

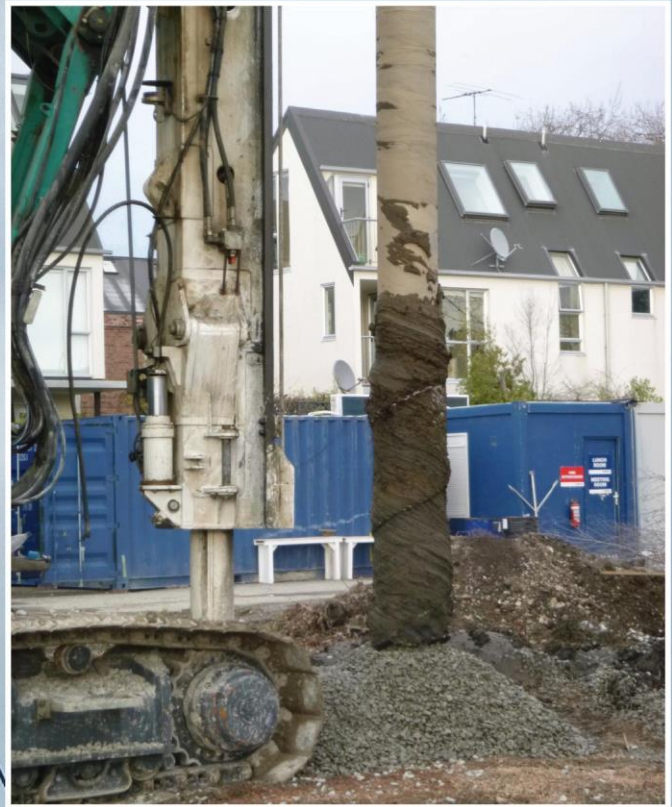
STONE COLUMNS



McMillan Drilling Group introduced a Patented Stone Column technique to the New Zealand Market following the Christchurch Earthquakes.

This provides the following benefits over traditional vibrating stone column installations:

- The method is vibration free so it can be used immediately next to sensitive sites or neighbouring buildings. (To within 1.5m of existing buildings have been done.)
- The method is fast to set up, and column installation can begin within 3 hours of the equipment arriving on site depending upon which base machine is used.
- Only two pieces of plant are required at each site. The stone column machine, and a loader. Stone deliveries by truck.
- The equipment involves less high pressure and high wear hydraulic components, and is subsequently more reliable with reduced costs.
- This method allows the introduction of cement, to create cement stabilised columns, providing increased load transfer properties.
- Graded filter selected materials can be used so columns are more resistant to clogging in liquefaction events. Columns remain effective for multiple events.
- No introduction of high pressure water or air required so relatively mess free. Sites immediately adjacent to sensitive environments completed.
- Method builds complete columns at all times, so there is no-void space introduction to allow column contamination at any time, unlike methods where a plunging motion is used.
- The tooling is a hybrid drilling assembly, this allows tool penetration through hard layers and removes the requirement for predrilling, that is often required for vibrating tooling.





McMillan—Stone Column Method, Excerpt from Opus Design Report

McMillan's displacement auger equipment has proven successful with ground improvement at Fitzgerald Avenue for the Christchurch City Council. Stone Columns were required to sufficiently densify the soil to mitigate potential for future liquefaction and lateral spreading.

The column spacing was adjusted in areas where quality assurance testing showed a higher replacement ratio was necessary.

The M6.0 earthquake on December 23 2011 caused no damage to the stone column improved ground at Fitzgerald Avenue but sand boils resulting from liquefaction were observed in neighbouring properties on the opposite side of the road.

CERTIFICATE OF GRANT STANDARD PATENT

2012241026

I, Victor Portelli, the Commissioner of Patents, certify that the following are the particulars of this patent appearing in the Register of Patents:

Name and Address of Patentee(s):

Jaron Lyell McMillan
120 High Street, Southbridge, Canterbury 7602, New Zealand

Name of Actual Inventor(s):

McMillan, Jaron Lyell

Title of Invention:

Machine and method for forming an in ground granular column

Term of Patent:

Twenty years from 1 April 2012

Priority Details

Number	Date	Filed with
592051	4 April 2011	NZ
593936	7 July 2011	NZ
592486	27 April 2011	NZ
592052	4 April 2011	NZ



Dated this 8th day of January 2015

Victor Portelli
Commissioner of Patents

PATENTS ACT 1990

LETTERS PATENT

Number 592051 592052, 592486, 593936

ELIZABETH THE SECOND, by the Grace of God Queen of New Zealand and Her Other Realms and Territories, Head of the Commonwealth, Defender of the Faith; To all to whom these presents shall come, Greeting;

WHEREAS pursuant to the Patents Act 1953 an application has been made for a patent of an invention for

Machine and method for forming an in ground granular column

(more particularly described in the complete specification relating to the application)

AND WHEREAS

Jaron Lyell McMillan, 120 High Street, Southbridge, Canterbury 7602, New Zealand

(hereinafter together with his or their successors and assigns or any of them called "the patentee") is entitled to be registered as the proprietor of the patent hereinafter granted:

Address for service: P. L. BERRY & ASSOCIATES, 158 Byron Street, Sydenham, Christchurch 8023, New Zealand

NOW, THEREFORE, We by these letters patent give and grant to the patentee our special licence, full power, sole privilege, and authority, that the patentee by himself, his agents, or licensees and no others, may subject to the provisions of any statute or regulation for the time being in force make, use, exercise and vend the said invention within New Zealand and its dependencies during a term of twenty years from 19 March 2012 and that the patentee shall have and enjoy the whole profit and advantage from time to time accruing by reason of the said invention during the said term:

AND WE strictly command all our subjects whomsoever within New Zealand and its dependencies that they do not at any time during said term either directly or indirectly make use of or put into practice the said invention, nor in any way imitate the said invention without the consent, licence, or agreement of the patentee in writing under his hand, on pain of incurring such penalties as are prescribed by law and of being answerable to the patentee according to law for his damages thereby occasioned:

PROVIDED ALWAYS:

- (1) That these letters patent shall determine and become void if the patentee does not from time to time pay the renewal fees prescribed by law in respect of the patent;
- (2) That these letters patent are revocable on any of the grounds prescribed by the Patents Act 1953 as grounds for revoking letters patent;
- (3) That nothing in these letters patent shall prevent the granting of licences in the manner in which and for the considerations on which they may by law be granted;

And that these letters patent shall be construed in the most beneficial sense for the advantage of the patentee.

IN WITNESS whereof We have caused these letters patent to be signed and sealed on 3 September 2012 with effect from 19 March 2012.



Neville Harris
Commissioner of Patents, Trade Marks and Designs

Intellectual Property Office of New Zealand
P.O. Box 1014, Barton Square, Wellington 6141, New Zealand or DX 58 1019, Wellington
International: +64 3 962 2507 National: 0800 447 448 Fax: 0800 447 449

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LETTERS PATENT Number 618804

ELIZABETH THE SECOND, by the Grace of God Queen of New Zealand and Her Other Realms and Territories, Head of the Commonwealth, Defender of the Faith; To all to whom these presents shall come, Greeting;

WHEREAS pursuant to the Patents Act 1953 an application has been made for a patent of an invention for

MODIFIED STONE COLUMN DRILL

(more particularly described in the complete specification relating to the application)

AND WHEREAS

Jaron Lyell McMillan, 120 High Street, Southbridge, Canterbury 7602, New Zealand

(hereinafter together with his or their successors and assigns or any of them called "the patentee") is entitled to be registered as the proprietor of the patent hereinafter granted:

Address for service: P. L. BERRY & ASSOCIATES, PO Box 1250, Christchurch 8140, New Zealand

NOW, THEREFORE, We by these letters patent give and grant to the patentee our special licence, full power, sole privilege, and authority, that the patentee by himself, his agents, or licensees and no others, may subject to the provisions of any statute or regulation for the time being in force make, use, exercise and vend the said invention within New Zealand and its dependencies during a term of twenty years from 10 December 2013 and that the patentee shall have and enjoy the whole profit and advantage from time to time accruing by reason of the said invention during the said term:

AND WE strictly command all our subjects whomsoever within New Zealand and its dependencies that they do not at any time during said term either directly or indirectly make use of or put into practice the said invention, nor in any way imitate the said invention without the consent, licence, or agreement of the patentee in writing under his hand, on pain of incurring such penalties as are prescribed by law and of being answerable to the patentee according to law for his damages thereby occasioned:

PROVIDED ALWAYS:

- (1) That these letters patent shall determine and become void if the patentee does not from time to time pay the renewal fees prescribed by law in respect of the patent;
- (2) That these letters patent are revocable on any of the grounds prescribed by the Patents Act 1953 as grounds for revoking letters patent;
- (3) That nothing in these letters patent shall prevent the granting of licences in the manner in which and for the considerations on which they may by law be granted;
- (4) That these letters patent shall be construed in the most beneficial sense for the advantage of the patentee.

IN WITNESS whereof We have caused these letters patent to be signed and sealed on 1 May 2014 with effect from 10 December 2013.

Mandy McDonald
Mandy McDonald
Commissioner of Patents, Trade Marks, and Designs

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United States Patent Memorandum

Patent No. US 9,115,477 B2
Date of Patent: Aug. 25, 2015

(54) MACHINE AND METHOD FOR FORMING AN IN-GROUND GRANULAR COLUMN

(75) Inventor: Jaron Lyell McMillan, Christchurch (NZ)

(*) Name: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) to 42 days.

(12) Appl. No.: 14/069,841

(22) Filed: Apr. 1, 2012

(85) Int. No.: PCT/NZ2012/001188

(31) (c)(1): 06.4.2013

(32) (c)(2): 06.4.2013

(33) (c)(3): 06.4.2013

(34) (c)(4): 06.4.2013

(35) (c)(5): 06.4.2013

(36) (c)(6): 06.4.2013

(37) (c)(7): 06.4.2013

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(39) (c)(9): 06.4.2013

(40) (c)(10): 06.4.2013

(41) (c)(11): 06.4.2013

(42) (c)(12): 06.4.2013

(43) (c)(13): 06.4.2013

(44) (c)(14): 06.4.2013

(45) (c)(15): 06.4.2013

(46) (c)(16): 06.4.2013

(47) (c)(17): 06.4.2013

(48) (c)(18): 06.4.2013

(49) (c)(19): 06.4.2013

(50) (c)(20): 06.4.2013

(51) (c)(21): 06.4.2013

(52) (c)(22): 06.4.2013

(53) (c)(23): 06.4.2013

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(69) (c)(39): 06.4.2013

(70) (c)(40): 06.4.2013

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(73) (c)(43): 06.4.2013

(74) (c)(44): 06.4.2013

(75) (c)(45): 06.4.2013

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(77) (c)(47): 06.4.2013

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(81) (c)(51): 06.4.2013

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(83) (c)(53): 06.4.2013

(84) (c)(54): 06.4.2013

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(92) (c)(62): 06.4.2013

(93) (c)(63): 06.4.2013

(94) (c)(64): 06.4.2013

(95) (c)(65): 06.4.2013

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JP Search Report dated Oct. 22, 2014 of Patent Application No. JP2012-001188.

* cited by examiner

Primary Examiner: Dawn M. Unruh

Assistant Examiner: John A. Gorman

ABSTRACT

A drill assembly for forming an in-ground granular column within the soil or otherwise compacting the soil assembly and the drill assembly includes a drill bit, a drill shaft, a motor, and a control system. The drill assembly is configured to form a granular column in the soil by rotating the drill bit and the drill shaft around a central axis of rotation. The drill assembly is configured to form a granular column in the soil by rotating the drill bit and the drill shaft around a central axis of rotation. The drill assembly is configured to form a granular column in the soil by rotating the drill bit and the drill shaft around a central axis of rotation.

FIG. 1 is a schematic diagram of the drill assembly.

FIG. 2 is a schematic diagram of the drill assembly.

FIG. 3 is a schematic diagram of the drill assembly.

FIG. 4 is a schematic diagram of the drill assembly.

FIG. 5 is a schematic diagram of the drill assembly.

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FIG. 50 is a schematic diagram of the drill assembly.

FIG. 51 is a schematic diagram of the drill assembly.