

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

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PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year)

14 DEC 2018

Applicant's or agent's file reference
059288-00009

FOR FURTHER ACTION

See paragraph 2 below

International application No.
PCT/US18/54384

International filing date (day/month/year)
04 October 2018 (04.10.2018)

Priority date (day/month/year)
06 October 2017 (06.10.2017)

International Patent Classification (IPC) or both national classification and IPC

IPC - E02D 27/12, 27/10, 17/12, 5/38, 5/66; E04B 1/18, 1/20; E04C 3/34, 3/36; E04G 13/02 (2018.01)

CPC - E04G 13/021; E02F 5/223; E02D 5/385, 5/665

Applicant
INGIOS GEOTECHNICS, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-8300

Date of completion of this opinion
13 November 2018 (13.11.2018)

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**WRITTEN OPINION OF THE
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Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

- ☒ the international application in the language in which it was filed.
- ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a)).

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

a. ☐ forming part of the international application as filed:

- ☐ in the form of an Annex C/ST.25 text file.
- ☐ on paper or in the form of an image file.

b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

- ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
- ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

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Box No. V	Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement		
1. Statement			
Novelty (N)	Claims	1-20	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	5, 14-17	YES
	Claims	1-4, 6-13, 18-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	NONE	NO
2. Citations and explanations:			
Claims 1-4, 6-7, 9-12, and 18 lack an inventive step under PCT Article 33(3) as being obvious over by US 4,618,289 A (Federer) in view of US 2004/0115011 A1 (Fox). As per claim 1 Federer discloses an apparatus for constructing a support column (the apparatus for performing pile forming operations; column 3 lines 65-67), comprising: a driving mandrel (the pile forming apparatus 10 includes a hollow rigid driving mandrel 11; Figure 3, column 4 lines 3-4) having a top portion (upper portion of mandrel surrounding conduit 13 and extending from partition plate 24 to driving head 19; Figure 3, column 5 lines 31-32), a feed tube (fitting 14 connecting conduit 13 (feed tube) to a grout pump; Figure 3, column 4 lines 11-13), and an expansion head portion that are operatively connected (mandrel 11 has radial apertures 12 in lower portion of the mandrel (expansion head portion); Figure 3, column 4 lines 4-6), wherein the expansion head portion comprises an expansion chamber (the interior (expansion chamber); compare to applicants expansion chamber 120) of the mandrel's lower section (expansion head portion); column 5 lines 30-31) and an egress port within the expansion chamber (interior conduit 13a (egress port) extends through partition plate 24 into the interior (expansion chamber) of the mandrel's lower section (expansion head portion); Figure 3, column 5 lines 28-31). Federer fails to disclose an egress port being adapted for crimping. Fox discloses an egress port being adapted for crimping (the hollow tube 30 (egress port) may comprise a cylindrical steel tube that is capable of being permanently crimped; Figure 1, Paragraph [0052]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Federer with the crimpable egress port as taught by Fox because steel is a strong, easily worked, readily available material. As per claim 2 Federer and Fox disclose the apparatus as recited in claim 1, and Federer further discloses wherein the top portion has an open upper end to the feed tube (the upper portion of the mandrel can be filled with grout if the driving head 19 is removed; Figure 3, column 5 lines 49-51), and the expansion chamber has an open lower surface (the driving foot 15 is releaseably coupled (allowing an open lower surface) to the lower section of the mandrel (expansion head portion); Figure 3, column 4 lines 13-14). As per claim 3 Federer and Fox disclose the apparatus as recited in claim 1, and Federer further discloses wherein the expansion head portion includes an internal connection ring (partition plate 24 (internal connection ring) in the interior of the mandrel's lower section (expansion head portion) creates a ring around conduit 13 allowing it to pass thru; Figure 3, column 5 lines 29-31), and the egress port is affixed to the internal connection ring and extends into the expansion chamber (conduit 13 (egress port) extends through partition plate 24 (internal connection ring) into the interior of the mandrel's lower section (expansion chamber); Figure 3, column 5 lines 28-31). As per claim 4 Federer and Fox disclose the apparatus as recited in claim 1. Federer fails to disclose wherein the egress port is a tube made of a material selected to be sufficiently flexible such that the tube is adapted to compress radially inwards to prevent backflow of infill material upward into the tube. Fox discloses wherein the egress port is a tube made of a material selected to be sufficiently flexible such that the tube is adapted to compress radially inwards to prevent backflow of infill material upward into the tube (the hollow tube 30 (egress port) may comprise a cylindrical steel tube that is capable of being permanently crimped; Figure 1, Paragraph [0052]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Federer with the tube adapted to be crimped radially as taught by Fox because steel is a strong, easily worked, readily available material. As per claim 6 Federer and Fox disclose The apparatus as recited in claim 1, and Federer further discloses wherein the top portion has a closed upper end (driving head 19 is attached to the top of the mandrel; Figure 1, column 4 lines 30-31), and the expansion chamber has an open lower surface (lower portion of the mandrel (expansion chamber) has radial apertures 12 in the lower section; Figure 1, column 4 lines 4-6). As per claim 7 Federer and Fox disclose the apparatus as recited in claim 6, and Federer further discloses an inlet injection port connected to the feed tube (the conduit 13 (feed tube) is connected to the mandrel through a fitting 14 (inlet injection port); Figure 1, column 4 lines 11-13). As per claim 9 Federer and Fox disclose the apparatus as recited in claim 1, and Federer further discloses wherein the feed tube has a feed tube inside diameter and a feed tube outside diameter (outside and inside diameter of conduit 13a (feed tube); Annotated Figure 3), wherein the expansion chamber has an expansion chamber inside diameter and an expansion chamber outside diameter (outside and inside diameter of the interior (expansion chamber) of the mandrel's lower section (expansion head portion); Annotated Figure 3), the expansion chamber inside diameter being greater than the feed tube outside diameter (the inside diameter of the interior (expansion chamber) of the mandrel's lower section (expansion head portion) is approximately 3 times the size of the outside diameter of conduit 13a (feed tube); Annotated Figure 3). ****-Continued Within the Next Supplemental Box-****			

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INTERNATIONAL SEARCHING AUTHORITY**International application No.
PCT/US18/54384**Box No. VII Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

Claim 1 is objected to under PCT Rule 66.2(a)(iii) as containing the following defect in the form or contents thereof: In line 4 of claim 1, the phrase "a an egress port" is interpreted as containing a typographical error and for the purposes of this opinion will be interpreted as "an egress port".

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claim 5 is objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because claim 5 is indefinite for the following reason: Claim 5 refers to "wherein the material is" in line 1. There is a lack of antecedent basis for "the material". For the purpose of this opinion, as best understood, claim 5 is interpreted as to depend on claim 4.

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

-Continued from Box V: Citations and Explanations-

As per claim 10 Federer discloses a method for constructing a support column (a method of forming a cast-in-place (support) column; column 2 lines 59-60), comprising the steps of: providing a mandrel assembly having a feed tube operatively connected to an expansion head (mandrel 11 is connected to conduit 13 (feed tube) thru fitting 14 and has radial apertures 12 in lower portion of the mandrel (expansion head portion); Figure 3, column 4 lines 3-14, column 5 lines 31-32), wherein the expansion head comprises an expansion chamber and an egress port within the expansion chamber (interior conduit 13a (egress port), extends through a partition plate 24 into the interior (expansion chamber) of the mandrel's lower section (expansion head portion); Figure 3, column 5 lines 29-31); driving the mandrel assembly into a ground surface to a prescribed initial depth with respect to the ground surface level (the mandrel is driven until the upper most apertures 12a are below the surface of the ground; Figure 3, column 5 lines 33-35); adding infill material to the feed tube (when uppermost aperture 12a is below the surface of the ground then the grout pump can be turned on (add infill material) to pump concrete or grout through conduit 13 (feed tube); Figure 3, column 4 lines 42-46), wherein the infill material has sufficient mobility for advancing within the feed tube and through the egress port (pumping of concrete or grout will ensure even low mobility infill can move thru conduit 13 (feed tube) and interior conduit 13a (egress port); Figure 3, column 4 line 44); driving the mandrel assembly further into the ground surface to a prescribed driving termination depth with respect to the ground surface level (when the desired depth has been reached, the mandrel 11 can be left in place or withdrawn; Figure 3, column 5 line 40-41); raising the mandrel assembly above the prescribed driving termination depth (when the desired depth is reached, the mandrel 11 can be removed (raised above the prescribed driving termination depth); Figure 3, column 5 lines 40-41); forming a space at the bottom of the mandrel assembly (additional grout can be pumped into the area vacated by the mandrel; column 5 lines 20-22); allowing a first portion of the infill material to exit through the egress port by gravity into the expansion chamber and into the space (as the mandrel is being withdrawn, additional grout can be pumped into the area vacated by the mandrel and is capable of exiting the bottom end of conduit 13a (egress port) by gravity; Figure 3, column 5 lines 20-22); and forming a first placed infill material at the prescribed driving termination depth (as the mandrel is being withdrawn, from the desired depth, additional grout can be pumped into the area vacated by the mandrel; column 5 lines 14, 20-22). Federer fails to disclose an egress port being adapted for crimping. Fox discloses an egress port being adapted for crimping (the hollow tube 30 (egress port) may comprise a cylindrical steel tube that is capable of being permanently crimped; Figure 1, Paragraph [0052]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Federer with the crimpable egress port as taught by Fox because steel is a strong, easily worked, readily available material.

As per claim 11 Federer and Fox disclose the method as recited in claim 10, and Federer further discloses wherein the adding step is done by pumping the infill material into the feed tube (the grout pump can be turned on (add infill material) to pump concrete or grout through conduit 13 (feed tube); Figure 3, column 4 lines 44-46).

As per claim 12 Federer and Fox disclose the method as recited in claim 10. Federer fails to disclose wherein the infill material is mobile medium slump concrete, mobile high slump concrete, sand-cement grout, or neat cement grout. Fox discloses wherein the infill material is mobile medium slump concrete, mobile high slump concrete, sand-cement grout, or neat cement grout (inlet port 60 allows the addition of water or water-cement-sand grout; Figure 5, Paragraph [0061]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Federer to use the cement-sand grout as taught by Fox because sanded grout is more durable than unsanded grout and will allow the support column to last longer.

As per claim 18 Federer and Fox disclose the method as recited in claim 10. Federer fails to disclose further comprising the step of forming a second placed infill material at a different depth than the prescribed driving termination depth. Fox discloses the step of forming a second placed infill material at a different depth than the prescribed driving termination depth (Figure 10 illustrates the second lift formation effected by lifting of the hollow tube 30; Figure 10, Paragraph [0068]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Federer with the second placed infill material as taught by Fox because making a second infill would increase the support columns stability.

Claim 8 lacks an inventive step under PCT Article 33(3) as being obvious over Federer in view of Fox and US 2,968,915 A (Feistel).

As per claim 8 Federer and Fox disclose the apparatus as recited in claim 7, and Federer further discloses a pressure gauge that is connected to the feed tube (the grout pump can be provided with a pressure gauge to monitor grout flow; column 4 lines 48-50). Federer fails to disclose a pressure relief valve connected to the feed tube. Feistel discloses a pressure relief valve connected to the feed tube (a pressure relief valve 28 is connected to conduits 31, 32 by way of lines 29, 30 (feed tubes); Figure 1, column 2 lines 41-43). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Federer with the pressure relief valve as taught by Feistel because adding a pressure relief system can prevent dangerous buildup of pressure that can cause injuries to users and damage the apparatus.

Claims 13 and 20 lack an inventive step under PCT Article 33(3) as being obvious over Federer in view of Fox and US 2008/0205993 A1 to Wissmann K. et al. (hereinafter "Wissmann").

As per claim 13 Federer and Fox disclose the method as recited in claim 10. Federer fails to disclose further comprising the step of constructing an expanded diameter of the first placed infill material, the constructing step comprising the step of re-driving the raised mandrel assembly downwards into the first placed infill material. Wissmann discloses the step of constructing an expanded diameter of the first placed infill material, the constructing step comprising the step of re-driving the raised mandrel assembly downwards into the first placed infill material (to achieve a wider aggregate pier the mandrel 1 is raised and then driven back down to provide a greater volume of compacted aggregate; Figure 9, Paragraph [0051]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Federer with the method of compacting the first infill material as taught by Wissmann because compacting the first infill material provides additional column stability and helps prevent the sidewalls of the hole from caving in.

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Supplemental Box

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As per claim 20 Federer and Fox disclose the method as recited in claim 10. Federer fails to disclose further comprising the step of compacting the first placed infill material to have a diameter a larger than the diameter of the expansion chamber. Wissmann discloses the step of compacting the first placed infill material to have a diameter a larger than the diameter of the expansion chamber (to achieve a wider aggregate pier the mandrel 1 is raised and then driven back down to provide a greater volume of compacted aggregate as shown in Figure 9; Figure 9, Paragraph [0051]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Federer with the method of compacting the first infill material as taught by Wissmann because compacting the first infill material provides additional column stability and helps prevent the sidewalls of the hole from caving in.

Claim 19 lacks an inventive step under PCT Article 33(3) as being obvious over Federer in view of Fox and US 2016/0312430 A1 to Geopier Foundation Company Inc. (hereinafter "Geopier").

As per claim 19 Federer and Fox disclose the method as recited in claim 10. Federer fails to disclose further comprising the step of forming a second placed infill material having a different diameter than the first placed infill material and at a different depth than the prescribed driving termination depth. Geopier discloses further comprising the step of forming a second placed infill material having a different diameter than the first placed infill material and at a different depth than the prescribed driving termination depth (the mandrel assembly 1 is raised and additional aggregate 15 is allowed to fill the annular space between the pipe 14 and the sidewall of the cavity 16; Figure 6E, Paragraph [0045]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Federer with the smaller second infill as taught by Geopier because having the second infill smaller than the first would use less material overall while still providing added stability.

Claim 5 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest wherein the material is concrete hose, Kevlar tubing, or aramid fiber tubing.

Federer discloses the apparatus as recited in claim 1 but Federer fails to disclose wherein the material is concrete hose, Kevlar tubing, or aramid fiber tubing.

Fox fails to disclose wherein the material is concrete hose, Kevlar tubing, or aramid fiber tubing.

Wissmann fails to disclose wherein the material is concrete hose, Kevlar tubing, or aramid fiber tubing.

As the prior art fails to disclose a material for the egress port tube, and the claimed materials are quite specific, it would have required the use of impermissible hindsight to modify the prior art to include the claimed materials.

Claim 14 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the steps of: crimping and constricting by the egress port to prevent upward movement into the egress port by the first placed infill material.

Federer fails to disclose the constructing step further comprising the steps of: crimping and constricting by the egress port to prevent upward movement into the egress port by the first placed infill material; and allowing the expansion chamber to push the first placed infill material downward and outward at a prescribed expanded diameter ground depth with respect to the ground surface level.

Fox discloses allowing the expansion chamber to push the first placed infill material downward and outward at a prescribed expanded diameter ground depth with respect to the ground surface level (Figure 9 illustrates the subsequent pushing down of hollow tube 30 and lower head element 32 (expansion chamber), forcing the aggregate both laterally and vertically into the soil matrix; Figure 9, Paragraph [0067]). Fox fails to disclose crimping and constricting by the egress port to prevent upward movement into the egress port by the first placed infill material.

Wissmann discloses crimping and constricting of a structure to prevent upward movement into the egress port by the first placed infill material (flow restrictors 6 constrict upwards preventing any significant amount of aggregate going back up into the mandrel 1 thru the hole in connector plate 10 (egress port); Figure 9, Paragraph [0050]); and allowing the expansion chamber to push the first placed infill material downward and outward at a prescribed expanded diameter ground depth with respect to the ground surface level (to achieve a wider aggregate pier the bottom portion 2 (expansion chamber) of mandrel 1 may be driven down from a height of 4 or 5 feet; Figure 9, Paragraph [0051]). Wissmann fails to disclose wherein that structure is the egress port.

While narrowing the effective diameter of the egress port in order to press into the deposited infill is known in the art, doing so by crimping the port is not known. As performing the task in this manner is not known to have problems that crimping would solve, it would require the use of impermissible hindsight on the part of one of ordinary skill in the art at the time of the invention to modify the prior to include crimping of the egress port as a means of constricting the port.

Claims 15-17 meet the criteria set out in PCT Article 33(2)-(3), because they are dependent upon claim 14.

Claims 1-20 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

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Supplemental Box

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Annotated Figure 3
US 4,618,289 A

