APPLICATION FOR A STANDARD PATENT

Form 1.
Patents Act 1952
Regulation 9

19171/83

OY TAMPELLA AB

of Lapintie 1, 33100 Tampere 10 / Finland

hereby apply for the grant of a Standard Patent for an invention entitled

CONTINUOUSLY REVOLVING PERCUSSION DRILLING MACHINE

which is described in the accompanying specification.

For a Convention application - details of basic application(s) -

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>COUNTRY</th>
<th>DATE OF APPLICATION</th>
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<tbody>
<tr>
<td>823315</td>
<td>Finland</td>
<td>27 September 1982</td>
</tr>
</tbody>
</table>

Our address for service is C/- SANDERCOCK, SMITH & BEADLE
203 Riversdale Road, (P.O. Box 410) Hawthorn, Victoria 3122.
Dated this 15th day of September, 1983.

OY TAMPELLA AB

(Signature)

LODGED AT SUB-OFFICE 15 SEP 1983
BY: SANDERCOCK, SMITH & BEADLE
Melbourne
PATENT DECLARATION FORM

CONVENTION OR NON-CONVENTION

DECLARATION IN SUPPORT OF APPLICATION FOR A PATENT

In support of the application made by

Oy Tampella Ab
Lapintie 1, 33100 Tampere 10, Finland

for a patent for an invention entitled: "Continuously revolving percussion drilling machine"

We, Esa Mattinen, Lapintie 1, 33100 Tampere 10, Finland
Maija-Liisa Antila, Lapintie 1, 33100 Tampere 10, Finland

both procurators holder of applicant
do solemnly and sincerely declare as follows:

1. (a) 1 am/We are the applicant(s) for the patent.
   OR (b) I am/We are authorized by the aforementioned applicant to make this declaration on its behalf.

2. (a) 1 am/We are the actual inventor(s) of the invention.
   OR (b) Pekka Seli, Nahkatehtaankatu 4 C 14, 33270 Tampere 27, Finland
       Hannu Pasanen, Kehontie 10, 37120 Nokia 2, Finland

3. The basic application(s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date(s) by the following applicant(s).
   a. by OY TAMPELJA AB in Finland No. 823319 on September 27 1982
   b. by ________________________________ on ____________
   c. by ________________________________ on ____________
   d. by ________________________________ on ____________

4. The basic application(s) referred to in paragraph 3 of this Declaration was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

Declared at Tampere this 30th day of August 1983

By Tampella Ab

Esa Mattinen, Maija-Liisa Antila

Signature(s) of declarant(s).

NO ATTESTATION
OR SEAL

To: The Commissioner of Patents
Australia

SANDERCOCK, SMITH & BEADLE
P.O. Box 410, Hawthorn, 3122, Australia
Cables: Sandpat Melbourne
Tel: 34491, Sandpat
The object of the present invention is to provide a percussion drilling machine which avoids the above drawbacks and in which the generation of heat in the toothing of the drill shank is low and the lubrication can be accomplished reliably. This object is achieved by means of a percussion drilling machine in accordance with the present invention, which is characterized in that the toothing of the drill shank is coupled in direct engagement with a toothing revolving in relation to the drill shank and rotating the drill shank, said toothing of the drill shank being axially displaceable in relation to said rotating toothing.

The invention is based on the idea that the contact surfaces of the teeth of the toothing of the drill shank and of the toothing rotating the drill shank revolve and are exchanged constantly, whereby the same position of each tooth is not subjected to successively repeated axial movement nor to strain caused by surface pressure, and the contact faces have time to be cooled before the next contact. Owing to this, the teeth operate sufficiently cold, and since the surfaces are apart from each other between contacts, they obtain a good lubricating film.
1. Continuously revolving percussion drilling machine, which comprises
   - a body,
   - a drill shank mounted rotably and axially slidably in the body for causing impacts on the drill rod,
   - an impact mechanism positioned in the body for causing axial impacts on the drill shank, and
   - a rotating device for rotating the drill shank around its axis,
   whereby the drill shank is provided with a toothing by means of which the drill shank is coupled in engagement with the rotating device, characterized in that the toothing of the drill shank is coupled in direct engagement with a toothing revolving in relation to the drill shank and rotating the drill shank, said toothing of the drill shank being axially displaceable in relation to said rotating toothing.
SHORT TITLE: COn'ed

APPLICATION NUMBER: 19171/83

COMPLETE SPECIFICATION—LODGED:

BOUGHT: —

PRIORITY:

RELATED ART:

TO BE COMPLETED BY APPLICANT

NAME OF APPLICANT: OY TAMPELLA AB

ADDRESS OF APPLICANT: Lapintie 1, 33100 Tampere 10 / Finland

ACTUAL INVENTOR: PEKKA SALMI
HANNU PAASONEN

ADDRESS FOR SERVICE: C/- SANDERCOCK, SMITH & BEADLE
203 Riversdale Road, (P.O. Box 410), HAWTHORN. VIC. 3122.

COMPLETE SPECIFICATION FOR THE INVENTION ENTITLED:

CONTINUOUSLY REVOLVING PERCUSSION DRILLING MACHINE.

THE FOLLOWING STATEMENT IS A FULL DESCRIPTION OF THIS INVENTION, INCLUDING THE BEST METHOD OF PERFORMING IT KNOWN TO ME:

*Note: The description is to be typed in double spacing, pica type face, in an area not exceeding 250 mm in depth and 160 mm in width, on tough white paper of good quality and it is to be inserted inside this form.
The present invention is concerned with a continuously revolving percussion drilling machine, which comprises
- a body,
- a drill shank mounted rotably and axially slideably in the body for causing impacts on the drill rod,
- an impact mechanism positioned in the body for causing axial impacts on the drill shank, and
- a rotating device for rotating the drill shank around its axis,
whereby the drill shank is provided with a toothing by means of which the drill shank is coupled in engagement with the rotating device.

In a continuously revolving percussion drilling machine, the drill rod is rotated constantly during drilling, at the same time as successive impacts are directed at the drill rod. The transmission of the torque of rotation from the rotating device to the drill shank has been accomplished by means of a toothing provided on the drill shank, to which toothing the power is transmitted from the rotating device by means of a grooved sleeve and a frame sleeve (e.g., U.S. Patent 3,082,741) or by means of a frame sleeve (e.g., U.S. Patent 4,289,209) provided with toothed grooves corresponding to the toothing on the drill shank. The toothings do not revolve in relation to each other, but form a groove-wedge joint between the drill shank and the groove sleeve or the frame sleeve.

A problem in conventional percussion drilling machines is the tooth transmission between the drill shank and the groove sleeve or frame sleeve, because, at the same time as the teeth of the toothings are in tight contact with each other owing to the torque of rotation, 1500 to 5000 impacts per minute are repeatedly
directed at the drill shank by means of the percussion mechanism, so that a high speed movement back and forth is imparted to the drill shank, said speed being about 5 to 10 metres per second. Owing to this, a large quantity of heat is generated in the surfaces of the teeth, which results in shear of the teeth and in melting of the material and in rapid wear. In order to avoid this, most varying combinations of materials have been used in the tooth surfaces, but with relatively poor results. In order to reduce the surface pressure and to reduce the said drawbacks, attempts have been made to distribute the surface pressure among several teeth over an area as large as possible.

The prior art constructions also involve drawbacks in view of their manufacture, such as the inside toothing comprising teeth having straight flanks, in which the precision of the pitch is poor and only some of the teeth are supporting. Also, the surface quality of the teeth is often poor, which results in high local surface pressures damaging the toothing, and thereby in a relatively poor result. Moreover, it is difficult to provide adequate lubrication between the tooth surfaces sliding against each other, which deteriorates the situation even further. The prior art constructions are also expensive to manufacture, and the expenses of spare parts are high.

The object of the present invention is to provide a percussion drilling machine which avoids the above drawbacks and in which the generation of heat in the toothing of the drill shank is low and the lubrication can be accomplished reliably. This object is achieved by means of a percussion drilling machine in accordance with the present invention, which is characterized in that the toothing of the drill shank is coupled in direct engagement with a toothing revolving in relation to the drill shank and rotating the drill shank, said toothing of the drill shank being axially
displaceable in relation to said rotating toothing.

The invention is based on the idea that the contact surfaces of the teeth of the toothing of the drill shank and of the toothing rotating the drill shank revolve and are exchanged constantly, whereby the same position of each tooth is not subjected to successively repeated axial movement nor to strain caused by surface pressure, and the contact faces have time to be cooled before the next contact. Owing to this, the teeth operate sufficiently cold, and since the surfaces are apart from each other between contacts, they obtain a good lubricating film.

The toothings on the drill shank and on a rotating cogwheel or tooth rim can be manufactured by means of a so-called generating method. The result is more precise toothings, whereby no exceptionally high local surface pressures are produced at the surfaces of the teeth, but all the teeth which are in contact at the same time support the loading uniformly.

It is a surprising feature of the invention that, in spite of the fact that the power required for rotating the drill shank is transmitted via a few teeth only which are in contact with each other at one time and which are displaceable in relation to each other, so that the contact area is relatively little, the wear resistance of the toothing of the drill shank is considerably better than in the prior art solutions, in which the number of teeth participating in the power transmission and the power transmission area are large as compared with the solution of the present invention. Correspondingly, the service life of the drill shank is prolonged, which reduces the spare part expenses. The elimination of the conventional expensive groove sleeve and/or frame sleeve construction simplifies the entire construction and lowers both the manufacturing costs and the spare part costs.
The invention will be described in more detail below with reference to the attached drawings, wherein

Figure 1 is an axial cross section of the front end of a percussion drilling machine in accordance with the invention, illustrating a first embodiment of the gear transmission of the drill shank,

Figure 2 shows a second embodiment of the gear transmission of the drill shank in a way corresponding to Fig. 1, and

Figure 3 shows a section along line III-III in Fig. 2.

As its main components, the percussion drilling machine shown in Fig. 1 comprises a body 1, a drill shank 2 rotably and axially slidably journalled in the body, an impact mechanism provided in the body, of which only the axially mobile impact piston 3 is shown, and a rotating device 4 mounted in the body. In Fig. 1 only the front end of the drilling machine is shown, because the invention is actually concerned with the rotating members provided in the front end. In other respects, the construction of the drilling machine is conventional and it is therefore not described in more detail in this connection.

The rotating device 3 includes a rotating motor 5 having a shaft to which is fastened a cogwheel 6 in engagement with a cogwheel 7 mounted in the body. A toothing 8 consisting of an outside tooth rim has been formed on the drill shank, said toothing being in engagement with the toothing 9 on the cogwheel 7.

For rotating the drill shank, an ordinary cogwheel 7 is used in this embodiment. The toothing on the drill shank is coupled in direct engagement with this cogwheel. In the embodiment of Fig. 1 the cogwheel 7 is arranged as an intermediate cogwheel between the cogwheel 6 of the rotating motor and the drill shank.

It is also possible that the cogwheel with which the toothing of the drill shank is coupled in direct
engagement is the cogwheel 6 of the rotating motor.

In the embodiment shown in Figures 2 and 3, a tooth rim 17 is journalled rotably in the body, said tooth rim being positioned around the drill shank. The tooth rim is provided with an inside toothing 19, which is coupled in direct engagement with the toothing 18 on the drill shank, and with an outside toothing 20, which is in engagement with the cogwheel 6 of the rotating motor.

The teeth of the toothing 18 of the drill shank and the teeth of the toothing 9 of the cogwheel or of the toothing 19 of the tooth rim, respectively, may be straight, as is shown in Fig. 2, or helical, as is shown in Fig. 1. By means of helical gears, it is possible to make the tooth contact lighter during the axial movement of the drill shank. The helicity of the teeth may vary within 0 to 10°, the preferable helicity being about 1 to 5°. The direction of helicity in relation to the direction of rotation of the drill depends on whether the tooth contact is supposed to be made lighter during the impact movement or during the return movement.

The drawings and the related description are only supposed to illustrate the idea of the invention. In its details, the percussion drilling machine in accordance with the invention may vary within the scope of the claims. The tooth rim with which the toothing on the drill shank is coupled in direct engagement may be an element of the rotating device, such as the inner body of such a hydraulic motor in which the outer body and the inner body revolve relative each other, a toothing being provided on the inner body. It is also possible to couple several rotating motors to act upon the drill shank in parallel in relation to each other by arranging their cogwheels so that they rotate the drill shank at different sides thereof.

The claims form part of the disclosure of this specification.
CLAIMS
The claims defining the invention are as follows:

1. Continuously revolving percussion drilling machine, which comprises
   - a body,
   - a drill shank mounted rotably and axially slidably in the body for causing impacts on the drill rod,
   - an impact mechanism positioned in the body for causing axial impacts on the drill shank, and
   - a rotating device for rotating the drill shank around its axis,
   whereby the drill shank is provided with a toothing by means of which the drill shank is coupled in engagement with the rotating device, characterized in that the toothing of the drill shank is coupled in direct engagement with a toothing revolving in relation to the drill shank and rotating the drill shank, said toothing of the drill shank being axially displaceable in relation to said rotating toothing.

2. Drilling machine as claimed in claim 1, characterized in that the toothing of the drill shank is in engagement with a toothing of a cogwheel, which is directly or indirectly coupled to said rotating device.

3. Drilling machine as claimed in claim 1, characterized in that the toothing of the drill shank is in engagement with a toothing of a tooth rim positioned around the drill shank, which tooth rim is directly or indirectly coupled to said rotating device.

4. Drilling machine as claimed in claim 3, characterized in that the tooth rim is a part of the rotating motor.
5. Drilling machine as claimed in claim 2 or 3, characterized in that the toothing on the drill shank and the toothing rotating the drill shank are helical.

6. Drilling machine as claimed in claim 2 or 3, characterized in that the toothing on the drill shank and the toothing rotating the drill shank are straight.

7. Drilling machine substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

8. Drilling machine substantially as hereinbefore described with reference to Figures 2 and 3 of the accompanying drawings.

9. The articles, things, parts, elements, steps, features, methods, processes, compounds and compositions referred to or indicated in the specification and/or claims of the application individually or collectively, and any and all combinations of any two or more of such.

DATED THIS 15th DAY OF September, 1983.
DRAWINGS