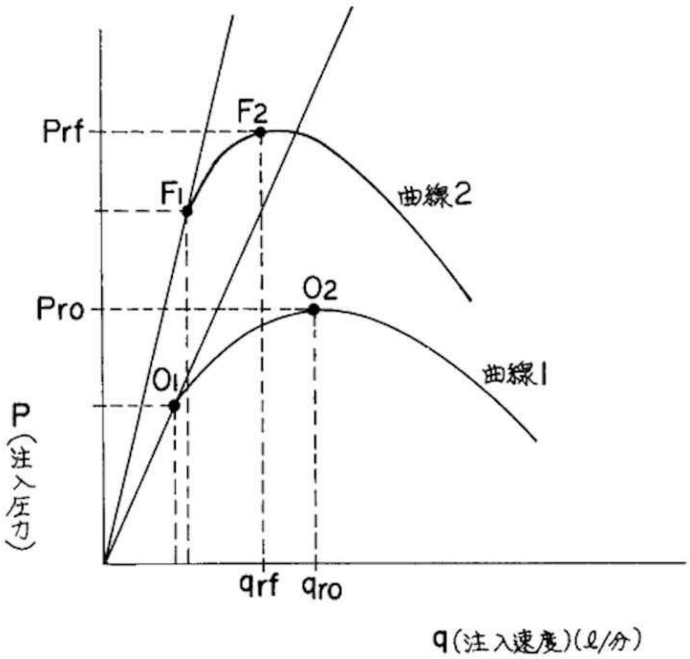
[Fig. 1]



注入記録盤　　Injection recording board
データ入力装置　Data input device
注入監視盤　　Injection monitoring board
操作盤　Operation board
制御部　Control part
注入液槽　　Injection liquid tank
インバータ　　Inverter
注入液加圧部　Injection liquid pressurization part
グラウトポンプ　Grout pump
導管　Conduit
送液系　Liquid feeding system
注入液槽２へ　To injection liquid tank 2
リターン管路　Return pipeline
注入液分配部　Injection liquid distribution part
分岐バルブ　　Branch valve
分配容器　　Distribution container
オリフィス　　Orifice
分岐流量計　　Branch flowmeter
分岐圧力計　　Branch pressure meter
分岐管　Branch pipe
連結部　Coupling part
地盤　Ground

第一改良ブロック　　　　First improved block
第二改良ブロック　　　　Second improved block
注入管路　　　　Injection pipeline
注入部　Injection part

[Fig. 26]



曲線２　Curve 2
曲線１　Curve 1
（注入圧力）　　(Injection pressure)
（注入速度）　　(Injection speed)
（ℓ／分）　　(l/minute)

K　As described above, considering the error of H above, it is recognized that Evidence A No. 1 describes the following invention (hereinafter, referred to as "Invention A-1").
"An injection device which simultaneously injects a ground injection liquid into a ground through a plurality of injection pipelines installed in the ground to consolidate the ground, and is composed of a control part X, an injection pressurization part Y, an injection liquid distribution part Z, an injection part W, and a liquid feeding system A; and a ground injection construction method using the ground injection device, the device comprising: an injection liquid pressurization part Y which pressurizes the injection liquid from an injection liquid tank 2 with a grout pump 1, and feeds that to the injection liquid distribution part Z through the liquid feeding system A as a pressurized injection liquid; the liquid feeding system A of the pressurized injection liquid from the injection liquid pressurization part Y to the injection liquid distribution

part Z; namely, a conduit 7 equipped with a liquid feeding flowmeter f_0 and a liquid feeding pressure meter P_0; the injection liquid distribution part Z which is provided with a pressurized injection liquid distribution container 6 coupled with the liquid feeding system A (conduit 7), and a plurality of branch pipes S, S...S equipped so as to extend from the distribution container 6, respectively communicate with a plurality of injection pipelines 9, 9...9 at coupling parts SO at tip ends, mounted with branch valves V_1, V_2...V_i, V_n and orifices O_1, O_2...O_i, O_n, and mounted with branch flowmeters f_1, f_2...fi, fn and branch pressure meters P1, P2...Pi, Pn; and the control part X configured by connecting an operation board X2, an injection recording board X3, and a data input device X4 to an injection monitoring board X1 which are respectively connected to the liquid feeding flowmeter f_0 and the liquid feeding pressure meter P_0, the injection pressurization part Y, the branch valves V_1, V_2...V_i, and V_n, the branch flowmeters f_1, f_2...f_i, and f_n, and the branch pressure meters P_1, P_2...P_i, and P_n by signal circuits, wherein the injection pipeline 9 is a bound injection pipe configured by binding a plurality of thin pipes 10, 10...10 through fixed plates 11, 11...11, the respective thin pipes 10, 10...10 having tip end discharge ports 12, 12...12 respectively opened at different positions in an axial direction, wherein when constructing the ground injection prior to the injection in a first stage, a water injection test is performed to take out a P-q curve (curve 1); namely, P(injection pressure P)-q(injection speed or flow rate 1/minute) curve, and thus the limit injection pressure P_{r0} and the limit injection flow rate q_{r0} (injection speed) at which the ground breaks can be known, wherein by assuming a number n of injection pipelines T as n=100, an orifice caliber=1.0 mm, and liquid feeding flowmeter f_0=150 l/minute, and when injection is simultaneously carried out from discharge ports positioned on the first stage of the injection pipelines (T1 to T100), the branch pressure meter P_{11} indicates 2 kgf/cm^2, the branch flow meter f11 indicates 1.5 1/minute, and the liquid feeding pressure meter P_0=30 kgf/cm^2, and in a water permeability test before the injection in the first stage, it was q_{1r0}=5 l/minute and P_{1r0}=5 kgf/cm^2."

(2) Evidence A No. 2

Evidence A No. 2 which was distributed prior to the application of the Patent, describes the following matters.

A [Detailed Description of the Invention]

[0001]

[Field of the Invention] The present invention relates to a ground injection device and construction method which inject a ground injection liquid into a ground through injection pipelines installed in the ground to consolidate the ground, especially to a ground injection device and construction method which carry out injection by a predetermined discharge amount regardless of pressure change during injection, and can optionally adjust the discharge amount according to an injection situation, and specifically relates to a ground injection device and construction method which adjust a throttle of a cross section of a conduit feeding the ground injection liquid to the injection pipelines and can carry out injection by a predetermined discharge amount.

[0002]

[Conventional Art] As a ground improvement technology which injects an injection liquid into a ground to improve the ground, conventionally, there is known a method which installs injection pipes in a ground to be improved, and carries out injection while shifting injection stages by pulling up these injection pipes from a lower side to an upper side one by one or pushing down them from the upper side to the lower side.

[0003] However, the target ground to be injected is mostly weak alluvium, and is configured by laminating soil layers having different values of water permeability. Therefore, it is extremely cumbersome to accomplish the optimal injection for each soil layer by shifting the injection stage; namely, to accomplish injection with optimal injection pressure, injection speed, injection amount, injection rate, and the like, and it takes a long time, becomes uneconomical, and is substantially impossible.

[0004] Also, in recent years, it is required to prevent liquefaction by ground injection. For such liquefaction prevention, economically rapid construction of large capacity soil is necessary. However, in the conventional injection construction method, such rapid construction is impossible.

[0005] Especially, as described above, the ground is configured by laminating the soil layers having different levels of water permeability, therefore, injection pressure varies between each soil layer, causing a pressure change or a change in injection pressure during injection, and due to this pressure change in the ground, it is very difficult to carry out the ground injection at a constant rate of discharge amount.

[0006] [Problem to be solved by the invention] Also, when injection is simultaneously carried out from one pump into a plurality of injection pipelines installed in the ground, if the injection pressure of the ground at each injection pipeline discharge port differs, an injection liquid is discharged only into the injection pipeline with low pressure, and it is impossible to simultaneously inject a predetermined injection amount into the plurality of injection pipelines.

[0007] Furthermore, a method is also proposed, which simultaneously feeds the injection liquid from one pump to a large number of the injection pipes through a large number of orifices or injection ports to inject that into the ground. In this method, for each injection pipe, if the change of the resistance pressure of the ground is wide, or if the ground resistance pressure at each injection pipe changes during an injection process, pump pressure fluctuates, and thus it is difficult to inject into each injection pipe at a predetermined discharge speed. Also, since it is also difficult to carry out injection from the rest injection pipes while maintaining a predetermined pressure and discharge amount after the completion of injection of any of the injection pipes, among the large number of the injection pipes, it has not actually been put to practical use.

[0008] For example, when the injection of some injection pipes among the plurality of injection pipe is completed, valves of the injection pipelines are closed, pressure in a liquid feeding pipe rapidly increases, and the injection amount to the rest injection pipe suddenly increases, so that it becomes difficult to continue injection by maintaining a constant injection amount at a constant injection pressure. Also, it is difficult to vary the discharge amount from the injection pipe for each injection pipe according to the injection situation.

[0009] Then, the object of the present invention is to provide <u>a ground injection device and construction method</u> which can carry out injection by a predetermined discharge amount, and improve defects existing in the publicly known techniques mentioned above, regardless of changes in injection pressure when performing ground injection.

[0010] Furthermore, another object of the present invention is to provide a ground injection device and construction method, which can carry out injection at a predetermined injection speed, simultaneously from a plurality of injection pipelines, even if the permeation resistance pressures of a plurality of injection pipeline discharge ports are different from each other, can easily carry out injection until the last one injection pipeline, even if among the plurality of injection pipelines, a part of injection is completed to stop injection, without influencing the remaining injection pipelines, while maintaining a predetermined pressure and discharge amount, can adjust the discharge amount of each injection pipeline according to an injection situation, during the injection, and improve defects existing in the publicly known techniques mentioned above.

[0011] Furthermore, another object of the present invention is to provide a ground injection device and construction method which are suitable for ground improvement of large capacity soil, such as liquefaction preventive construction or ground improvement for rapid construction in large scale construction, especially installed with a plurality of injection pipelines in a ground to be improved, and can simultaneously, selectively, and automatically inject an injection liquid from the plurality of injection pipelines."

B "[0016]

[Embodiments of the invention] Hereinafter, the present invention will be depicted by reference to the attached drawings.

[0017] Figure 1 is a flow sheet of one example of the present invention device. Figure 2 is a graph showing a relationship between resistance pressure P at an orifice caliber φ 2.0 mm and a flow rate f from the orifice, about each liquid pressure. Figure 3 is a graph showing a relationship between resistance pressure P at an orifice caliber φ 2.5 mm and the flow rate f from the orifice, about each liquid pressure. Figure 4 is an explanatory view of an injection liquid pressurization part and another example according to the present invention. Figure 5 is a flow sheet of a modified example of a ground injection device according to the present invention. Figure 6 is a cross-sectional view of one example of a flow rate control valve used as a throttle part of the present invention. Figure 7 is a cross-sectional view of another example of the flow rate control valve. Figure 8 is a cross-sectional view of an example of an injection liquid return system used for the present invention. Figure 9 is a cross-sectional view of another example of the throttle part according to the present invention. Figure 10 is an explanatory view of further another form of the throttle part according to the present invention. Figure 11 is a partial cross-sectional view showing an operation state of the throttle part of Fig. 10. Figure 12 is a partial cross-sectional view of a modified example of the throttle part of Fig. 10. Figure 13 is a partial cross-sectional view of further another modified example of the throttle part of Fig. 10. Figure 14 is a flow sheet of another example of the ground injection device according to the present invention. Figure 15 is a flow sheet of further another example of the round injection device according to the present invention. Figure 16 is a flow sheet of further another example of the ground injection device according to the present invention. Figure 17 is a flow sheet of one example of the present invention device connected to a center management part. Figure 18 is an explanatory view specifically showing the device of Fig. 1 having the center management part. Figure 19 is an operation flow chart of a centralized control device X1. Figure 20 is a screen showing data of 10 liquid feeding systems of Fig. 18. Figure 21 is a cross-sectional view of a state that the injection pipelines of one example according to the present invention are embedded in the ground. Figure 22 is a cross-sectional view of a state that the injection pipelines of another example according to the present invention are embedded in the ground. Figure 23 is a cross-sectional view of a state that the injection pipelines of further another example of the present invention are embedded in the ground.

[0018] As shown in Fig. 1, the present invention ground injection device A is a device which injects a ground injection liquid 5 into a ground 3 through one or a plurality of injection pipelines 2, 2...2 installed in the ground 3 to consolidate the ground 3, and is basically composed of an injection liquid pressurization part 1 pressurizing the ground injection liquid 5 to a predetermined pressure, conduits 6 feeding the injection liquid 5 to the injection pipelines 2, and throttle parts 7 provided on the conduits 6. Also, the throttle parts 7 may be provided at upper end parts of the conduits 6; namely, branch points of a liquid feeding system 13 and the conduits 6, or outlets from a distribution device 11 mentioned below to the conduits 6.

[0019] Also, as shown in Fig. 1, an injection liquid return system RS; namely, a liquid feeding flowmeter f_0 and/or a liquid feeding pressure meter P_0, and an injection liquid return device RA are provided in the liquid feeding system 13 reaching the throttle parts 7 of the ground injection liquid 5; the return device RA is controlled by a flow rate pressure control device 10 so as to maintain a predetermined injection pressure P_0; and a part of the injection liquid is returned to an injection liquid tank 4 through a return pipeline R. That is, the injection liquid return system RS receives signal information from the liquid feeding pressure meter P_0 and/or the liquid feeding flowmeter f_0 by the flow rate pressure control device 10, and transmits the signal to the injection liquid return device RA. The injection liquid return device RA, based on the information from the liquid feeding pressure meter P_0 and/or the liquid feeding flowmeter f_0, divides the injection liquid in the liquid feeding system 13 from the liquid feeding system 13 to the return pipeline R to return that to the injection liquid tank 4, thereby maintaining the liquid pressure of the liquid feeding system 13 at a required pressure, and thus maintains the discharge amount of the injection liquid fed from the conduit 6 to the injection pipelines 2 through the throttle parts 7 at a predetermined amount.

[0020] In Fig. 1, the ground injection liquid 5 is jetted from a high pressure part on an upstream side of the throttle part 7 to a low pressure part on a downstream side. In that case, if the differential pressure between the injection pressure P_0 of the pressurized ground injection liquid 5 and the injection pressure P_{1n} of the ground 3 to be injected is taken to be sufficiently large, even if the injection pressure of the respective conduits 6, 6, ... 6 on the downstream side of the throttle parts 7 varies, the discharge amount (injection speed) of each conduit 6 is almost the same if an area of the throttle part 7 is the same. Then, the discharge amount is decided according to the injection pressure P_0 and an area of a hole of the throttle part 7.

[0021] However, in Fig. 1, the ground injection liquid 5 is not necessarily injected from the whole conduits 6, 6...6 from the beginning to the end of injection precisely in the same way, and depending on the target injection site, the conduit 6 which completes early and ends the injection comes out. However, if a part of the conduits 6, 6...6 ends the injection, the injection amount is distributed into the remaining other conduits 6, 6...6, so that pressure in the conduits 6 becomes high, and the discharge amount from the remaining other conduits 6, 6...6 is increased. So as to prevent that, by adjusting an inverter (not shown) of a pump 14 to adjust a number of rotations, a flow rate is adjusted by decreasing pressure, or the return system is actuated. Thus, regardless of variations in a number of the conduits 6 during the injection, the pressure of the liquid feeding system 13 can be maintained at a predetermined value, and the injection of a predetermined flow rate from the respective conduits 6, 6...6 can be automatically continued.

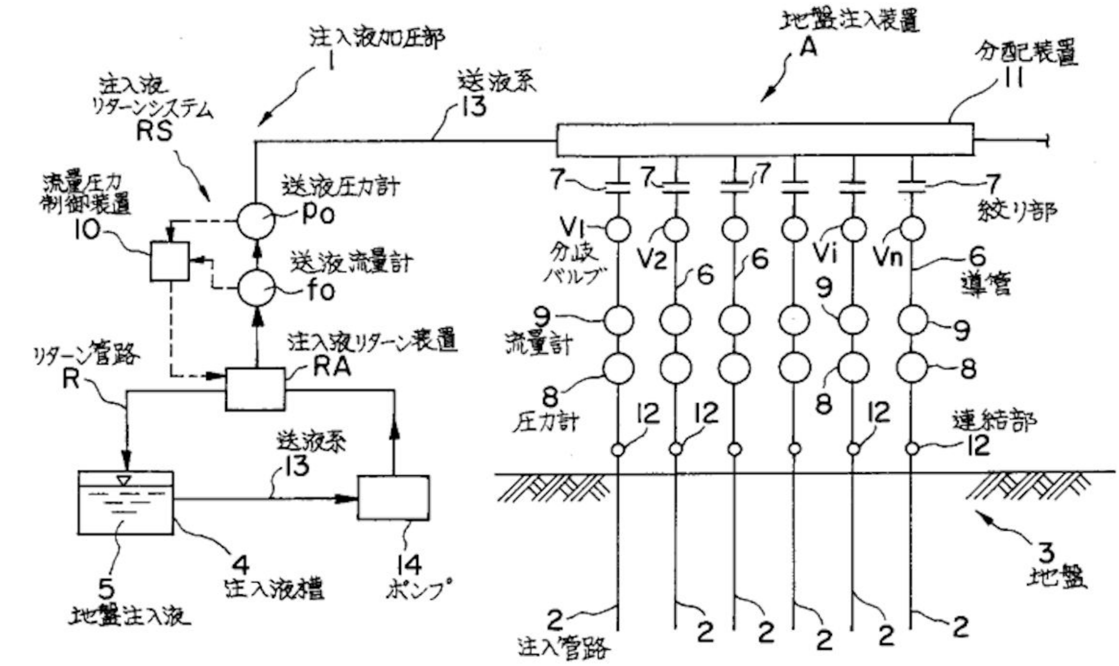
[0022] Also, in Fig. 1, from injection start to completion, the injection pressure P_0 is set to any value by an injection liquid return system RS to automatically return ground injection liquid 5, and discharge amount corresponding to the injection pressure P_0 and the number of the operating conduits 6, 6...6 can be optionally obtained. Furthermore, by providing the inverter not shown on the pump 14, within the most suitable flow rate range (pressure range), it can be adjusted to the predetermined flow rate or pressure. Thus, the injection liquid pressurization part 1 which pressurizes the ground injection liquid to the predetermined pressure by the injection liquid return system RS, or the inverter, or furthermore by combining those, is referred to, in the present invention, as the injection liquid pressurization part 1 having a flow rate pressure control function. Also, in Fig. 1, the distribution device 11 is provided between the liquid feeding system 13 and the conduits 6, and the conduits 6, 6...6 may be extended from the distribution device 11. Also, 12 are coupling parts between the conduits 6 and the injection pipelines 2. Furthermore, the conduits 6, as shown in Fig. 1, may be optionally provided with branch valves V_1, V_2...V_i, and V_n, in addition, a pressure meter (pressure detector) 8, and a flowmeter (flow rate detector) 9.

[0023] Fig. 2 and Fig. 3 are graphs of changes in a flow rate f (l/minute) from the orifice, if the pressurized ground injection liquid 5 (liquid pressure on an upstream side of the throttle part 7 (orifice)=P_0) in the distribution device 11 of FIG. 1 is injected from the orifice (throttle part 7), when the caliber of the orifice is made to be 2.0 mm and 2.5 mm, the liquid pressure on the upstream side of the orifice is kept at the predetermined pressure by using the return system RS, and the liquid pressure (ground resistance pressure) on the downstream side of the orifice is changed variously.

[0024] From Fig. 2 and Fig. 3, when the liquid pressure P_0 is sufficiently higher than the ground resistance pressure P, the flow rate f is decided by the liquid pressure P and the caliber of the orifice O, and even if the fluid pressure P fluctuates, the flow rate f hardly fluctuates. Also, it can be seen that when the difference between the fluid pressures P_0 and P falls within a certain range, the flow rate f rapidly decreases. Generally, the liquid pressure P_0 is made to be 20 to 100 kgf/cm^2, and the difference between P_0 and P is 5 kgf/cm^2 or more, preferably, 10 kgf/cm^2."

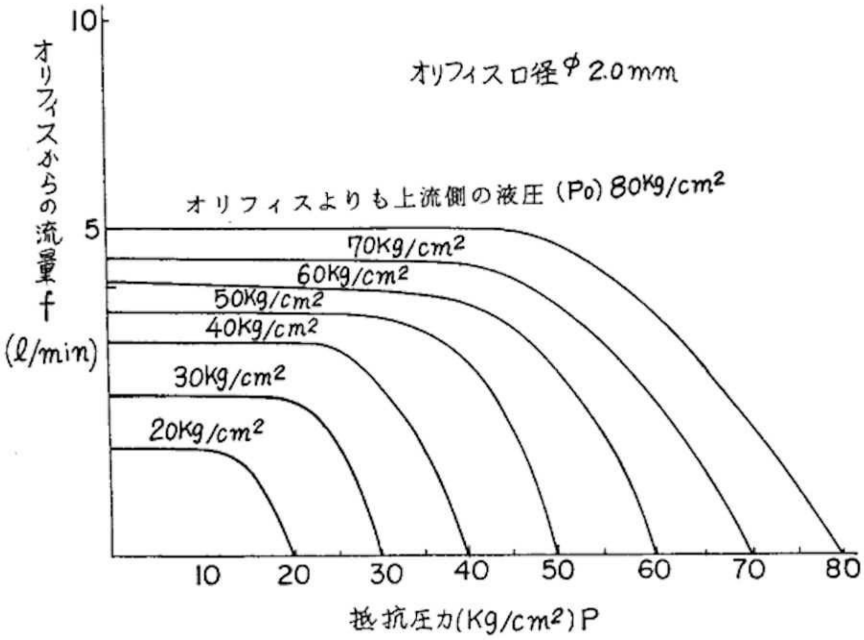
C [0085] Fig. 21 is the cross-sectional view of the state that the injection conduits according to the present invention are embedded in the ground, and shows an example using the injection pipelines 2 made by binding a plurality of thin pipes 32 as the injection pipelines 2. The respective thin pipes 32, 32...32 have tip end discharge ports 33 respectively opened at different positions in the axial direction, and are installed in the ground 3 so as to be embedded in a sleeve grout 35 filled in a drilling hole 34. The ground injection liquid from the discharge ports 33 breaks the solidified sleeve grout 35, penetrates and is injected into the ground 3 through the ground wall 3a. Also, it is not necessary to use this sleeve grout 35."

D Figure 1, Fig. 2, and Fig. 3 are as follows.
[Fig. 1]



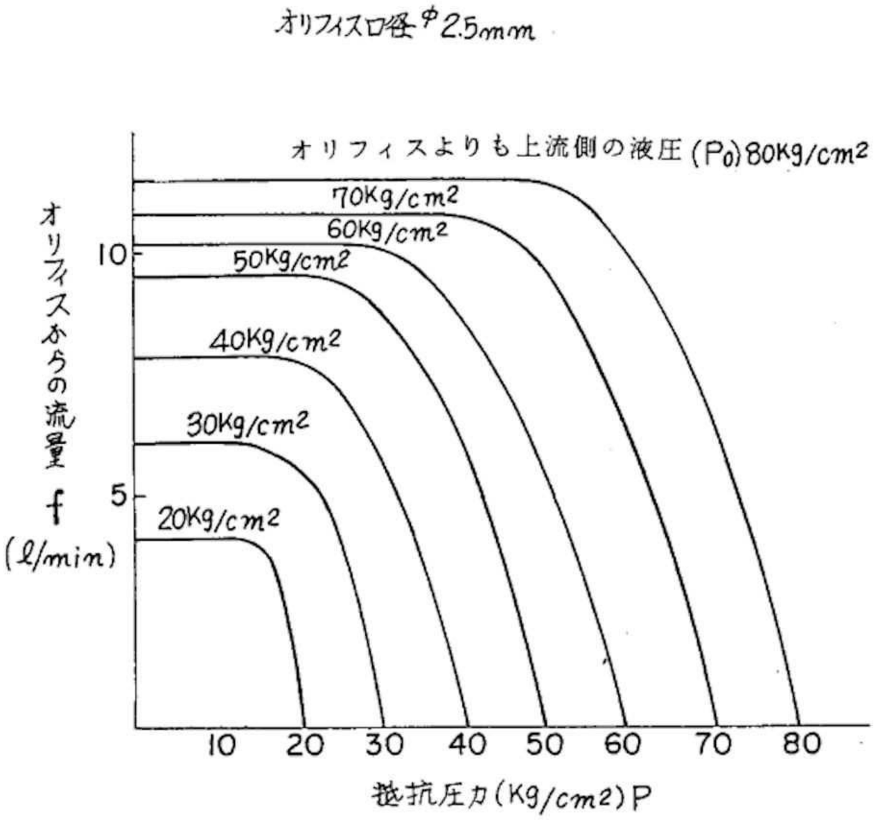
注入液加圧部　Injection liquid pressurization part
注入液リターンシステム　Injection liquid return system
送液系　Liquid feeding system
流量圧力制御装置　Flow rate pressure control device
リターン管路　Return pipeline
地盤注入液　Ground injection liquid
注入液槽　Injection liquid tank
送液圧力計　Liquid feeding meter
送液流量計　Liquid feeding flowmeter
注入液リターン装置　Injection liquid return device
ポンプ　Pump
地盤注入装置　Ground injection device
分配装置　Distribution device
絞り部　Throttle part
分岐バルブ　Branch valve
流量計　Flowmeter
圧力計　Pressure meter
注入管路　Injection pipeline
導管　Conduit
連結部　Coupling part
地盤　Ground

[Fig. 2]



オリフィスからの流量　　Flow rate from orifice
オリフィス口径　Orifice caliber
オリフィスよりも上流側の液圧　　Liquid pressure on the upstream side of orifice
抵抗圧力　　　　Resistance pressure

[Fig. 3]



オリフィスからの流量　　Flow rate from orifice
オリフィス口径　Orifice Caliber
オリフィスよりも上流側の液圧　　Liquid pressure on the upstream side of orifice
抵抗圧力　　　　Resistance pressure

E　As described above, it is recognized that Evidence A No. 2 describes the following invention (hereinafter, referred to as "Invention A-2").

"A ground injection device A and construction method which inject a ground injection liquid 5 into a ground 3 through one or a plurality of injection pipelines 2, 2...2 installed in the ground 3 to consolidate the ground 3,

wherein the ground injection device A being composed of an injection liquid pressurization part 1 pressurizing the ground injection liquid 5 to a predetermined pressure, conduits 6 coupled to the injection liquid pressurizing part 1 and feeding the injection liquid 5 to the injection pipelines 2, and throttle parts 7 provided on the conduits 6,

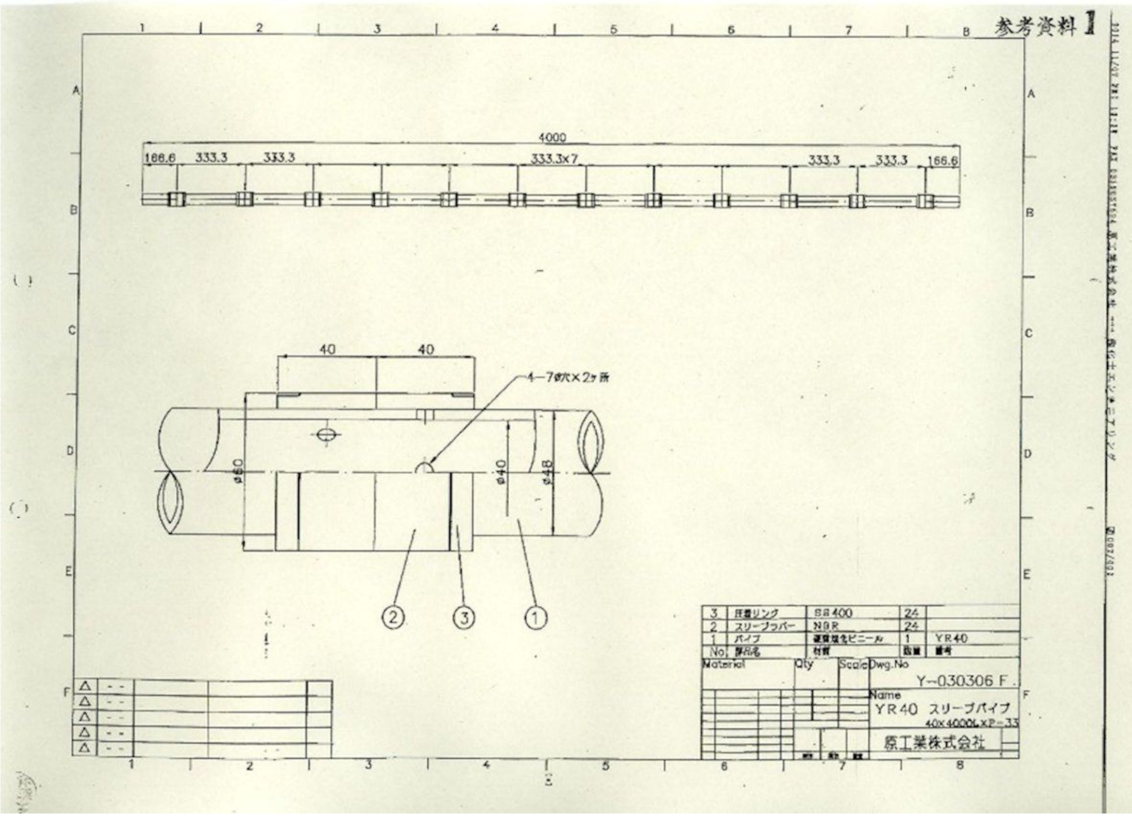
wherein the pressurization part 1 has an injection liquid return system RS provided in a liquid feeding system 13 reaching the throttle parts 7 of the ground injection liquid 5, provided with a liquid feeding flowmeter f_0 and a liquid feeding pressure meter P_0 and an injection liquid return device RA, controlling the injection liquid return device RA by a flow rate pressure control device 10 so as to maintain a predetermined injection pressure P_0, and returning a part of the injection liquid to an injection liquid tank 4 through a return pipeline R; and a flow rate pressure control function of pressurizing the ground injection liquid to the predetermined pressure by an inverter provided on the pump 14,

wherein a distribution device 11 is provided between the liquid feeding system 13 and the conduits 6, the conduits 6, 6...6 being extended from the distribution device 11, the conduits 6 and the injection pipelines 2 being coupled by coupling parts 12, the conduits 6 being provided with branch valves V_1, V_2...V_i, and V_n, in addition, a pressure meter (pressure detector) 8, and a flowmeter (flow rate detector) 9, the throttle parts 7 being provided at outlets from a distribution device 11 to the conduits 6, the injection pipelines 2 being made by binding a plurality of thin pipes 32, the respective thin pipes 32, 32...32 having tip end discharge ports 33 respectively opened at different positions in the axial direction,

wherein although the ground injection liquid 5 is jetted from a high pressure part on an upstream side of the throttle part 7 to a low pressure part on a downstream side, if the differential pressure between the injection pressure P_0 of the pressurized ground injection liquid 5 and the injection pressure P_{1n} of the ground 3 to be injected is taken to be sufficiently large, even if the injection pressure of the respective conduits 6, 6, ... 6 on the downstream side of the throttle parts 7 varies, the discharge amount (injection speed) of each conduit 6 is almost the same if an area of the throttle part 7 is the same, and then, the discharge amount is decided according to the injection pressure P_0 and an area of a hole of the throttle part 7."

(3) Evidence A No. 3

Evidence A No. 3 whose distribution property is unknown is as follows.



(4) Evidence A No. 4

Evidence A No. 4 which was distributed prior to the application of the Patent, describes the following matters.

A "Chapter 3 Design and construction

3-1 Basic matters about design and construction

Regarding the design and construction of construction by the chemical-injecting construction method, in order to maintain the water quality standard in Appendix 1 in groundwater and a public water area and the like around the chemical liquid injection point, it must be appropriate according to the situation of nature of the ground in the area, groundwater and the situation of public water area and the like.

3-2 Field injection test

In conducting chemical liquid injection work, investigation is made in advance as to whether or not the injection of the chemical liquid as designed in an injection planning ground or a ground equivalent thereto is carried out.

3-3 Measures for injection

(1) For injection of the chemical liquid, necessary measures must be taken so that the chemical liquid can be mixed thoroughly.

(2) During injection of a chemical liquid, injection pressure and injection volume are constantly monitored, and in case of abnormal change, immediately stop the injection, investigate the cause thereof, and take appropriate measures.

(3) In the case of injecting a chemical liquid in the vicinity of an underground buried object, it is necessary to take necessary measures to prevent the situation where the chemical liquid flows out along the underground buried object."

(Page 2, Line 26 to Page 3, Line 3)

(5) Evidence A No. 5

Evidence A No. 5 which was distributed prior to the application of the Patent, describes the following matters.

A "5. 3 Prediction and actual condition of improvement range

In a chemical-injecting construction method, a method of quantitatively determining whether or not the injection conditions (an injection range, an injection rate, kinds of chemical liquids, an injection method, injection speed, etc.) set for the target ground are appropriate has not yet been established. Although it is generally implemented by an injection plan by applying empirical injection condition, since the injection condition and its improvement effect do not necessarily correspond, it is necessary to spend considerable expenses and time to confirm the improvement effect (consolidated range and quality: strength, water permeability and the like and its continuity) and it is not practical. Therefore, confirmation of the effect under the current situation is only a partial investigation, and tests such as a standard penetration test, a field permeability test, etc. are carried out. In order to establish a reasonable injection technique, it is important to establish prediction methods more reliable than at present, and this requires development of prediction methods based on an injection mechanism and application in a lot of fields. Here, we introduce the prediction methods 3) to 5) of the currently proposed improvement range, and the example 6) of the field excavation experiment which examined the improvement range and the improved quality in detail.

5.3.1 Prediction of improvement range

(1) Regarding prediction

When targeting a sandy ground, an injection form is largely divided into permeation injection and split injection.

Also, the predication, in temporal stages, is divided into

[1] Prediction before chemical-injecting construction, and during design.

[2] Estimation by management measurement during injecting construction

[3] Estimation by investigation/inspection as confirmation of effect after injecting construction.

When the split injection is mainly used, a shape of the consolidated body is not fixed, and variation in a consolidated portion and a consolidation degree is also large. On the other hand, in the case of permeation consolidation, a consolidation range (volume) is related to the injection amount of a chemical liquid and a permeation distance from an injection hole, variation in the strength and water permeability of the consolidated portion is small and quality rarely becomes a problem 4) (Fig. 5.10).

That is, it can be said that the possibility of prediction is high in the case where the injection range is an injection form mainly based on permeation consolidation indicated by the permeation distance from the injection hole. Therefore, the prediction of effect basically aims at judging to what extent permeation injection can be expected and the size of an improvement range where permeation consolidation is assumed. It can also be said that the prediction accuracy is based on the fact that it is possible to discriminate whether the injection form of each step is permeation injection or split injection.

In order to realize permeation injection, the most certain approach is to conduct a test injection and confirm the injection form. Although it is essentially necessary to conduct the test injection under the same conditions as this work, a simple method of predicting the injection form from a relationship between injection pressure and injection speed in the injection test using water instead of the chemical liquid has recently been proposed. Hereinafter, the outline of this method will be described.

This method is fundamental for establishing a "rational injection method" 3) that enables selection of gel time that is consistent with injection speed and conditions of the ground that mainly takes the permeation injection. In the field of dam grout, injection based on the idea of limit pressure according to actual measured data at a site has been done for a long time. This 'rational injection method' is based on a water injection test (Fig. 5.11) developed by the similar way of thinking to the dam grout method 3) - 5). This test aims to grasp the approximate conditions under which the injection form changes from permeation to split by obtaining the relationship (p to q curve) between injection pressure and injection speed while gradually increasing the injection speed."

(Page 279, Line 1 to Page 280, Line 24. Also, encircled numbers 1 to 3 are displayed as [1] to [3]. The same applies hereafter.)

B "In order to obtain a consolidated shape with sufficient improvement effect on strength and water permeability and high continuity, it is important to certainly carry out permeation injection, and it is also important to know injection characteristics (a relationship between injection pressure and injection amount, and temporal change of injection pressure) of a chemical liquid on the target ground, and to select a proper injection speed by determining whether the ground is suitable for the permeation injection or is unsuitable for the permeation injection and easy to generate a split form.

A method of obtaining a limit injection speed q_{cr} (an upper limit value of injection speed at which a generally fine consolidated shape can be obtained at a single point injection) as an index from p-q curves has also been proposed. 4),5)."
(Page 281, Lines 21 to 27)

C　Fig. 5.10 is as follows.

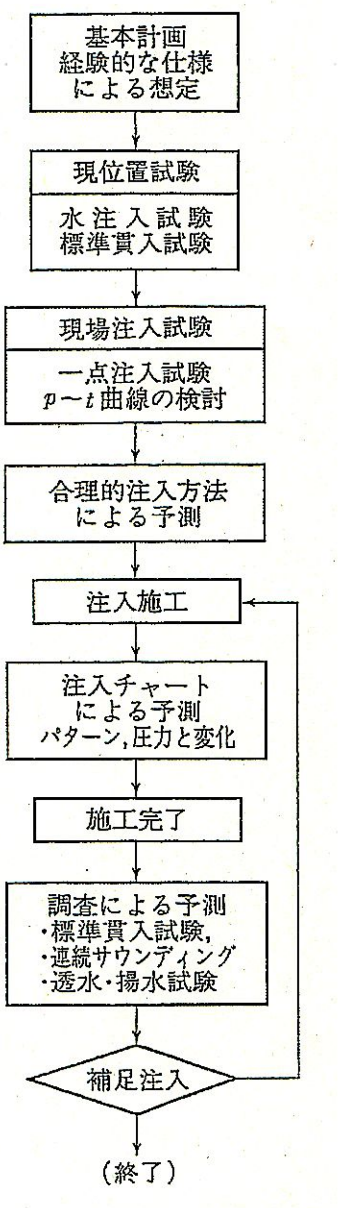


図-5.10　注入効果予測

基本計画　　　　Basic plan
経験的な仕様による想定　Assumption based on empirical specifications
現位置試験　　　Present position test

水注入試験　　　Water injection test
標準貫入試験　　Reference penetration test
現場注入試験　　Field injection test
一点注入試験　　Single point injection test
ｐ～ｔ曲線の検討　　　　Examination of p to t curves
合理的注入方法による予測　　　　Prediction by rational injection method
注入施工　　　　Injecting construction
注入チャートによる予測パターン，圧力と変化　　　Prediction based on injection chart, pattern, pressure, and change
施工完了　　　　Construction completion
調査による予測　Predication based on investigation
・標準貫入試験　*Reference penetration test
・連続サウンディング　　*Continuous sounding
・透水・揚水試験　　　　*Water permeability and pumping test
補足注入　　　　Supplement injection
（終了）　　　　(Finish)
図－５．１０　注入効果予測　　　Fig. 5.10 Injection effect prediction

(6) Evidence A No. 6

Evidence A No. 6 which was distributed prior to the application of the Patent, describes the following matters.

A "[II. Management of injection and confirmation of injection effect]

1. Management of injection

It is injected with an initial designed amount (when the designed amount changes due to test injection and the like, the designed amount after the change) as the target. At the time of injection, the situation of injection amount-injection pressure and circumstances during construction should be monitored at all times, and it is injected appropriately while paying attention to the following cases."

(Page 5, Line 4 from the bottom to Page 6, Line 2)

B "Chapter 3 Design and construction

3-1 Basic matters about design and construction

Regarding the design and construction of construction by the chemical-injecting construction method, in order to maintain the water quality standard in Appendix 1 in groundwater and a public water area and the like around the chemical liquid injection point, it must be appropriate according to the situation of groundwater and the situation of public water area and the like.

3-2 Field injection test

In conducting chemical liquid injection work, investigation is made in advance as to whether or not the injection of the chemical liquid as designed in an injection planning ground or a ground equivalent thereto is carried out.

3-3 Measures for injection

(1) For injection of the chemical liquid, necessary measures must be taken so that the chemical liquid can be mixed thoroughly.

(2) During injection of a chemical liquid, injection pressure and injection volume are constantly monitored, and in case of abnormal change, immediately stop the injection, investigate the cause thereof, and take appropriate measures.
(3) In the case of injecting a chemical liquid in the vicinity of an underground buried object, it is necessary to take necessary measures to prevent the situation where the chemical liquid flows out along the underground buried object."
(Page 9, Line 4 from the bottom to Page 10, Line 15)

2 Regarding Invention 1
(1) Comparison
First, Invention 1 and Invention A-1 will be compared.
A "a ground," "discharge ports 12," "a grout pump 1," "conduits 7," "a distribution container 6," "orifices O_1, O_2...O_i, and O_n," and "injection pipelines 9" of Invention A-1 respectively correspond to "a ground," "injection ports," "an injection pump," "first injection hoses," "a liquid separation board," "discharge ports," and "second injection hoses" of Invention 1.

B "An injection liquid" of Invention A-1 is "injected in a ground to consolidate the ground," and thus corresponds to "a grout" of Invention 1. Also, "a ground injection construction method using a ground injection device" of Invention A-1 corresponds to "a grout injection method" of Invention 1.
Then, "a ground injection construction method using the ground injection device" "which simultaneously injects a ground injection liquid into a ground through a plurality of injection pipelines installed in the ground to consolidate the ground" of Invention A-1 corresponds to "a grout injection method which simultaneously injects grout at least through a plurality of injection holes installed in a ground" of Invention 1.

C A section until "the orifices O_1, O_2...O_i, and O_n" of "branch pipes S, S...S" among "an injection liquid pressurization part Y," "a liquid feeding system A," and "an injection liquid distribution part Z" of Invention A-1, corresponds to "a first division which reaches an inlet of a discharge port on a liquid separation board to which grout is press-fed by an injection pump through first injection hoses" of Invention 1.
Also, a section from "the orifices O_1, O_2...O_i, and O_n" of "the branch pipes S, S...S" of "the injection liquid distribution part Z" to "tip end discharge ports 12, 12...12" of "a plurality of thin pipes 10, 10...10" of "the injection pipeline 9" of Invention A-1, and "a second division until the grout separated in the liquid separation board and respectively passing through discharge ports with the same cross-sectional area is injected into a ground from the plurality of injection ports through second injection hoses" of the Invention 1 are common in the point that "a second division until the grout separated in the liquid separation board and respectively passing through discharge ports is injected into a ground from the plurality of injection ports through second injection hoses."

D In the fact that "by assuming a number n of injection pipelines T as n=100, an orifice caliber=1.0 mm, and liquid feeding flowmeter f_0=150 l/minute, and when injection is simultaneously carried out from discharge ports positioned on the first stage of the injection pipelines (T1 to T100), the branch pressure member P_{11} indicates 2 kgf/cm^2, the branch flow meter f11 indicates 1.5 1/minute, and the liquid pressure meter P_0=30 kgf/cm^2" of Invention A-1, a numerical value of the liquid feeding pressure sensor P_0 indicating pressure on the upstream side of the orifices O_1, O_2...O_i, and O_n is 30 kgf/cm^2, and a numerical value of the branch pressure meter P_{11} indicating pressure on the downstream side of the same is 2 kgf/cm^2, so that according to the numerical values of the respective pressure meters, it is obvious that an opening area of the discharge ports of the injection pipelines is larger than an opening area of the orifices O_1, O_2...O_i.

E Then, Invention 1 and Invention A-1 correspond to each other in the following corresponding features.
Corresponding features: A grout injection method which simultaneously injects grout at least through a plurality of injection holes installed in a ground,

forming a first division which reaches an inlet of a discharge port on a liquid separation board to which grout is press-fed by an injection pump through first injection hoses, and a second division until the grout separated in the liquid separation board and respectively passing through discharge ports is injected into a ground from the plurality of injection ports through second injection hoses; and

setting a total cross-sectional area of the plurality of injection ports to be larger than a total cross-sectional area of the discharge ports.

Also, the two inventions are different in the following different features 1 and 2.

Different feature 1: The discharge ports have the same cross-sectional area in Invention 1, whereas it is unclear whether or not they have the same sectional area in Invention A-1.
Different feature 2: Invention 1 uniformly separates the grout from the plurality of discharge ports on the liquid-separation board, by deciding a flow rate in advance, measuring ground resistance pressure, and loading the grout flowing in the first division to have compulsive pressure higher than the measured ground resistance pressure; and injects the grout flowing in the second division based on the ground resistance pressure through the injection holes, whereas, it is unknown whether or not Invention A-1 does so.

(2) Judgment

Different features 1 and 2 will be examined.

A Different feature 1

(A) Seeing described matters of Evidence A No. 1 (1 (1) C above), as another example of a multidirectional branch body, branch valves V_{11}...V_{1n} also serving as stop valves and having throttle valves are described, and it is described that if the valves are adjusted to a predetermined throttle degree, for example, if they are made to be the same throttle degree, when pressurizing and feeding an injection liquid of 60 l/minute, in the case where n of V_{1n} is 5, it separately flows at 12 l/minute through each valve.

It is obvious that the branch valves V_{11}...V_{1n} having the throttle valves have a function of adjusting the throttle degree, and the orifices of Invention A-1 also have a function of throttling cross-sections of the pipelines. Then, considering that the branch valves V_{11}...V_{1n} having the throttle valves are another example in Evidence A No. 1

describing Invention A-1, it can be easily conceived by a person skilled in the art to apply making the branch valves V_{11}...V_{1n} have the same throttle degree to the orifices O_1, O_2...O_i, and O_n of Invention 1. Therefore, it could have been easily conceived by a person skilled in the art to make the throttle degree of the orifices O_1, O_2...O_i, and O_n of Invention A-1 have the same throttle degree described in Evidence A No. 1; namely, make the orifices O_1, O_2...O_i, and O_n have the same cross-sectional area.

(B) Also, in Evidence A No. 2, Invention A-2 described in 1 (2) E above is described, "the throttle parts 7" in which "an area is the same" of Invention A-2 correspond to "discharge ports with the same cross-sectional area" of Invention 1. Then, Invention A-1 and Invention A-2 belong to the same technical field, and are inventions relating to adjustment of a flow rate or pressure of grout, so that concerning the discharge ports ("the orifices" of Invention A-1 and "the throttle parts 7" of Invention A-2) relating to the adjustment, it could have been easily conceived by a person skilled in the art to replace the orifices of Invention A-1 with those with the same cross-sectional area similar to the throttle parts 7 of Invention A-2.

B Different feature 2

(A) First, concerning "deciding a flow rate in advance, measuring ground resistance pressure" of Invention 1 relating to Different feature 2, the demandant made the following allegations (a) to (e).

(a) In Paragraph 0072 of Evidence A No. 1, there is a description that "then, when constructing the ground injection using the device of Fig. 14, for example, prior to the injection in a first stage, a water injection test is performed to take out a P-q curve (curve 1) shown in Fig. 26; namely, P (injection pressure P)-q (injection speed or flow rate 1/minute) curve. Figure 26 is an injection pressure-flow rate (injection amount/minute) curve. In Fig. 26, the injection speed and the injection pressure are in a proportional relationship until a point O_1, and it becomes perfect infiltration injection without generating ground breakage. However, until the points O_1 to O_2, the injection speed and the injection pressure are not in the proportional relationship, and although cracking is partially generated, there is no injection pressure drop at which the ground breaks and the injection liquid deviates. The injection pressure of the point O_2 is made to be limit injection pressure P_{r0} and limit water injection speed (flow rate) q_{r0}. Thus, the limit injection pressure P_{r0} and the limit injection flow rate q_{r0} (injection speed) at which the ground breaks can be known."

The fact that a water injection test is performed to take out a P-q curve corresponds to "deciding a flow rate in advance, measuring ground resistance pressure" in the patent invention relating to Claim 1 of the case. That is, the curve in Fig. 26 of Evidence A No. 1 is obtained by the water injection test, and by injecting the grout within the limit injection pressure P_{r0} and the limit water injection speed (flow rate) q_{r0}, it becomes possible to obtain the effect that "the injection of a low flow rate (3 to 6 l/minute) can be carried out to the plurality of injection holes, and it is possible to penetrate the grout finely into the clearances of the sandy soil, thereby further improving an injection effect." mentioned in Paragraph 0024 of the description of the patent of the case.

(Page 9, Line 23 to Page 10, Line 13 of the written demand for trial)

(b) "By a preliminary water permeability test, it is P_{1r0}=6 kgf/cm^2 and q_{1r0}=4 l/minute" in Paragraph 0080 of Evidence A No. 1 substantially corresponds to "deciding a flow rate in advance, measuring ground resistance pressure" in the constitution D of the patent invention.

Also, as it is described in Paragraph 0072 of Evidence A No. 1 that "then, when constructing the ground injection using the device of Fig. 14, for example, prior to the injection in a first stage, a water injection test is performed to take out a P-q curve (curve 1) shown in Fig. 26, namely, P (injection pressure P)-q (injection speed or flow rate 1/minute) curve," and is described in Paragraph 0073 "also, unlike the water injection test, when injecting a chemical liquid...," not only the injection test, but also the preliminary injection using the actual chemical liquid is described. As described in Paragraphs 0072 to 0074, the case in which the curve 1 in Fig. 26 of Evidence A No. 1 is the water injection test and the curve 2 is the chemical liquid injection (chemical liquid injection as a preliminary test) is shown.
(Page 3, Lines 10 to 22 of the statement brief)

(c) In this regard, in Evidence A No. 1, although it is clearly described that a preliminary water permeability test and the like are carried out as mentioned above, also in Evidence A No. 2, for example, there are descriptions that "by using such a flow rate control valve C, it is possible to adjust the screw 24 in advance to set to a predetermined discharge amount, based on the flow rate test before construction, and it is also possible to appropriately adjust the discharge amount by rotating the screw 24 according to an injection state during the injection." in Paragraph 0037, "this is used when the ground conditions are generally the same, the injection conditions are generally the same, and injection is carried out simultaneously from the plurality of injection pipelines. In this case, pressure and/or a flow rate on the downstream side of the throttle parts 7 can be measured only by one conduit." in Paragraph 0050, and "also, a water permeability test of the ground 3 can be carried out after the injection, through the outer pipe discharge port 40a, and as a result of the test, if the injection is insufficient, the ground injection liquid can be re-injected from the discharge port 40a of the outer pipe 40. In Fig. 23, 41 is a rubber sleeve and the discharge port is covered with the rubber sleeve 41." in Paragraph 0087. Therefore, also from the relationship with Fig. 2 and Fig. 3, it can be said that the constitution D of Claim 1 of the case is substantially described.
(Page 16, Lines 12 to 25 of the written demand for trial)

(d) In the first place, the constitution "by deciding a flow rate in advance, measuring ground resistance pressure" itself, is described as "In conducting chemical liquid injection work, investigation is made in advance as to whether or not the injection of the chemical liquid as designed in an injection planning ground or a ground equivalent thereto is carried out" as "3-2 Field injection test," in "Notification and interim guidelines relating to construction of construction work by a chemical-injecting construction method" (No. 160 issued by Ministry of Construction Secretariat Technique on July 10, 1974) in 1974, about the field injection test in a chemical-injecting construction method (see Reference Material 2).
(Page 4, Lines 7 to 14 of the statement brief)

(e) First, in 3-2 of Evidence A No. 4 which is interim guidelines of the Ministry

of Construction, the implementation of the field injection test is instructed as follows.
"3-2 Field injection test

In conducting chemical liquid injection work, investigation is made in advance as to whether or not the injection of the chemical liquid as designed in an injection planning ground or a ground equivalent thereto is carried out."

On Pages 279-286 of Geotechnical engineering/the business series 11 "the prediction and actual condition of a soil improvement effect" issued by Japanese Geotechnical Society (February 15, 2000) as Evidence A No. 5, under the theme of prediction and actual condition of improvement range, it is described that an injection form is largely divided into permeation injection and split injection, and the predication, in temporal stages, is divided into [1] Prediction before chemical-injecting construction, and during design, [2] Management measurement during injecting construction, and [3] Estimation by investigation/inspection as confirmation of effect after injecting construction (see Page 279, Lines 15 to 21).

The patent invention relates to the permeation injection of these, and it becomes the prediction before chemical-injecting construction as a temporal stage, and during design of [1], Prediction before chemical-injecting construction. Then, it is described that "the prediction of effect basically aims at judging to what extent permeation injection can be expected and the size of an improvement range where permeation consolidation is assumed" (see Page 279, the lower 2 lines).

Concerning the test injection, as described as "In order to realize permeation injection, it is most certain to conduct a test injection and confirm the injection form. Although it is essentially necessary to conduct the test injection under the same conditions as this work, in the injection test using water instead of the chemical liquid..." on Page 280, Lines 3 to 6, it is based on the test injection with chemical liquid under the same conditions as this work, and it is suggested that the injection test using water can be substituted.

Also, in Fig. 5.10 on the left side of Page 280, the procedures such as "Basic plan assumption based on empirical use," "Present position test, water injection test, and reference penetration test," "Field injection test, single point injection test, and examination of p to t curves," "prediction by rational injection method," and "injecting construction."

Evidence A No. 6 relates to notification and interim guidelines relating to construction of construction work by a chemical-injecting construction method by the Ministry of Construction (Current Ministry of Land, Infrastructure and Transport), and a part relating to interim guidelines has the same contents as Evidence A No. 4.

As described on Page 5, Line 4 from the bottom to Page 6, Line 2, in relation to the management of injection is said that "It is injected with an initial designed amount (when the designed amount changes due to test injection and the like, the designed amount after the change) as the target. At the time of injection, the situation of injection amount-injection pressure and circumstances during construction should be monitored at all times and it is injected appropriately while paying attention to the following cases."

As described above, in the chemical-injecting construction method (grout construction), under the basic plan as shown in Fig. 5.10 on the left side of Page 280 of Evidence A No. 5, after the present position test, the water injection test, the reference penetration test, and the like, the injection amount or injection speed (flow rate) of the chemical liquid (grout) is decided, and the construction is carried out after the field injection test.

It is described that "this test aims at grasping the approximate condition under which an injection form changes from penetration to split by obtaining a relationship (p to q curves) between injection speed and injection pressure while gradually increasing the injection speed" on Pages 280, Lines 19 to 24, and that "in order to obtain a consolidated shape with sufficient improvement effect on strength and water permeability and high continuity, it is important to certainly carry out permeation injection, and it is also important to know injection characteristics (a relationship between injection pressure and injection amount, and temporal change of injection pressure) of a chemical liquid on the target ground, and to select a proper injection speed by determining whether the ground is suitable for the permeation injection or is unsuitable for the permeation injection and easy to generate a split form. A limit injection speed q_{cr} (an upper limit value of injection speed at which a generally fine consolidated shape can be obtained at a single point injection) as an index is obtained from p-q curves" on Page 281, Lines 21 to 27. Examples are described in the p to q curves in Fig. 5.12, and the p to q curves in Fig. 5.15 on Page 284.
(Page 2, Line 3 to Page 3, Line 21 of the written statement)

(B) The above mentioned allegations (a) and (b) will be examined.

In Evidence A No. 1, according to the description of Paragraph [0072], a test carried out prior to the construction of ground injection does not inject mortar, but is a water injection test injecting water. The injection test, first, creates a curve 1 shown in [Fig. 26]; namely, an inflow pressure P-injection speed q curve. Until the points O_1 to O_2, on the curve, the injection speed and the injection pressure are not in the proportional relationship, although cracking is partially generated, since it is a part where there is no injection pressure drop at which the ground breaks and the injection liquid deviates, it is a test for knowing the injection pressure at the point O_2 where the ground breaks as limit injection pressure P_{r0} and limit water injection speed q_{r0}. Then, in Paragraph [0073], although it is described that "unlike the water injection test, when injecting a chemical liquid, ... In Fig. 26, those are in a linear relationship until a point F_1, and those are not a straight line, but do not break from the points F_1 to $F_{2''}$, it is unknown how the curve 2 on which the points F_1 to F_2 supposed to have injected the chemical liquid instead of water are on the line is obtained, and it is impossible to understand whether it is obtained by injecting the chemical liquid or it is a theoretical curve derived from the result of the water injection test. Also, in Paragraph [0074], concerning the relationship between the limit injection pressure P_{1rf} of the chemical liquid and the limit injection pressure P_{1r0} of the water injection test, it is described that "it is set to P_{1rf}=7.5 kgf/cm^2 (1.5 times P_{1r0})," and according to the fact that it is set to be 1.5 times, it cannot be recognized that the test prior to the construction of the ground injection alleged by the demandant is a test using a chemical liquid.

Also, the fact that the test creates the P-q curve means that measurement is carried out while changing injection pressure and injection speed appropriately, and the actual injection speed or injection pressure in Evidence A No. 1 adopts an appropriate numerical value from the P-q curve.

Then, it can be said that injection amount decided in advance of Invention 1, and ground resistance pressure measured with respect to the injection amount are not described in Evidence A No. 1.

Also, even based on the test described in Evidence A No. 1 or other technical common sense, it cannot be said that a person skilled in the art could easily conceive the constitution of Invention 1 relating to Different feature 2.

(C) Next, the above mentioned allegation (c) will be examined.

Even in Evidence A No. 2, although it is described that a flow rate test before construction is carried out, it is not clearly described that the flow rate test is carried out by injecting the chemical liquid at the site where the actual injection is performed, and depending on circumstances, it may be possible to carry out the test in other places with similar conditions, to perform a general soil test such as permeability test, and to carry out the test by injecting water, so that it cannot be recognized that the test alleged by the demandant is described.

(D) Furthermore, the above mentioned allegations (d) and (e) will be examined.

The test described in Evidence A No. 5 is an injection test using water instead of a chemical liquid, similarly to the one described in Evidence A No. 1 examined in B above, and aims at grasping the approximate condition under which an injection form changes from penetration to split by obtaining p to q curves in the same manner, so that as described in B above, according to the described matters of Evidence A No. 5, it does not decide a flow rate in advance and measure ground resistance pressure.

In Evidence A No. 5, although there is a description that "although it is essentially necessary to conduct the test injection under the same conditions as this work," even though it may be carried out under the same conditions as this work, it is unknown whether or not it was directly carried out at the site of this work, and as described as "a simple method of predicting the injection form from a relationship between injection pressure and injection speed in the injection test using water instead of the chemical liquid has recently been proposed," it is natural that it is understood that the test described in Evidence A No. 5 is just a test to inject water.

Also, as alleged by the demandant, even though on-site testing has been practiced conventionally, according to the descriptions of Evidence A No. 4 and Evidence A No. 6, various cases are thought of, whether the test is carried out by directly injecting a chemical liquid to the site to be injected the chemical liquid, or the test is carried out by injecting water, or the test is carried out at a place near the site, or the water permeation test and the like is carried out on a soil of the site, and also, it is unknown whether or not ground resistance pressure is measured. In the end, it is not possible to grasp what type of test was done, and it cannot be recognized that deciding a flow rate in advance and measuring ground resistance pressure are well-known techniques.

(E) Therefore, in the evidences presented by the demandant, there is no description about "deciding a flow rate in advance, and measuring ground resistance pressure," and it cannot be easily conceived by a person skilled in the art from the evidences, so that, in Invention A-1, it cannot be said that a person skilled in the art could easily make the constitution of Invention 1 relating to the different feature 2 based on the Evidence A No. 1 to Evidence A No. 6.

C Summary

As described above, it cannot be said that Invention 1 is the invention described in Evidence A No. 1, and it cannot be concluded that Invention 1 could have been easily made by a person skilled in the art prior to the application of the patent, based on the invention described in Evidence A No. 1 or based on the inventions described in Evidence A No. 1 and Evidence A No. 2.

3 Regarding the Invention 2

(1) Comparison

First, Invention 2 and Invention A-1 will be compared.

A "a ground," "discharge ports 12," "a grout pump 1," "conduits 7," "a distribution container 6," "orifices O_1, O_2...O_i, and O_n," and "injection pipelines 9" of Invention A-1 respectively correspond to "a ground," "injection ports," "an injection pump," "first injection hoses," "a liquid separation board," "discharge ports," and "second injection hoses" of Invention 2.

B "An injection liquid" of Invention A-1 is "injected in a ground to consolidate the ground," and thus corresponds to "a grout" of Invention 2. Also, "ground injection device" of Invention A-1 corresponds to "a grout injection device" of Invention 2.

Then, "a ground injection device" "which simultaneously injects a ground injection liquid into a ground through a plurality of injection pipelines installed in the ground to consolidate the ground" of Invention A-1 corresponds to "A grout injection device which simultaneously injects grout at least through a plurality of injection holes installed in a ground" of Invention 2.

C A section until "the orifices O_1, O_2...O_i, and O_n" of "branch pipes S, S...S" among "an injection liquid pressurization part Y," "a liquid feeding system A," and "an injection liquid distribution part Z" of Invention A-1, corresponds to "a first division which reaches an inlet of discharge port on a liquid separation board to which grout is press-fed by an injection pump through first injection hoses" of Invention 2.

Also, a section from "the orifices O_1, O_2...O_i, and O_n" of "the branch pipes S, S...S" of "the injection liquid distribution part Z" to "tip end discharge ports 12, 12...12" of "a plurality of thin pipes 10, 10...10" of "the injection pipeline 9" of Invention A-1, and "a second division until the grout separated in the liquid separation board and respectively passing through discharge ports with the same cross-sectional area is injected into a ground from the plurality of injection ports through second injection hoses" of Invention 2 are common in the point that "a second division until the grout separated in the liquid separation board and respectively passing through discharge ports is injected into a ground from the plurality of injection ports through second injection hoses."

D In the fact that "by assuming a number n of injection pipelines T as n=100, an orifice caliber=1.0 mm, and liquid feeding flowmeter f_0=150 l/minute, and when injection is simultaneously carried out from discharge ports positioned on the first stage of the injection pipelines (T1 to T100), the branch pressure member P_{11} indicates 2 kgf/cm^2, the branch flow meter f11 indicates 1.5 1/minute, and the liquid pressure meter P_0=30 kgf/cm^2" of Invention A-1, a numerical value of the liquid feeding pressure sensor P_0 indicating pressure on the upstream side of the orifices O_1, O_2...O_i, and O_n is 30 kgf/cm^2, and a numerical value of the branch pressure meter P_{11} indicating pressure on the downstream side of the same is 2 kgf/cm^2, so that according to the numerical values of both pressure meters, it is obvious that an opening area of the discharge ports of the injection pipelines is larger than an opening area of the orifices O_1, O_2...O_i.

E Then, Invention 2 and Invention A-1 correspond to each other in the following corresponding features.
Corresponding features: A grout injection device which simultaneously injects grout at least through a plurality of injection holes installed in a ground,

having a first division which reaches an inlet of discharge ports on a liquid separation board to which grout is fed by an injection pump through first injection hoses, and a second division until the grout separated in the liquid separation board and respectively passing through the discharge ports is injected into a ground from the plurality of injection ports through second injection hoses,

wherein a total cross-sectional area of the injection holes is set to be larger than a total cross-sectional area of the plurality of discharge ports.

Also, the two inventions are prima facie different in the following Different features 1' and 2'.

Different feature 1': The discharge ports have the same cross-sectional area in Invention 2, whereas it is unclear whether or not they have the same sectional area in Invention A-1.
Different feature 2': In Invention 2, the first division uniformly separates the grout from the plurality of discharge ports on the liquid-separation board, by deciding a flow rate in advance, measuring ground resistance pressure, and loading the flowing grout to have compulsive pressure higher than the measured ground resistance pressure, and the second division injects the flowing grout based on the ground resistance pressure through the injection holes, whereas it is unknown whether or not Invention A-1 does so.

(2) Judgment

The different features 1' and 2' will be examined.

A Different feature 1'
(A) Seeing described matters of Evidence A No. 1 (1 (1) C above), as another example of a multidirectional branch body, branch valves V_{11}...V_{1n} also serving as stop valves and having throttle valves are described, and it is described that if the valves are adjusted to a predetermined throttle degree, for example, if they are made to be the same throttle degree, when pressurizing and feeding an injection liquid of 60 l/minute, in the case where n of V_{1n} is 5, it separately flows in every valve at 12 l/minute.

It is obvious that the branch valves V_{11}...V_{1n} having the throttle valves have a function of adjusting the throttle degree, and the orifices of Invention A-1 also have a function of throttling cross-sections of the pipelines. Then, considering that the branch valves V_{11}...V_{1n} having the throttle valves are another example in Evidence A No. 1 describing Invention A-1, it can be easily conceived by a person skilled in the art to apply making the branch valves V_{11}...V_{1n} with the throttle valves have the same throttle degree as the orifices O_1, O_2...O_i, and O_n of Invention A-1. Therefore, it could have been easily conceived by a person skilled in the art to make the throttle degree of the orifices O_1, O_2...O_i, and O_n of Invention A-1 have the same throttle degree described in Evidence A No. 1; namely, make the orifices O_1, O_2...O_i, and O_n have the same cross-sectional area.

(B) Also, in Evidence A No. 2, Invention A-2 described in 1 (2) E above is described, "the throttle parts 7" in which "an area is the same" of Invention A-2 correspond to "discharge ports with the same cross-sectional area" of Invention 1. Then, Invention A-1 and Invention A-2 belong to the same technical field, and are inventions relating to adjustment of a flow rate or pressure of grout, so that concerning the discharge ports ("the orifices" of Invention A-1 and "the throttle parts 7" of Invention A-2) relating to the adjustment, it could have been easily conceived by a person skilled in the art to replace the orifices of Invention A-1 with those with the same cross-sectional area similar to the throttle parts 7 of Invention A-2.

B Different feature 2'

(A) Since "measuring ground resistance pressure with respect to a flow rate in advance" of Invention 2 can be regarded as a method of determining "ground resistance pressure," it cannot be recognized that it is the matter specifying the invention in Invention 2 which is an invention of an object "a grout injection device."

Then, "the first division measures ground resistance pressure with respect to a flow rate in advance, and loads the flowing grout to have compulsive pressure higher than the measured ground resistance pressure" can be said as "the first division loads the flowing grout to have compulsive pressure higher than ground resistance pressure."

Considering the propriety of the matter specifying the invention, Different feature 2' is substantially that "In Invention 2, the first division uniformly separates the grout from the plurality of discharge ports on the liquid-separation board, by loading the flowing grout to have compulsive pressure higher than ground resistance pressure, and the second division injects the flowing grout based on the ground resistance pressure through the injection holes, whereas it is unknown whether or not Invention A-1 does so" (hereinafter, referred to as "Different feature 2").

(B) Here, in Invention A-1, since it is that a value of the liquid feeding pressure meter P_0 (30 kgf/cm^2) > a value of the branch pressure meter P_{11} (2 kgf/cm^2), a pressure value of "the branch flowmeter P_{11}" which is one of "the branch pressure meters P_1, P_2...P_i, and P_n" mounted to "the branch pipes S, S...S" of Invention A-1, and a pressure value of "the liquid feeding pressure meter P_0" equipped on "the conduit 7" respectively correspond to "ground resistance pressure" and "compulsive pressure higher than ground resistance pressure" of Invention 2.

Then, as described in A above, it can be easily conceived to make discharge ports have the same cross-sectional area, so that if combining a magnitude relationship between the values of the above two pressure meters, with the same reason as described in Paragraphs [0009] to [0018] of the description of the patent of the case, it is possible to uniformly separate grout from a plurality of discharge ports.

Then, since the fact that "by assuming a number n of injection pipelines T as n=100, an orifice caliber=1.0 mm, and liquid feeding flowmeter f_0=150 l/minute, and when injection is simultaneously carried out from discharge ports positioned on the first stage of the injection pipelines (T1 to T100), the branch pressure meter P_{11} indicates 2 kgf/cm^2, the branch flow meter f11 indicates 1.5 1/minute, and the liquid feeding pressure meter P_0=30 kgf/cm^2, and in a water permeability test before the injection in the first stage, it was q_{1r0}=5 l/minute and P_{1r0}=5 kgf/cm^2" of Invention A-1 corresponds to the fact that "the first division uniformly separates the grout from the plurality of discharge ports on the liquid-separation board, by loading the flowing grout to have compulsive pressure higher than ground resistance pressure, and the second division injects the flowing grout based on the ground resistance pressure through the injection holes" which is the constitution of Invention 2 relating to Different feature 2", Invention A-1 is equipped with the constitution of Different feature 2" and Different feature 2" cannot be said to be substantial.

(C) Also, seeing Invention A-2 described in Evidence A No. 2, "a high pressure part on an upstream side of the throttle part 7," "a low pressure part on a downstream side" "of the throttle part 7," "the discharge amount(injection speed)," "the injection pressure P_{1n} (of the ground 3 to be injected)," "the injection pressure P_0 (of the pressurized ground injection liquid 5)," "the ground injection liquid 5," "the distribution device 11," "tip end discharge ports 33," and "the throttle part 7" of Invention A-2, respectively correspond to "a first division," "a second division," "a flow rate," "ground resistance pressure," "compulsive pressure," "grout," "a liquid separation board," "discharge ports," and "injection ports" of Invention 2.

Also, the fact that "the differential pressure between the injection pressure P_0 of the pressurized ground injection liquid 5 and the injection pressure P_{1n} of the ground 3 to be injected is taken sufficient largely" of Invention A-2, corresponds to "compulsive pressure higher than ground resistance pressure" of Invention 2, and similarly, the fact that "the discharge amount (injection speed) of each conduit 6 is almost the same if an area of the throttle part 7 is the same" corresponds to "uniformly separating the grout from the plurality of discharge ports."

Then, the fact that "wherein a distribution device 11 is provided between the liquid feeding system 13 and the conduits 6, the conduits 6, 6...6 being extended from the distribution device 11, the conduits 6 and the injection pipelines 2 being coupled by coupling parts 12, the conduits 6 being provided with branch valve V_1, V_2...V_i, and V_n, in addition, a pressure meter (pressure detector) 8, and a flowmeter (flow rate detector) 9, the throttle parts 7 being provided at outlets from a distribution device 11 to the conduits 6, the injection pipelines 2 being made by binding a plurality of thin pipes 32, the respective thin pipes 32, 32...32 having tip end discharge ports 33 respectively opened at different positions in the axial direction,

wherein although the ground injection liquid 5 is jetted from a high pressure part on an upstream side of the throttle part 7 to a low pressure part on a downstream side, if the differential pressure between the injection pressure P_0 of the pressurized ground injection liquid 5 and the injection pressure P_{1n} of the ground 3 to be injected is sufficiently large, even if the injection pressure of the respective conduits 6, 6, ... 6 on the downstream side of the throttle parts 7 varies, the discharge amount (injection speed) of each conduit 6 is almost the same if an area of the throttle part 7 is the same, and then, the discharge amount is decided according to the injection pressure P_0 and an area of a hole of the throttle part 7" of Invention A-2, if expressed in terms of Invention

2, corresponds to the fact that "the first division uniformly separates the grout from the plurality of discharge ports on the liquid-separation board, by loading the flowing grout to have compulsive pressure higher than ground resistance pressure, and the second division injects the flowing grout based on the ground resistance pressure through the injection holes."

Invention A-1 and Invention A-2 belong to the same technical field, and are inventions relating to adjustment of a flow rate or pressure of grout, so that concerning the constitution relating to the adjustment, it could have been easily conceived by a person skilled in the art to make the constitution of Invention 2 relating to the different feature 2" by applying Invention A-1 to Invention A-2.

C Summary

As described above, Invention 2 could have been easily conceived by a person skilled in the art prior to the filing of the application, based on the invention described in Evidence A No. 1 or based on the inventions described in Evidence A No. 1 and Evidence A No. 2.

No. 5 Closing

Therefore, the patent relating to the Invention 1 cannot be invalidated by the reasons and the means of proof alleged by the demandant.

Also, the appellant should not be granted a patent for Invention 2 under the provisions of Article 29(2) of the Patent Act, and thus, the patent falls under Article 123(1)(ii) of the Patent Act and should be invalidated.

With regard to the costs in connection with the trial, 1/2 shall be borne by the demandant, and 1/2 shall be borne by the demandee under the provisions of Article 64 of the Code of Civil Procedure which is applied mutatis mutandis in the provisions of Article 169(2) of the Patent Act.

Therefore, the trial decision shall be made as described in the conclusion.

December 17, 2015

Chief administrative judge: HONGO, Toru
Administrative judge: SUMIDA, Hidehiro
Administrative judge: NAKADA, Makoto