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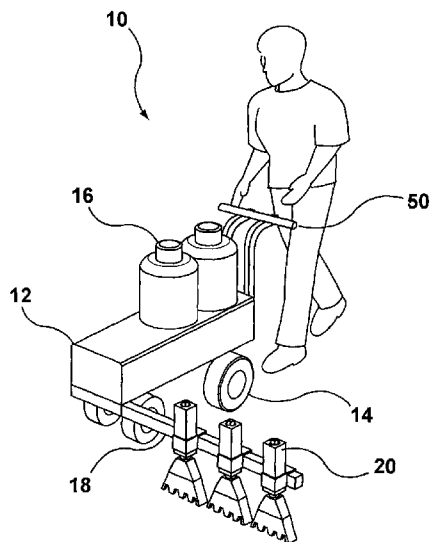
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(54) Title: HEATING DEVICE



**FIG. 1**

(57) **Abstract:** This invention relates to a mobile heating device having an extension with a plurality of heating torches adjustably mountable on the extension for heating a substrate. More particularly this invention relates to a mobile jet torch heating device for heating a substrate, the heating device having an extension disposed substantially parallel to the surface with a plurality of heating torches mounted for selective placement on the extension to provide a short wide substantially flat flame for heating the surface as well as the method embodied therein.

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## HEATING DEVICE

### Field of Invention

This invention relates to a mobile heating device having an extension with a plurality of heating torches adjustably mountable on the extension for heating a substrate. More particularly this invention relates to a mobile jet torch heating device for heating a substrate, the heating device having an extension disposed substantially parallel to the surface with a plurality of heating torches mounted for selective placement on the extension to provide a short wide substantially flat flame for heating the surface as well as the method embodied therein.

### 10 Background to the Invention

There are a variety of heating devices which have been used in the prior art for heating substrates such as asphalt, concrete or the like. Such heating devices can comprise of massive machines that can be used to lay kilometres of highways to smaller machines or devices that are utilized to heat cracked asphalt to repair same or to apply thermoplastic markings to the substrate.

Since a large percentage of the worlds population live in urban areas and approximately 1/3 of the surface area of these urban regions are covered by concert or asphalt pavements, sidewalks, parking lots and the like which present a variety of environmental, safely, health and social issues, there has been a recent movement to apply markings for functional or decorative proposes to the asphalt.

For example, U.S. Patent No. 6,998,010 relates to a method and apparatus for heating a surface marking, such as thermoplastic patterns in an asphalt substrate. The markings may be selective for functional or decorative purposes. The method involves gradually applying heat to the markings to avoid scorching and to ensure a consistent bond with the underlying substrate, even in the case of markings having a very large surface area. In one embodiment of the method, a portable heating surface is provided having infrared heaters mounted for reciprocal movement in a travel path periodically passing over the marking and the underlying substrate. The heating permits a direct visual monitoring of the worksite to achieve optimal adhesion of the marking to the asphalt or other substrate. Although a method described in U.S. Patent No. 6,998,010

provides an effective way of heating a surface marking, such device is generally large and heavy to operate, which makes it difficult to work in confined areas. It is also very complex which makes it expensive to manufacture and maintain.

There is a need for smaller, simpler, less expensive devices which can be used.

- 5 Smaller devices are known in the prior art which include hand held propane jet torches which generally comprise a torch gun which are very tiring to use for the operator and are very slow and costly. Example of such torch guns can be found in U.S. Patent No. 3,779,694 which comprise hand held heat guns heated at 250 to 1000 degrees centigrade that employ high performance combustion burner discharge exhaust gases at a high speed.
- 10 U.S. Patent No. 5,476,378 relates to a pressure head needed to drive combustion air into a combustion region of a heat gun having compression blades in a turbine whose blades are interposed in the fade conduit that leads to the combustion region.

Furthermore, U.S. Patent No. 6,010,329 relates to a jet pump for heat guns which includes an elongated hollow pump body lying along a horizontal axis. The pump body has an inlet, a mixing  
15 section and an outlet. The nozzle unit is actually aligned with the inlet for directing pressurized fluid into the inlet of the pump body.

These and other prior art hand held propane jet torches can cause under or over heating if not properly used that result in quality issues and are generally difficult to control.

Moreover, prior art mobile infrared heating machines have used propane-fired infrared heaters  
20 which are more expensive to purchase and maintain than the handheld propane jet torches and they are much heavier which makes operation tiring and difficult. Another problem with the mobile infrared heating machines is that they take a long time to heat up and cool down making for uneven heating in large areas. Furthermore they require a long heating area, namely longer heater bed in a direction of machine travel to provide enough heating time which makes heating  
25 uneven at the stop and start point when operating in a back and forth reciprocal motion as these heaters are commonly operated.

Accordingly, there is a need to provide an improved heating device and method for heating substrates.

It is an aspect of this invention to provide a mobile heating device which comprises a portable carriage for holding heating fuel; an extension from the carriage; a plurality of heating torches selectively mounted on said extension for heating a substrate. The torches provide a short wide substantially flat flame for heating the substrate.

- 5 It is another aspect of this invention to provide a mobile jet torch heating device for heating a substrate comprising a wheeled carriage having handles; a fuel tank carried by the wheeled carriage; an extension from the carriage disposed substantially parallel to the substrate; a plurality of heating torches mounted for selective placement on the extension, to provide a short wide substantially flat flame which produces hot gases for heating the substrate.
- 10 Another aspect of this invention provides a method of heating a substrate comprising: gradually heating the substrate by periodically passing at least one heater in proximity to the substrate; providing heating apparatus having a support arm extending over the substrate, wherein the heating apparatus is mounted for selective placement on the support arm and the heating apparatus moved in a travel path periodically passing over the substrate.
- 15 These and other features and objects of the invention shall now be described in relation to the following drawings:

#### Description of the Drawings

Figure 1 is the perspective view of the mobile heating device.

Figure 2 is another perspective view of the invention showing the plurality of heating torches.

- 20 Figure 3 is an enlarged perspective view of the heating torch.

Figure 4 is a perspective view of the heating device utilised to apply thermoplastic markings on a surface.

Figure 5 is another perspective view showing the use of the heating device to repair potholes.

Figure 6 is a cross sectional view of an embodiment of a heating torch.

### Detailed Description of the Invention

Throughout the following description specific details are set forth in order to provide a more thorough understanding of the invention. However, the invention may be practiced without these particulars. In other instances, well known elements have now been shown or described in detail  
5 to avoid unnecessarily obscuring the invention. Accordingly, the specifications and drawings are to be regarded in an illustrative rather than a restrictive sense.

Figure 1 generally illustrates the mobile heating device **10** which comprises a portable carriage **12** having wheels **14**. In one embodiment, the rear wheels can be driven by a motor ( which is not shown ) although this is an optional feature.

10 The carriage **12** is utilized to hold or carry fuel tanks, such as propane tanks **16** or other suitable fuel. Although two propane tanks were shown, one or any number of tanks may be utilized.

The carriage **12** includes an extension or support arm **18** which has a plurality of heating means or torches **20** which are mounted for selective adjustment and placement along the support arm **18**.

15 In one embodiment of the support arm **18** comprises a bar extending outwardly to one side of the carriage **12** as shown in Figure 1 along an axis **X** , which is generally disposed horizontally or substantially parallel to the substrate **40**.

The support arm **18** includes a bracket **22** which slides along the bar **18** in a substantially parallel disposition relative to the surface or substrate **40** to be heated. The bracket **22** includes two  
20 sections , namely first hollow bracket section **22a** having a substantially rectangular cross section and second hollow bracket section **22b** having a substantially rectangular cross section . First hollow bracket section **22a** is disposed perpendicular to second hollow bracket section **22b**.

First hollow bracket section **22a** slidingly receives support arm **18**. This permits the plurality of torches **20** to be selectively placed along the bar **18** so that the plurality of torches produce a  
25 short flat flame.

The bracket **22** includes tightening mechanism **24** which in one embodiment comprises a lock nut at the end of a threaded stud that is threaded into the bracket **22** so as to bear against the vertical adjustment proportion **26** of the heating torches **20** as best seen on Figure 3. This permits

adjustment of the heating torches **20** vertically relative to the substrate **40**. Bracket **22** also includes a second tightening mechanism **25** disposed on the top part of the first hollow bracket section **22a** as best seen in Figure **2** so as to secure and tighten the position of the heating torches substantially horizontally along the bar **18** relative to the surface.

- 5 The second cross-section is adapted to slidably receive the rectangular cross-section of the vertical portion **26** of the heating torches **20**. This permits adjustment of the heating torches **20** vertically relative to the substrate **40**.

The heating torches **20** include a combustion head **28** guard which has a plurality of holes therein as shown in Figure **3**. Figure **6** shows a cross sectional view of an embodiment of a heating torch  
10 **20**. The heating torch **20** has a propane orifice **25** with a venturi hollow pump body **27** which is tapered slightly outwardly along the length thereof as shown and merges with the outlet **29** which has tapered sides to produce the wide narrow flame. The combustion head guard **28** covers the outlet **29** and is shaped (oblong shape as shown) on the bottom to produce a wide narrow flame. The structure shown in Figure **6** produces the hot gases to heat the substrate as described  
15 herein.

The fuel tanks **16** have the appropriate conduits **32** communicating with the heating torches **18**.

The fuel tank nozzle also includes a safety stop **34** to prevent the nozzle **28** from contacting the surface or substrate.

The invention described herein includes the mounting of the propane hot air jet torches **18** onto a  
20 mobile machine **10** for the purpose of heating substrates including asphalt, concrete pavement and thermoplastic paving markings. The invention described herein can be utilized so as to produce a short wide flat flame that heats a wide area with hot gases or direct flame depending on how high the device is mounted from the surface. The torch enables the distribution of less intense heat over wider area than a standard propane torch. Accordingly, the invention described  
25 herein is lighter, more cost effective, provides better control of heating, is safer and easier to operate than alternate methods and devices as disclosed in the prior art.

Figure **4** illustrates a method of heating a substrate **40** which comprises gradually heating the substrate **40** by periodically passing at least one heater **20** in proximity to the substrate; providing heating apparatus or device **10** having a support arm **18** extending over the substrate **40** wherein

the heater **20** is mounted for selective placement on the support arm **18**, and moving the device in a travel path **42a**, **42b** periodically passing over the substrate **40**.

The heating torches **20** provide a short and substantially flat flame to heat over the substrate **40**.

In one embodiment the method comprises applying a thermoplastic safety marking **44** onto the substrate **40**. As previously mentioned the substrate **40** may comprise of an asphalt surface. Asphalt means a paving compound for constructing roads, driveways, walkways and the like which consist of a combination of bituminous binder, such as tar, and an aggregate, such as sand or gravel. Furthermore, this substrate **40** can comprise concrete or other materials capable of binding thermoplastic markings **44**. An example of markings comprise symbols such as arrows, crosshatched lines and are available for example from Flint Trading sold under the trademarks PreMark, HotTape and Traffic Patterns. The markings **44** may be selected for a functional purpose such as traffic markings or corporate logos or maybe purely decorative.

In another embodiment it important to dry the pavement prior to applying thermoplastic markings and the infrared heaters that are used are not good at drying whereas the jet torch is highly effective. Any moisture present will prevent the thermoplastic from bonding properly.

Another reason to heat pavements in this industry is to dry the pavement prior to applying water based acrylic coatings to promote good adhesion an speed drying and the device **2** is highly effective at this versus using infrared heaters which do not provide the air movement above the heated surface or substrate.

Also the device **2** could be used to dry water based acrylics once they are applied to help them dry using a jet torch raised to 12 inches about the surface which would product a 650 F hot air blast at 1200 fpm velocity, This would dry the coating quickly without overheating and damaging it.

Figure **5** also shows another embodiment of the method whereby the mobile heating device **10** can be utilized to repair potholes.

Accordingly, the plurality of heating torches **20** can be selectively mounted on the support arm **18** by utilizing the tightening mechanisms **24** described above so that the plurality of heating

torches 20 are adjusted at the right height (i.e., vertically or perpendicularly relative to the support arm 18) and horizontally along the axis X of the support arm 18 so that the flame from the plurality of torches 20 produce a substantially short flat heating flame, where the heat along the flame of the torches is generally uniform (see Figure 4) to heat the substrate 40 as the user pushes and pulls on the handles 50 to gradually heat an area of the thermoplastic safety markings 44 as shown in Figure 4 so as to bond same to the substrate. In other words the torches can be adjusted so that the flame is uniform ie does not overlap each other; or if the flames overlap they overlap uniformly along the entire flame front exposed to the substrate 40.

The same method can be utilized to repair the cracked pothole so that the asphalt is heated to a sufficient temperature within a range of 100 degrees to 400 degrees Fahrenheit or a temperature sufficient to cause the cracked asphalt to become malleable and repairable. Furthermore the temperature of the plurality of heating torches can be adjusted to heat the thermoplastic safety marking to a temperature which is sufficient to heat and bond the marking to the substrate. Depending upon the material used, markings 44 are heated in situ to temperature within a range of 100 degrees to 400 degrees Fahrenheit, or more particularly 150 degrees to 350 degrees Fahrenheit. Optionally markings 44 and/or substrate 40 may be preheated prior to placement of the markings at the worksite.

It will be apparent to those persons skilled in the art that many alternations and modifications are possible in the practice of the invention without departing from the spirit or scope thereof. Accordingly the scope of the invention is to be construed in accordance with the substance defined by the following claims.

These and other features of the invention should not be described in relation to the following claims.

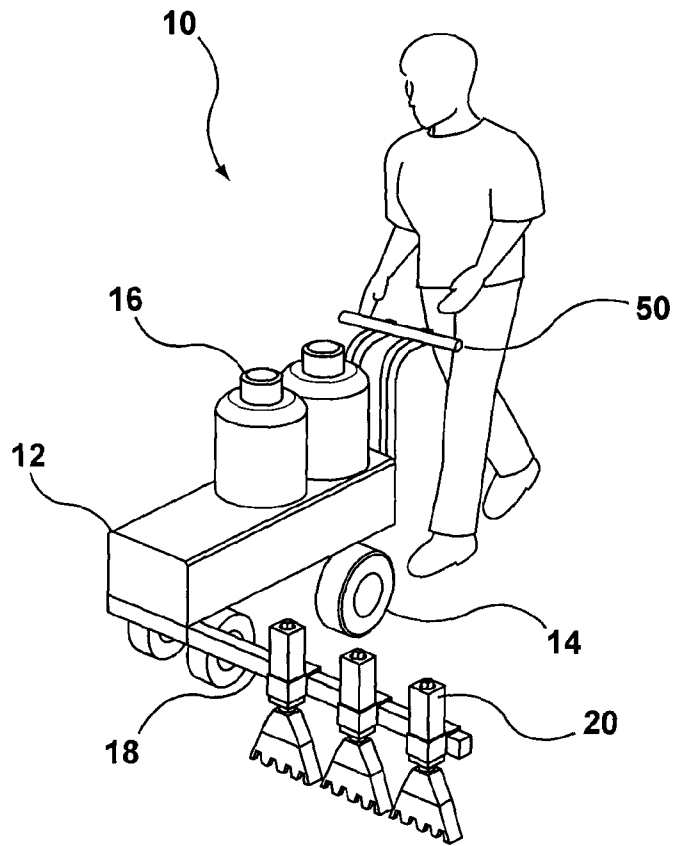
We claim:

1. A mobile heating device comprising:
  - (a) a portable carriage for holding heating fuel;
  - (b) an extension from said carriage;
  - 5 (c) a plurality of heating torch means selectively adjustably mounted on said extension for heating a substrate.
2. A mobile heating device as claimed in claim 1 wherein said extension comprises a support arm, and said heating torch means are adjustably mounted on said support arm for heating said substrate.
- 10 3. A mobile heating device as claimed in claim 2 wherein said heating torch means provide a short wide substantially flat flame for heating said surface.
4. A mobile device as claimed in claim 3 wherein said plurality of heating torch means are each selectively adjustable to provide a short wide substantially flat flame for heating said substrate.
- 15 5. A mobile device as claimed in claim 4 wherein the support arm is substantially horizontally disposed on said portable carriage relative said substrate.
6. A mobile heating device as claimed in claim 5 wherein each heating torch means is selectively adjustable horizontally along said support arm.
7. A mobile heating device as claimed in claim 6 wherein each said heating torch means is  
20 selectively adjustable vertically along said support arm.
8. A mobile device as claimed in claim 7 including a controller to enable the distribution of less intense heat over a wider area on said substrate.
9. A mobile jet torch heating device for heating a substrate comprising
  - (a) a wheel carriage having handles

- (b) a fuel tank carried by said wheeled carriage
  - (c) an extension from said carriage disposed substantially parallel to said substrate
  - (d) a plurality of heating torches mounted for selective placement on said extension
- to provide a short wide substantially flat flame for heating said substrate.

- 5 10. A mobile jet torch heating device as claimed in claim 9 wherein said extension comprises a bar extending horizontally along an axis.
11. A mobile jet torch heating device as claimed in claim 10 wherein each said heating torch is mounted for selective placement along the axis of the said bar.
12. A mobile jet torch heating device as claimed in claim 11 wherein said each heating torch  
10 is mounted for selective placement substantially perpendicular to the axis of said bar.
13. A method of heating a substrate comprising:
- (a) gradually heating said substrate by periodically passing at least one heater in proximity to said substrate;
  - (b) providing heating apparatus having a support arm extending over said substrate,  
15 wherein said heater is mounted for movement on a said bar and a travel path periodically passing over said substrate.
14. A method as claimed in claim 13 including providing a short wide substantially flat flame to heat said substrate.
15. A method as claimed in claim 14 wherein said substrate comprises asphalt.
- 20 16. A method as claimed in claim 15 wherein said asphalt is cracked and said method heat said cracked asphalt so as to repair same.
17. A method as claimed in claim 16 wherein said heating apparatus comprises a plurality of heating torches selectively adjustable relative said bar.

18. A method as claimed in claim 17 wherein said each heating torch is selectively adjustable along said bar.
19. A method as claimed in claim 18 wherein said each heating torch is selectively adjustable from said bar.



**FIG. 1**

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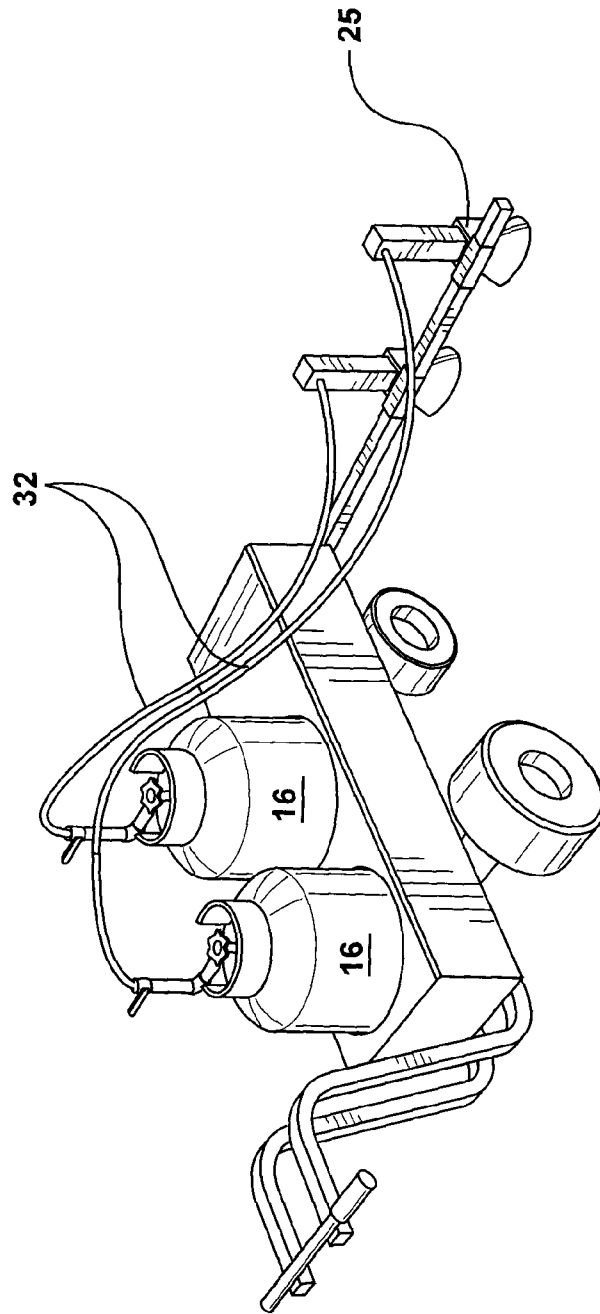
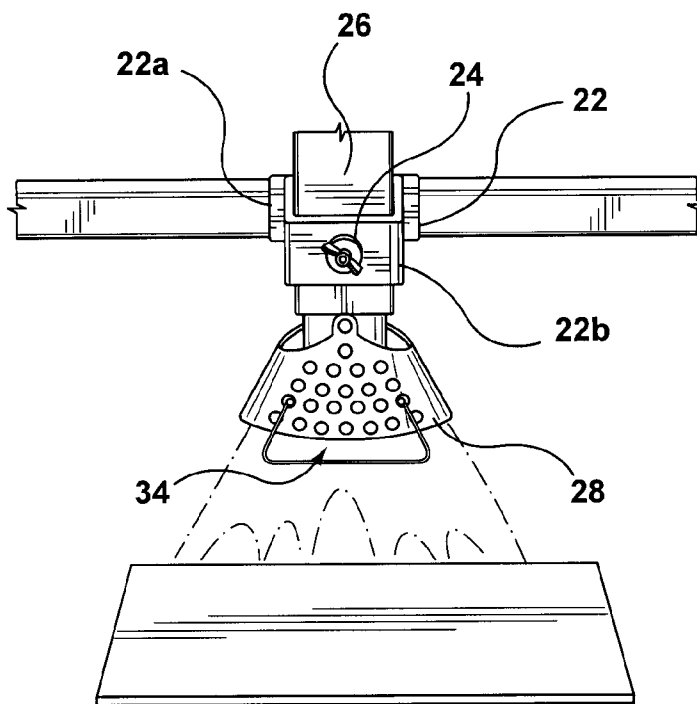
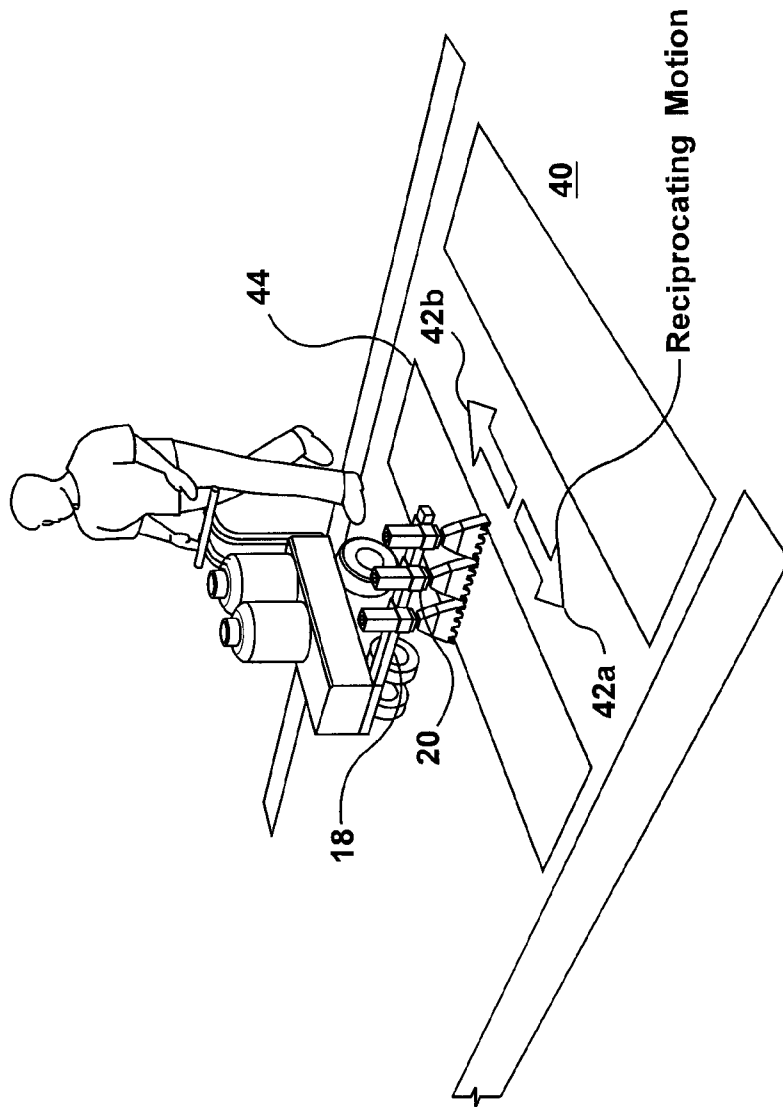


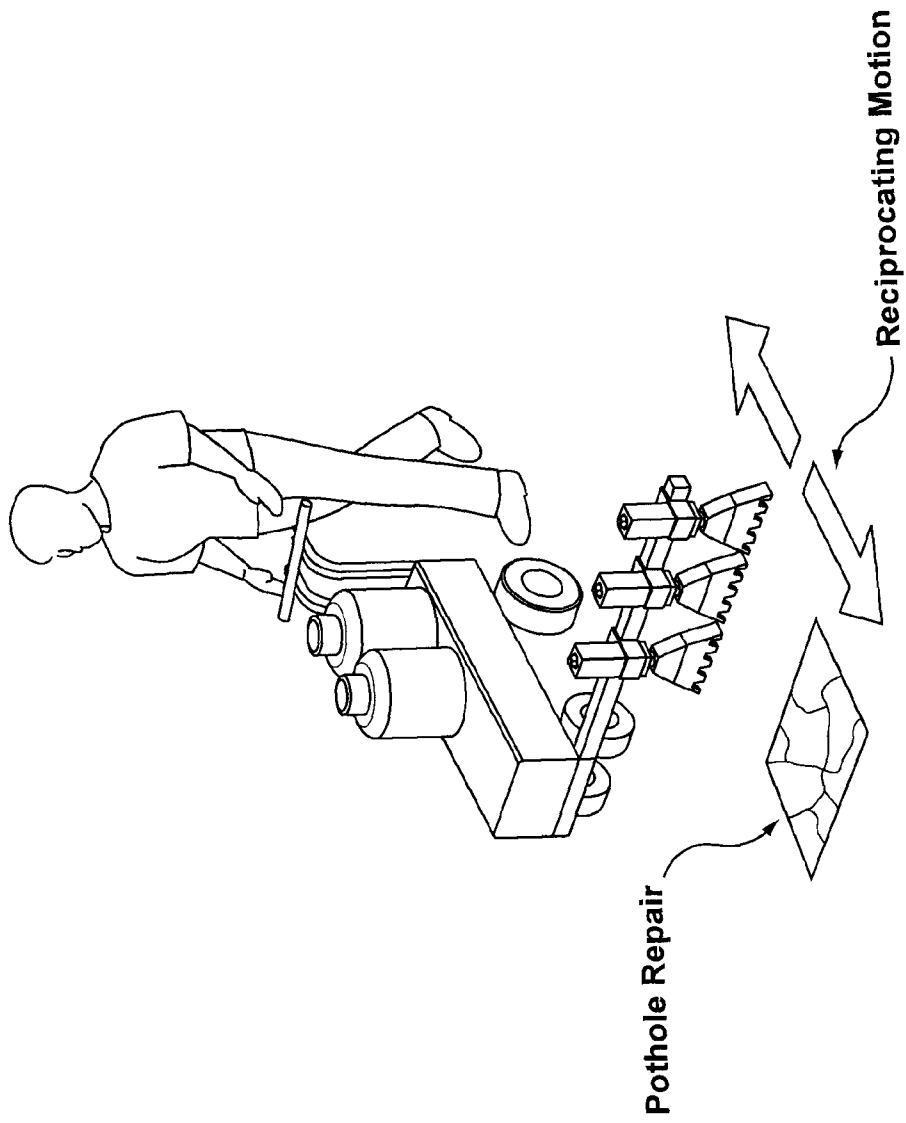
FIG. 2



**FIG. 3**

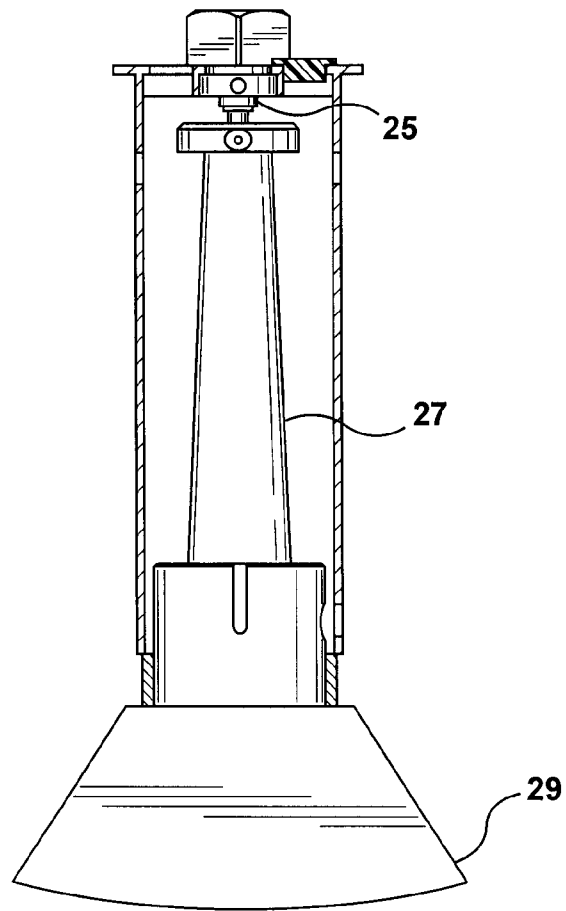


**FIG. 4**



**FIG. 5**

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**FIG. 6**

**INTERNATIONAL SEARCH REPORT**

International application No.  
PCT/CA2011/000890

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC: **E01C 23/14** (2006.01) , **B23K 7/00** (2006.01) , **E01C 23/18** (2006.01) , **F23D 14/38** (2006.01)  
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 IPC (2011.01): E01C 23/14, B23K 7/00, E01C 23/18, F23D 14/38

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)  
 databases: TotalPatent (all databases), EPOQUE(EPODOC), Canadian Patent Database  
 keywords: heat, torch, asphalt, pave, concrete, portable, mobile

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CA 1235935 A1 (O'Connor) 3 May 1988 (03-05-1988) page 6, line 7 to page 7, line 2, figure 1	1-19
X	US 7252455 B2 (Larsen) 7 August 2007 (07-08-2007) column 3, lines 44-55, figure 1	1-5, 9-16
A	US 4376007 (Eigenmann) 8 March 1983 (08-03-1983) figure 5	1-19
A	WO 03/048458 A1 (Wiley) 12 June 2003 (12-06-2003) figure 5	1-19

Further documents are listed in the continuation of Box C.       See patent family annex.

* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"B" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 17 November 2011 (10-11-2011)	Date of mailing of the international search report 2 December 2011 (02-12-2011)
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Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Authorized officer  Alison Canteenwalla 997-3093
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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/CA2011/000890**

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
CA1235935A1	03 May 1988 (03-05-1988)	None	
US7252455B2	07 August 2007 (07-08-2007)	US2006112951A1	01 June 2006 (01-06-2006)
US4376007A	08 March 1983 (08-03-1983)	AU524279B2 AU3235878A CA1064750A1 DE2801259A1 DE2801259C2 FR2377480A1 FR2377480B1 GB1574111A IT1077571B JP53089237A JP61017962B JP1352530C SE438166B SE438166C SE7800183A	09 September 1982 (09-09-1982) 19 July 1979 (19-07-1979) 23 October 1979 (23-10-1979) 20 July 1978 (20-07-1978) 27 July 1989 (27-07-1989) 11 August 1978 (11-08-1978) 30 March 1984 (30-03-1984) 03 September 1980 (03-09-1980) 04 May 1985 (04-05-1985) 05 August 1978 (05-08-1978) 10 May 1986 (10-05-1986) 11 December 1986 (11-12-1986) 01 April 1985 (01-04-1985) 11 July 1985 (11-07-1985) 13 July 1978 (13-07-1978)
WO03048458A1	12 June 2003 (12-06-2003)	AT498033T AU2002349235A1 AU2008316278A1 BR0214681A CA2433374A1 CA2433374C CA2508900A1 CA2508900C CA2706670A1 CN1599827A DE60239147D1 EP1451409A1 EP1451409B1 EP2219866A1 EP2305887A2 JP2005511922A JP4081443B2 JP2008101459A JP2011501006A KR20050058268A KR100712321B1 KR20060116035A KR100712322B1 MXPA04005409A NO20042817A NZ533144A US2004103988A1 US6998010B2 US2003103810A1 US7066680B2 US2004105933A1 US2005089372A1 US2006070698A1 US2008182016A1 WO2009052619A1 ZA200404117A	15 February 2011 (15-02-2011) 17 June 2003 (17-06-2003) 30 April 2009 (30-04-2009) 23 November 2004 (23-11-2004) 12 June 2003 (12-06-2003) 20 September 2005 (20-09-2005) 12 June 2003 (12-06-2003) 31 August 2010 (31-08-2010) 12 June 2003 (12-06-2003) 23 March 2005 (23-03-2005) 24 March 2011 (24-03-2011) 01 September 2004 (01-09-2004) 09 February 2011 (09-02-2011) 25 August 2010 (25-08-2010) 06 April 2011 (06-04-2011) 28 April 2005 (28-04-2005) 23 April 2008 (23-04-2008) 01 May 2008 (01-05-2008) 06 January 2011 (06-01-2011) 16 June 2005 (16-06-2005) 02 May 2007 (02-05-2007) 13 November 2006 (13-11-2006) 02 May 2007 (02-05-2007) 23 March 2005 (23-03-2005) 03 September 2004 (03-09-2004) 31 May 2007 (31-05-2007) 03 June 2004 (03-06-2004) 14 February 2006 (14-02-2006) 05 June 2003 (05-06-2003) 27 June 2006 (27-06-2006) 03 June 2004 (03-06-2004) 28 April 2005 (28-04-2005) 06 April 2006 (06-04-2006) 31 July 2008 (31-07-2008) 30 April 2009 (30-04-2009) 12 August 2005 (12-08-2005)