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(54) Title: A MOULD TOOL FOR INJECTION MOULDING

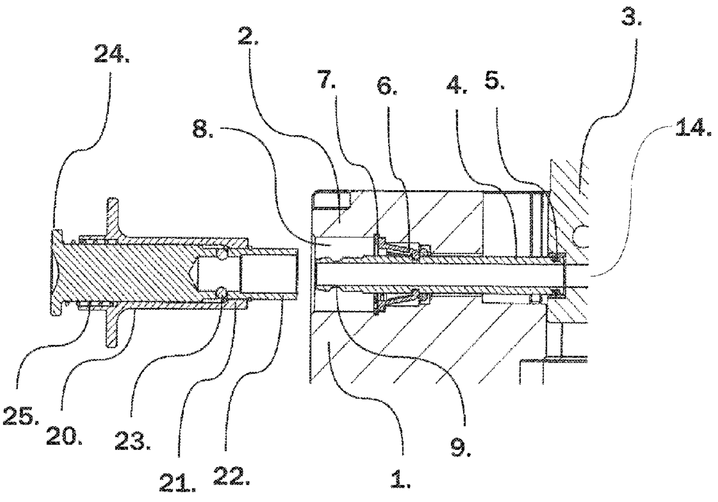

Fig. 1

(57) Abstract: Injection-moulding mould configured for being mounted in an injection- moulding apparatus for automated moulding of work pieces from plastics, said injection-moulding mould comprising at least two separate mould parts that are separated by a mould separation face, and wherein at least one mould part 1 is configured with an outer frame 2 in which one or more spaces is/are configured that are open relative to the mould separation face, in which is mounted at least one exchangeable mould insert 3, and wherein the exchangeable mould insert 3 has a mould cavity side that faces towards the mould separation face, which mould cavity side is provided with one or more mould cavities, and wherein, in the mould insert 3, a set of cooling channels 14 is provided and at least two pipe couplings to which there is, for each pipe coupling, configured a cooling pipe 4 being, with its first end, mounted to the pipe coupling and extending therefrom, in its longitudinal direction, from the pipe coupling and out through a channel 8 in the outer frame of the mould part and to its other end. The cooling pipe being secured in the channel in such a manner that it cannot be shifted in the longitudinal direction thereof, it is accomplished that the pipe coupling may be configured such as to occupy only very little space in the mould insert 3.

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Title:

A mould tool for injection moulding

Prior art:

The present invention relates to an injection-moulding mould configured for being mounted in an injection-moulding apparatus for automated moulding of work pieces from plastics, said injection-moulding mould comprising at least two separate mould parts that are separated by a mould separation face, and wherein at least one mould part is configured with an outer frame in which one or more spaces is/are configured that are open relative to the mould separation face, in which is mounted at least one exchangeable mould insert, and wherein the exchangeable mould insert has a mould cavity side that faces towards the mould separation face, which mould cavity side is provided with one or more mould cavities, and wherein, in the mould insert, a set of cooling channels is provided and at least two pipe couplings to which there is, for each pipe coupling, configured a cooling pipe being, with its first end, mounted to the pipe coupling and extending therefrom, in its longitudinal direction, from the pipe coupling and out through a channel in the outer frame of the mould part and to its other end.

An injection-moulding mould of that type is known from US patent No. 6936206, wherein the cooling channel is screwed into a side wall surface on the mould insert element and extends out through the passage on the frame of the mould part that encloses the mould insert element.

Object of the invention:

Based on this, it is the object of the present invention to provide an injection-moulding mould of the kind set forth above, whereby further space is provided in the mould insert for cooling channels, mould cavities, etc., and wherein mounting and dismounting of cooling pipes are considerably facilitated.

This is accomplished by the invention as set forth in claim 1; the cooling pipe being secured against dismounting by axial shifting out of the pipe coupling on the mould insert, it is enabled to configure the pipe coupling such that it takes up very little volume in the mould insert to the effect that more space is thereby provided for mould cavities, cooling channels and other components important to the moulding process in the mould insert.

For instance, the pipe coupling can, in a simple manner, be constituted by a cylindrical hole in the mould insert, into which hole the cooling pipe is introduced, and wherein, on the first end of the cooling pipe, a first round-going recess is configured on the outer side of the cooling pipe, in which a gasket is provided, such as an O-ring, which abuts on the inner side of the cylindrical hole on the mould insert.

According to a preferred embodiment, the cooling pipe is secured in the channel by means of a ring-shaped mounting clip that has an outer periphery extending around the cooling pipe and being securely mounted on the inner side of the channel, and having a number of elastic tongues that extend slantingly inwards from the outer periphery towards the cooling pipe and in a direction towards the pipe coupling on the mould insert, and wherein each of the elastic tongues has a pin that engages with another round-going recess on the outer side of the cooling pipe to the effect that the cooling pipe can be shifted along its longitudinal axis only if the pins on the elastic tongues are caused to disengage from the other round-going recess on the cooling pipe.

Said mounting clip may advantageously be configured from a thermoplastic plastics material to the effect that it thermally insulates the cooling pipe from the inner side of the channel.

According to a particularly preferred embodiment, particularly easy and safe mounting and dismounting of the cooling pipes can be established. That embodiment thus comprises a mounting tool for release of the mounting clip, said mounting tool comprising a pipe end that can be shifted on the outside of the cooling pipe in a direction towards the mounting clip, and wherein the mounting tool has, at its opposite end relative to pipe end, a pressure face configured such that pipe end can be pressed into the channel on the outside of the cooling pipe, where it, by shifting past the outer periphery of the mounting clip, presses said elastic tongues outwards towards the inner side of the channel in such a manner that the pins on the elastic tongues are pushed out of the second round-going recess on the cooling pipe.

Advantageously, the mounting tool may further comprise a number of holes configured in the pipe end, wherein, in each hole, a ball is provided that can be shifted radially outwards from and inwards to a ball seat configured in the hole, wherein a part of the ball's surface extends within the inner side of the pipe end, and wherein the mounting tool further comprises an outer pipe that extends on the outside of the pipe end and can be shifted axially longitudinally of same, and wherein there is configured, in the outer pipe, a guide for each ball, which guide is configured such that each ball is, by shifting of the outer pipe in a direction relative to the pipe end, pushed inwards towards its ball seat, and, by shifting of the outer pipe in the opposite direction, allows the ball to move radially outwards and away from its ball seat, and wherein the holes are arranged such that, when pipe end is pushed so far onto the cooling pipe that the tongues on the mounting clip are pushed out of the second round-going recess on the cooling pipe, the balls may, by shifting of the outer pipe on pipe end, engage with a third round-going recess on the outer side of the cooling pipe, to the effect that the cooling pipe can be withdrawn from the channel by a pull being exerted in the mounting tool.

The drawing:

Figure 1: is a sectional view through a part of an injection-moulding tool with a mould insert and a cooling pipe according to the invention.

Figure 2: is an exploded perspective view showing constituent components of the injection-moulding mould as shown in figure 1.

Description of an embodiment:

Thus, figure 1 shows a part of an injection-moulding mould seen in a cut face, wherein a cooling pipe 4 is mounted in the injection-moulding mould. For the sake of overview, only a small portion of an injection-moulding mould is thus shown, viz the part that characterises the invention compared to commonly known injection-moulding moulds. In this context, it will be clear to the person skilled in the art that the remainder of the injection-moulding mould can be configured in a vast number of different embodiments; mould parts 1 with exchangeable inserts 3 being commonly known where, by standard tools, manufacture of different components in the same mould tool is desired, whereby it is thus avoided that the overall mould tool is to be exchanged when production is to be switched to the manufacture of a new work piece. By use of the exchangeable inserts, the switch from production of one work piece to another can often be accomplished merely by an exchange of the mould insert 3.

An example of a known mould tool of this type will thus appear from the above-referenced US patent No. 6936206, wherein the cooling medium channel is screwed into a side wall surface on the mould insert element and extends out through the passage on the frame of the mould part that encloses the mould insert element.

Thus, from the drawing a mould insert 3 will appear which, by known means (not shown), is mounted in a mould part 1 comprising an outer frame 2 that encloses the periphery of the mould insert 3, of which only one side is shown in the figure.

Moreover, the mould insert 3 has one or more mould cavities (not shown) and a number of cooling channels 14, and with the purpose of supplying cooling water to the cooling channels 14 there is, according to the invention, mounted a cooling pipe 4 in a cooling coupling configured therefor in the cooling channel 14. In the shown embodiment, the pipe coupling is configured as a cylindrical hole which is provided with an annular lining 13 for the sake of ensuring an effective packing surface for the annular rubber gasket or so-called O-ring 5 shown in the drawing and being arranged in a first recess on the outside of the cooling pipe 4.

The cooling pipe 4 being moreover secured against axial displacement in the channel 8 by means of a mounting clip 6, it is possible to configure the pipe coupling such that it takes up only very little space in the mould insert 3, and hence more space becomes available to other functional parts in the mould insert 3, such as cooling channels, mould cavities, etc.

In figure 2, the cooling pipe and the mounting clip are shown, and so are the further components that it takes to establish the coupling of the cooling pipe 4 to the mould insert 3. From here it will appear that the mounting clip 6 has a plurality of tongues that each extends from the outer periphery of the mounting clip and slantingly forwards towards the pipe coupling on the mould insert 3 where, by means of a pin, it is capable of releasably engaging with another round-going recess 11 on the outer side of the cooling pipe 4.

The mounting clip 6 being secured in the channel 8 by means of the lock ring 7, this will mean that the cooling pipe 3 is thereby not displaceable in the longitudinal direction thereof, unless the elastic tongues on the mounting clip are caused to leave their engagement with the other round-going recess 11 on the cooling pipe 4.

To this end, the injection-moulding mould comprises a mounting tool 20, 24 which is shown in figure 1. That mounting tool 24 has a pipe end 22 that can be shifted on the outside of the cooling pipe 4 from the outside and so far onto it that the pipe end 22 can reach so far past the outer periphery of the mounting clip that it can force the elastic tongues on the mounting clip 6 outwards towards the inner side of the channel 8. Thereby, the pin is pulled out of the second round-going recess 11 on the cooling pipe, and the cooling pipe can be pulled out freely, apart from the friction between the pipe coupling on the insert and the O-ring 5 on the cooling pipe 4.

Moreover, the mounting tool 24 has a ball coupling functionality that comprises a number of balls 23 that are each arranged in a hole configured with a ball seat and configured in the pipe end. Here, the ball seat serves the function that the balls 23 cannot fall in on the inner side of the pipe end 22, but can only be moved so far inwards towards the centre axis of the pipe end 22 where it is capable of engaging with the third round-going recess 9 on the cooling pipe 4 and, in that position, seizing it to the effect that the mounting tool 24 can be used both to insert and withdraw the cooling pipe 4 into and from the channel 8. To be able to move balls out of and into, respectively, engagement with the recess 9 on the cooling pipe 4, the mounting tool 24 further comprises an outer pipe 21 that extends on the outside of the pipe end 22 and can be shifted axially longitudinally thereof 22, and wherein, in the outer pipe 21, a guide is provided for each ball 21, which guide is configured such that each ball 21 is, by shifting of the outer pipe 21 in a direction relative to the pipe end 22, pushed inwards towards its ball seat; and reversely, when the outer pipe 21 is shifted in the opposite direction, the ball 23 is allowed to move radially outwards and away from its ball seat. To the above end, the holes are arranged such that, when the pipe end 22 is pushed so far onto the cooling pipe 4 that the tongues on the mounting clip 6 are pushed out of the second round-going recess 9 on the cooling pipe 4, the balls 23 can, by shifting of the outer pipe 21 on the pipe end, enter into engagement with the third annular recess on the outer side of the cooling pipe, to the effect that the cooling pipe 4 can be pulled out of the channel 8 by a pull being exerted in the mounting tool 24.

To keep the outer pipe 21 and pipe end 22 at a mutual position wherein the balls are locked in each their ball seat, a spring 25 is configured that displaces the two parts 21, 22 in the direction by which the locking thereof appears.

Claims

1. An injection-moulding mould configured for being mounted in an injection-moulding apparatus for automated moulding of work pieces from plastics, said injection-moulding mould comprising at least two separate mould parts that are separated by a mould separation face, and wherein at least one mould part is configured with an outer frame in which one or more spaces is/are configured that are open relative to the mould separation face, in which is mounted at least one exchangeable mould insert, and wherein the exchangeable mould insert has a mould cavity side that faces towards the mould separation face, which mould cavity side is provided with one or more mould cavities, and wherein, in the mould insert, a set of cooling channels is provided and at least two pipe couplings to which there is, for each pipe coupling, configured a cooling pipe being, with its first end, mounted to the pipe coupling and extending therefrom, in its longitudinal direction, from the pipe coupling and out through a channel in the outer frame of the mould part and to its other end, **characterised in that** the cooling pipe is secured in the channel in such a manner that it cannot be shifted in the longitudinal direction thereof.

2. An injection-moulding mould according to claim 1, **characterised in that** the pipe coupling is constituted by a cylindrical hole in the mould insert, into which hole the cooling pipe is introduced, and wherein, on the first end of the cooling pipe, a first round-going recess is configured on the outer side of the cooling pipe, in which a gasket is provided, such as an O-ring, which abuts on the inner side of the cylindrical hole on the mould insert.

3. An injection-moulding mould according to claim 1, **characterised in that** the cooling pipe is secured in the channel by means of a ring-shaped mounting clip that has an outer periphery extending around the cooling pipe and being securely mounted on the inner side of the channel, and having a

number of elastic tongues that extend slantingly inwards from the outer periphery towards the cooling pipe and in a direction towards the pipe coupling on the mould insert, and wherein each of the elastic tongues has a pin that engages with another round-going recess on the outer side of the cooling pipe to the effect that the cooling pipe can be shifted along its longitudinal axis only if the pins on the elastic tongues are caused to disengage from the other round-going recess on the cooling pipe.

4. An injection-moulding mould according to claim 3, **characterised in that** the mounting clip is made from a thermoplastic plastics material.

5. An injection-moulding mould according to claim 3 or 4, **characterised in that** it comprises a mounting tool for release of the mounting clip, said mounting tool comprising a pipe end that can be shifted on the outside of the cooling pipe in a direction towards the mounting clip, and wherein the mounting tool has, at its opposite end relative to pipe end, a pressure face configured such that pipe end can be pressed into the channel on the outside of the cooling pipe, where it, by shifting past the outer periphery of the mounting clip, presses said elastic tongues outwards towards the inner side of the channel in such a manner that the pins on the elastic tongues are pushed out of the second round-going recess on the cooling pipe.

6. An injection-moulding mould according to claim 5, **characterised in that** the mounting tool further comprises a number of holes configured in the pipe end, wherein, in each hole, a ball is provided that can be shifted radially outwards from and inwards to a ball seat configured in the hole, wherein a part of the ball's surface extends within the inner side of the pipe end, and wherein the mounting tool further comprises an outer pipe that extends on the outside of the pipe end and can be shifted axially longitudinally of same, and wherein there is configured, in the outer pipe, a guide for each ball, which guide is configured such that each ball is, by shifting of the outer pipe

in a direction relative to the pipe end, pushed inwards towards its ball seat, and, by shifting of the outer pipe in the opposite direction, allows the ball to move radially outwards and away from its ball seat, and wherein the holes are arranged such that, when pipe end is pushed so far onto the cooling pipe that the tongues on the mounting clip are pushed out of the second round-going recess on the cooling pipe, the balls may, by shifting of the outer pipe on pipe end, engage with a third round-going recess on the outer side of the cooling pipe, to the effect that the cooling pipe can be withdrawn from the channel by a pull being exerted in the mounting tool.

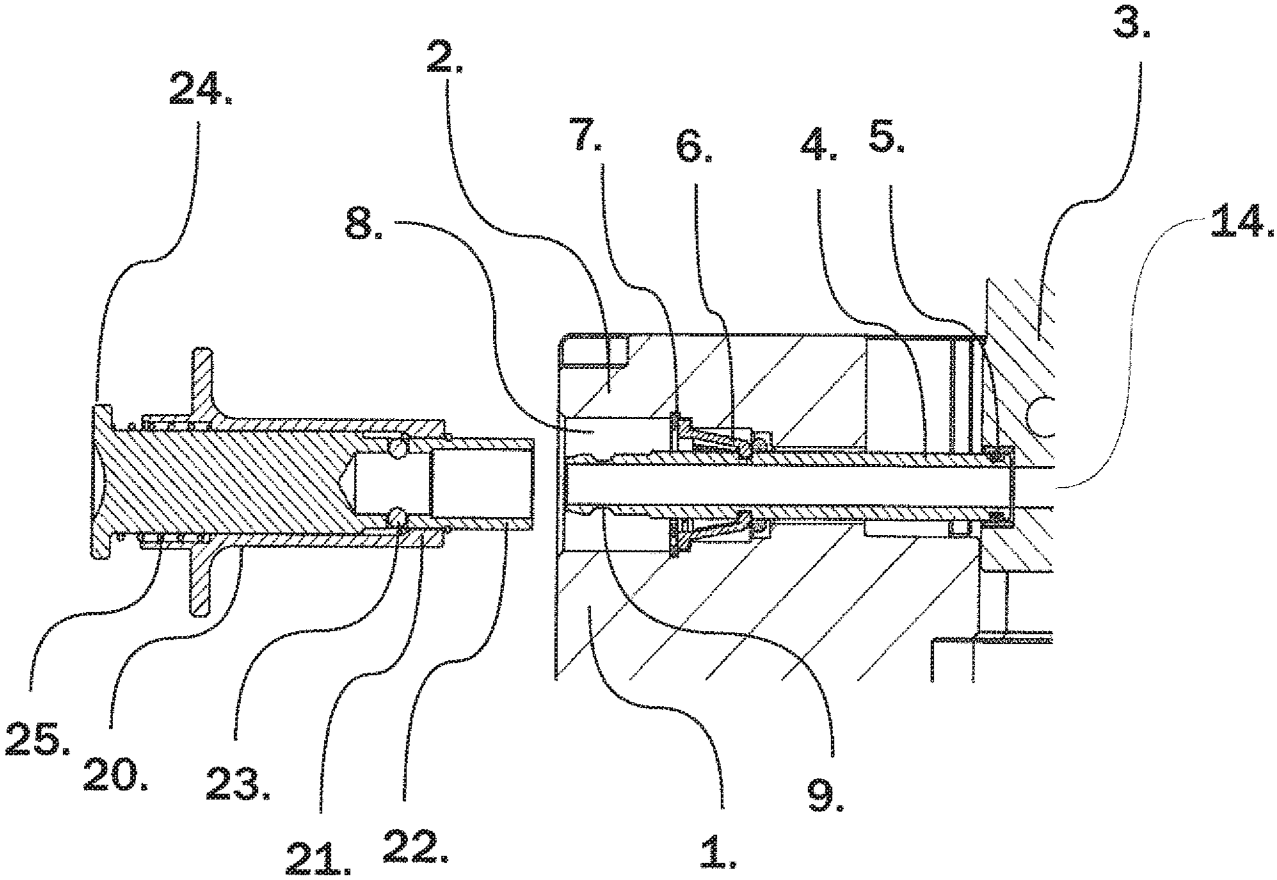

Fig. 1

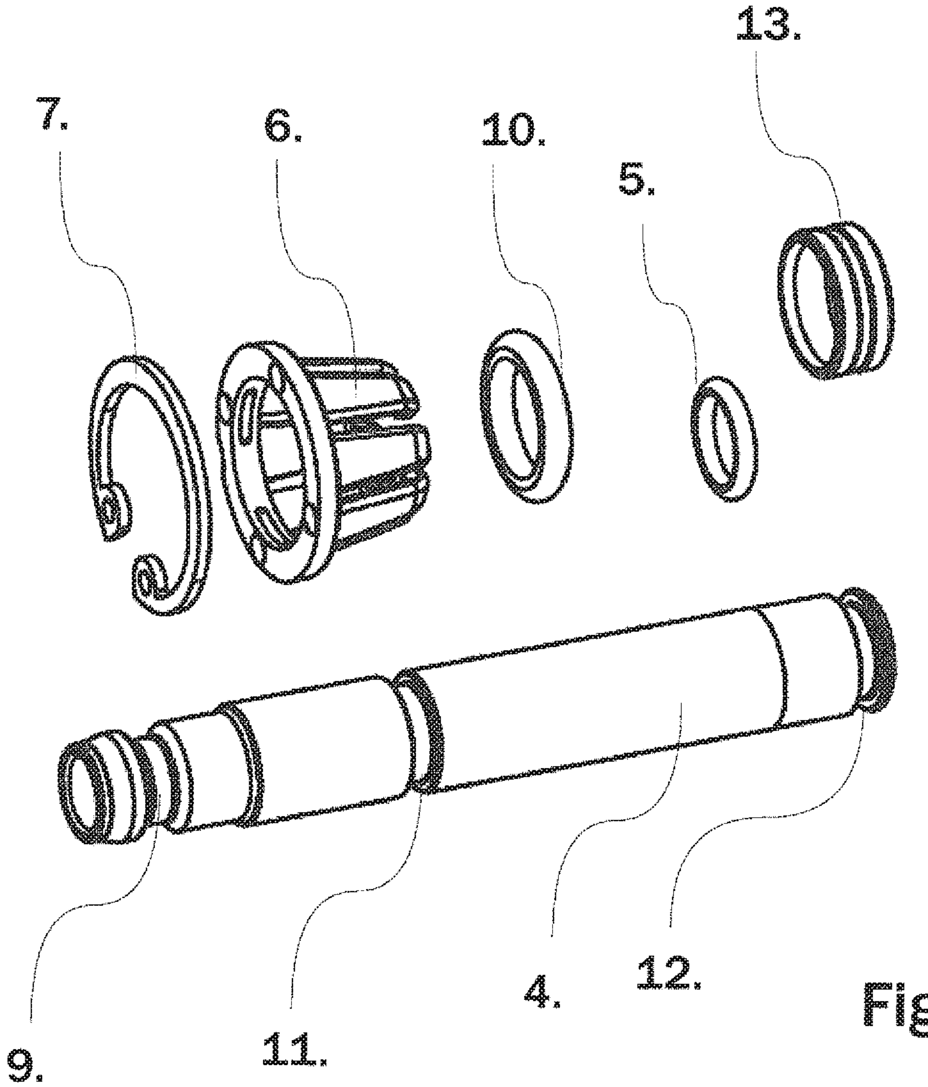

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/DK2015/050138

A. CLASSIFICATION OF SUBJECT MATTER

B29C 45/70 (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)

IPS&CPC&FICLA: B29C

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

DK, NO, SE, FI: Classes as above.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, FULL TEXT: ENGLISH

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A,D	US 6936206 B1 (SATOH et al.) 30 August 2005 (see abstract, claim 16, figures 1, 7A, 10 and 11 and col. 6 lines 44-49)	1-6
A	WO 98/56562 A1 (PLEASANT RONALDE E) 17 December 1998 (see abstract and figures 6 and 14 in particular)	1-6
A	JPS 60245525 A (NISSEI PLASTICS IND CO) 05 December 1985 (see abstract and figures 1-6 in particular)	1-6
A	EP 1614516 A1 (NISSHA PRINTING) 11 January 2006 (see abstract, sections [0021], [0065], [0066] and 6, 8A and 20 in particular)	1-6
A	EP 0580259 A1 (KONINKL PHILIPS ELECTRONICS NV) 26 January 1994 (see abstract and figure 1 in particular)	1-6
A	US 2011/0135780 A1 (YEH et al.) 09 June 2011 (see abstract, section [0015] and figures 1 and 5 in particular)	1-6

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

"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

"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12/08/2015	13/08/2015
Name and mailing address of the ISA Nordic Patent Institute Helgeshøj Allé 81 DK - 2630 Taastrup, Denmark. Facsimile No. + 45 43 50 80 08	Authorized officer Basel Hayatleh Telephone No. +45 43 50 83 66

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT	International application No. PCT/DK2015/050138

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK2015/050138

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US 2011135780 A1 2011.06.09	CN 201597169U U 2010.10.06 US 8070477 B2 2011.12.06