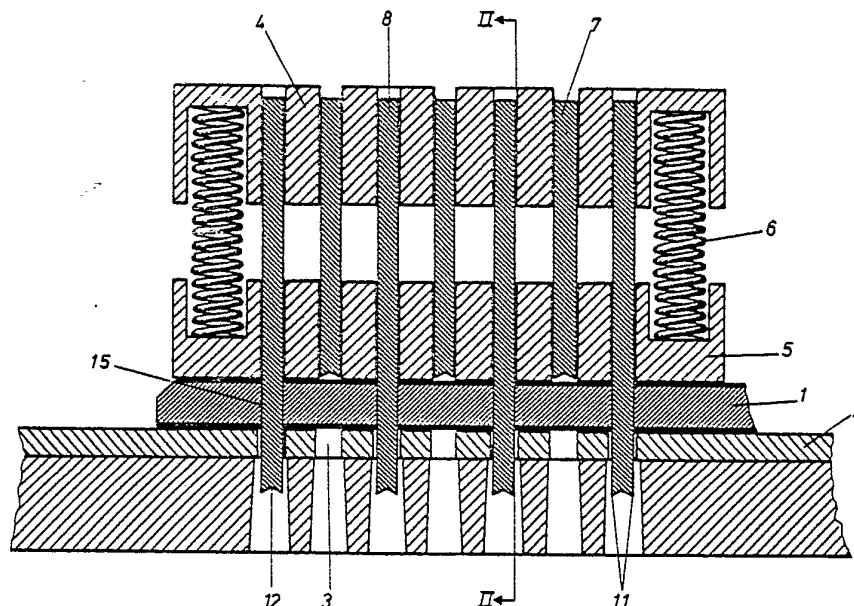


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(54) Title: METHOD AND TOOL FOR PUNCHING PLASTER PLATES**(57) Abstract**

In order that holes may be produced in a simple and safe manner in a plaster plate (1) to be used as sound adjuster in a room, holes (15) are punched out of the plate, e.g. in the shape of slits, by means of a cutting tool. Hereby the considerable dust and noise inconveniences caused by the hitherto known machining are avoided. By slits (15) that must lie close to each other, it is possible to punch in two stages, i.e. first with double distance and then in the space between. This prevents fracture of the plaster and tearing of any paper that may be on the surface. The cutting tool is provided with punches (7, 8), in a shape corresponding to the holes. Each punch is provided with an inclined blade (10) which forms an angle to the horizontal of 13°. The cross sectional shape of the blade is V-shaped, with two blades (11) running along the sides of the punch. In this manner the material (9) is punched out in a gentle and even manner, whereby is obtained a perfect hole free from burrs and fractures of the plaster in the edge area.

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1 METHOD AND TOOL FOR PUNCHING PLASTER PLATES

5 The invention relates to a method for punching plaster boards and like plate elements, primarily used for sound adjustment, and a tool for carrying out the method.

10 Plate elements of this sort are supplied with holes, either in the shape of circular holes or in the shape of slits and are often referred to as acoustic plates. By a suitable mounting of the plates, e.g. in ceilings with mineral wool at the back, an efficient sound adjustment of the time of reverberation
15 of the room may be obtained. This is due to the good sound absorption quality of the plates, which among other things depends on the size and number of the holes. The more material is removed by the punching, the higher the absorption factor.

20 Hitherto known acoustic plates of plaster are made from existing plaster boards normally coated with paper on both sides.

25 The plates are then placed under a multi-spindled drilling machine, and the spiral bits drill the many holes through the plates. This requires a complex drilling machine, and it is a time-consuming process because there are limits to the degree of tightening
30 since the plaster easily breaks, and in practice only a limited number of holes can be drilled at a time.

Add to this the drawbacks brought about by the deve-

1 lopment of dust which is a big nuisance for the
operators. Since plaster is fine-grained, it is
in practice difficult completely to avoid dust pro-
blems by the known protection and suction devices.

5

Where acoustic plates with oblong holes in the shape
of slits are to be made, such plates are also made
in a cutting machine, i.e. by means of rotary saw
blades mounted on a shared shaft. When the shaft
10 with the saw blades is lowered down into the plate,
a trace is produced, the dimension of which depends
on the width, diameter and tightening of the saw
blade.

15 The hereby produced saw traces do not always, however,
look nice because the plate is not cut into from
a right angle at the ends of the slits, where bevelled
edges corresponding to the outer periphery of the
saw occur. Add to this the tearing of the paper
20 at that end of the slit where the direction of motion
of the saw is from below up towards the front surface
of the plate.

Apart from these drawbacks that concern the finished
25 product, there are considerable dust and noise incon-
veniences brought about by these multi-saw machines
during operation. The saws raise the plaster dust,
and the blades are easily brought to vibrate which
produces a very unpleasant noise. Since the plaster
30 plates may only be machined dry these drawbacks
cannot be overcome by applying lubricants or the
like.

It is the object of the present invention to overcome

1 these drawbacks by the known methods for punching
particularly plaster boards, and this is achieved
by a method where the hole is punched in a cutting
5 cut, since practice surprisingly has proved that
this may be done without causing damage to the plaster
or paper in the edge area of the holes. Moreover,
the method is completely dustfree and noiseless,
which implies that the described method will be
10 preferred in future. Because the punched out material
furthermore is easily recovered and recycled, no
waste of material whatsoever occurs. Moreover, the
method enables fully automatic punching of the plates,
since by applying the generally known method the
15 plates are easily punched in a continuous operation.

In order to be able to produce the plates with closely
spaced cuts, it is expedient, as referred to in
claim 2, to punch the holes in two stages with every
20 other hole at a time.

By using the tool referred to in claim 3, the slit
can be punched in a pure and clean manner, because
the punching starts at one end of the blade and
25 continues from there until the whole blade has punched
the plate.

By, as referred to in claim 4, having the blade
take a gently sloping course, the energy requirements
30 of the press - and hence the punching - becomes
even and constant, which produces a completely even
cut.

Finally it is expedient, as referred to in claim

1 5, to give the blade a V-shape seen in its transverse
direction, to form a blade along each of the side
edges of the punch thereby loading the punch complete-
ly evenly.

5

In the following the invention will be described
in further detail with reference to the drawing,
wherein

10 fig. 1 shows a section through a tool during
punching of a set of slits,

fig. 2 shows a section through the tool seen
along II-II in fig. 1, and

15

fig. 3 shows a frontview of a section of a
plate after having been punched.

20 Figs. 1 and 2 show examples of a cutting tool for
punching holes or slits in a plaster plate 1.

25 The tool comprises a matrix, the main part 4 of
which holds the punches 7, 8 and moves them in and
out of the matrix 2, when the pressing piece actuates
the tool.

30 Between the main part 4 and the control plate 5
is fitted a number of helical springs 6 which serve
the purpose of ensuring the contact pressure on
the plaster plate 1 in the working position. It
is indeed important that the control plate is held
to abut closely to the plaster plate in order thereby
to ensure a pure and clean cut and at the same time
serve the purpose of being tearing device in the

1 tool.

The matrix comprises an upper wearing plate 2 with holes 3 and with a base plate below where the punched out material 9 is expelled through the tapered holes, as shown in fig. 2.

In fig. 1 the punch 7, 8 is seen from the end. As will appear, the lower blade of the punch is V-shaped in that a centrally running groove 12 together with the sides of the punch form a blade 11 along the side edges of the blade 10. Only every other punch 8 is pressed down to form the slits 5, and the matrix may then be pressed further down in order to punch interjacent slits by means of the shorter punches 7.

In fig. 2 the punches are pictured from the side. As will appear, each punch 7, 8 is supplied with an inclined blade 10, which may form an angle to the horizontal, i.e. in relation to the matrix, of approx. 13° . This inclination has in practice proved to provide the best cut. When the punching takes place, it starts in the protruding part of the blade 10 and runs evenly from there until the slit 15 has been formed. Since the cutting progresses evenly in the same direction, the punched out material 9 will be led away in an even flow, and there is no risk of blockings.

30

Fig. 1 is a cross section of the blade 10. This comprises a double-blade 11 running along the two side edges of the punch and is formed by a groove 12 running in the centre of the punch. Hereby occurs

1 a blade 11 which cuts the outer part of the slit
first and thus ensures a completely pure and clean
cut. Moreover, the punch will be evenly loaded during
the punching. In order to even out the loads even
5 more, every other punch may be turned so as to be
turned at an angle of 180° in relation to the adjacent
punch.

When the method is carried out, a whole plate 1
10 is placed in the tool with the patrixes lifted.
When the plate is placed correctly, i.e. abutting
stops or rails, the tool may be actuated to punch
the first set of slits. By further pressing, the
interjacent slits are punched, and when this punching
15 is completed, the patrix is lifted and the plate
may be shifted to the next punching position. This
process is repeated until the whole plate is punched
and ready for use as an acoustic plate.

20 An example of a finished plate 1 is shown in section
in fig. 3.

By this method all kinds of holes can be punched,
it alone being a question of tool. Thus holes may
25 be punched that deviate from circular and rectangular
holes since the capacity of the cutting tool places
no limits.

So far reference has only been made to the punching
30 of plaster plates, but it is within the scope of
the invention to use the method and tool for corre-
sponding plates such as wallboard, which in use
corresponds to plaster board.

1 P A T E N T C L A I M S

1. Method for punching plaster boards and like plate elements, primarily used for sound adjustment, characterized in that the hole (15) is punched in a cutting tool.

2. Method according to claim 1, where the punching comprises slits, primarily running parallel to each other, characterized in that punching
10 is first performed to form a number of slits (15), whereafter slits are punched in the space between the first punched slits.

15 3. Tool for carrying out the method according to claims 1 and 2, characterized in that the punch (7, 8) is provided with a blade (10) running backwards at an inclined angle from the one end edge of each blade (10).

20

4. Tool according to claim 3, characterized in that the inclined blade (10) forms an angle (α) of approximately 13° in relation to horizontal.

25

5. Tool according to claims 3 and 4, c h a r a c t e r i z e d in that the blade (10) in its transverse direction runs essentially V-shaped to form a blade (11) along each of the side edges of the blade (10).

30

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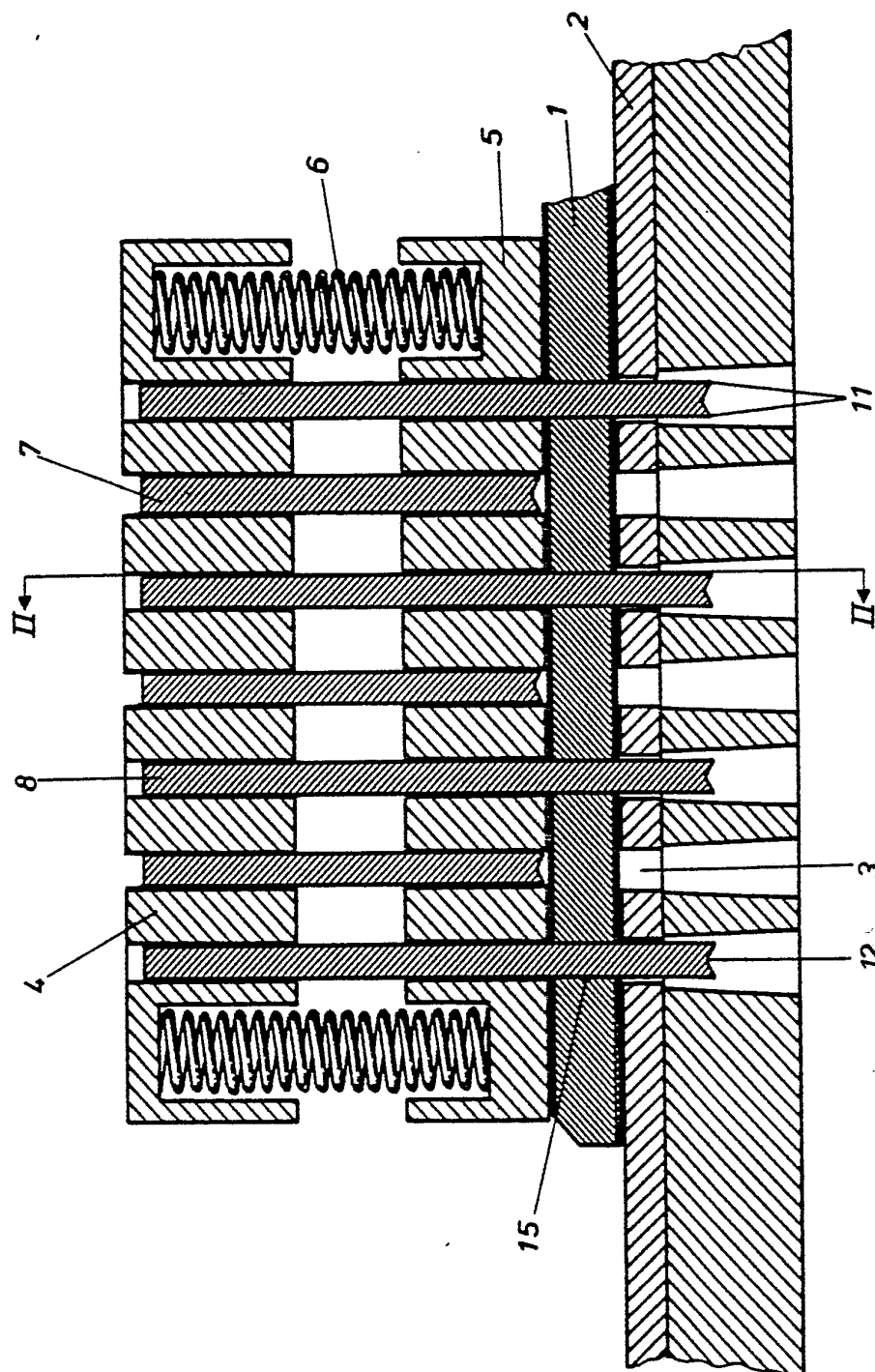


Fig. 1

2/3

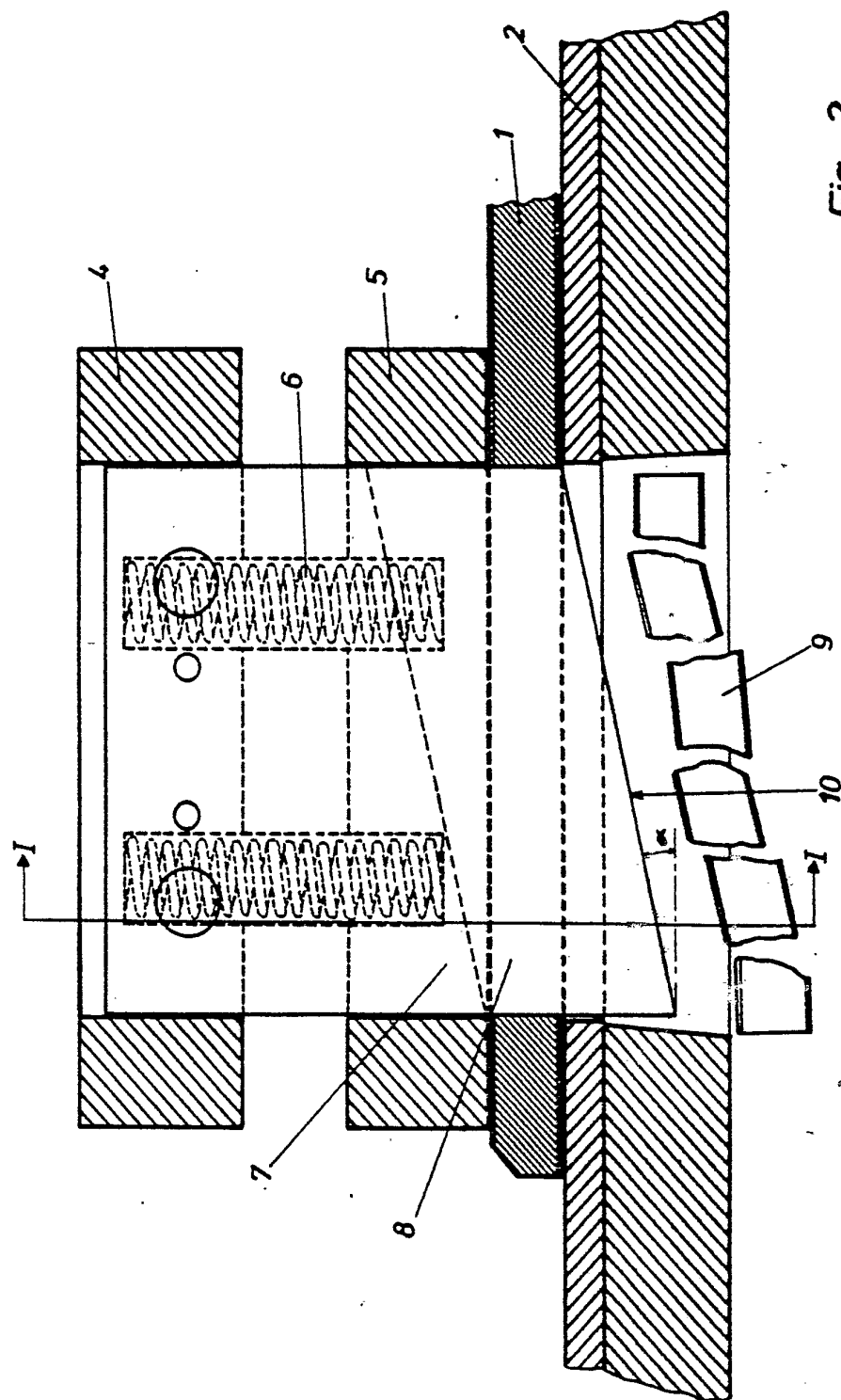


Fig. 2

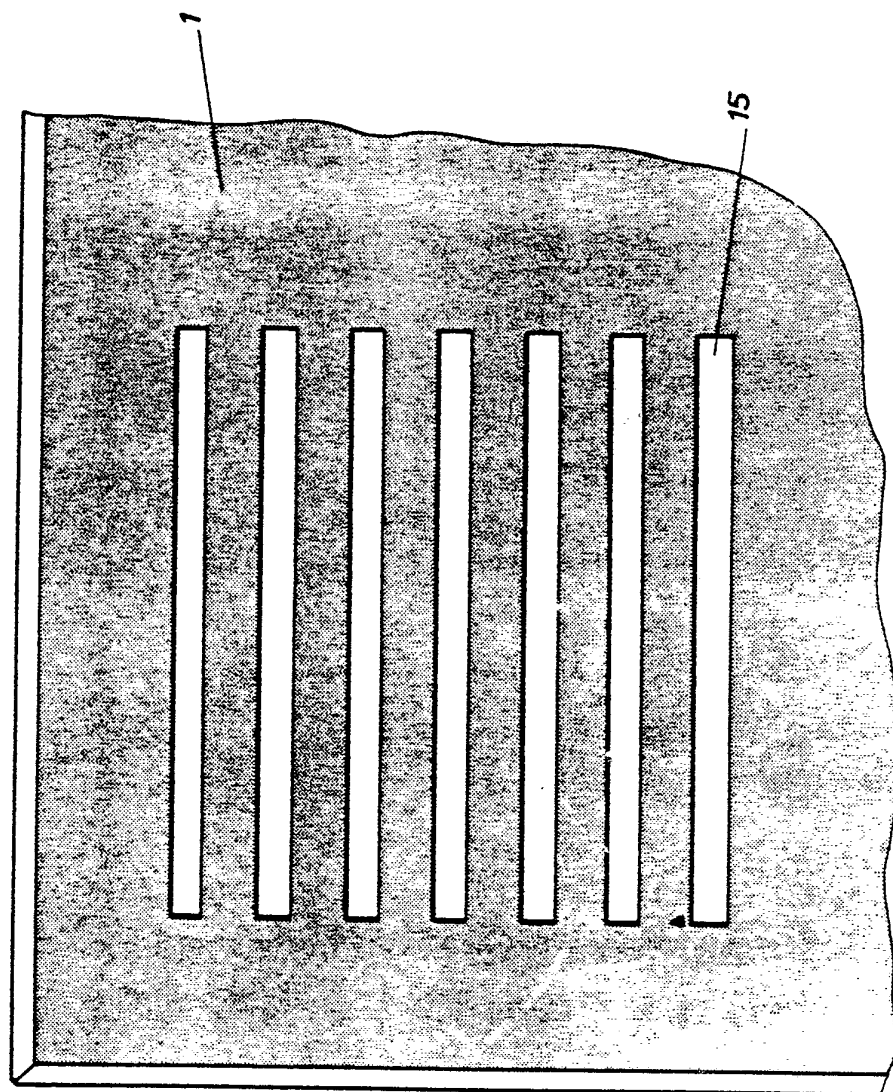
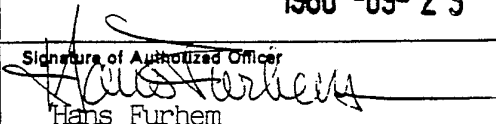


Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/DK86/00077

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC 4		
B 28 D 1/26, B 28 B 11/12, B 26 F 1/38 // E 04 B 1/84		
II. FIELDS SEARCHED		
Minimum Documentation Searched 7		
Classification System	Classification Symbols	
IPC 4	B 26 D 1/00-/09; B 26 F 1/00-/10, /14, /38-/46; B 28 B 11/12; B 28 D 1/00-/26; E 04 B 1/74, /82-/86	
Nat Cl	80d: 1 .../...	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched *		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT 9		
Category *	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No. 13
X	US, A, 907 877 (L M RADER) 29 December 1908	1
X	US, A, 2 408 488 (L N SORENSEN) 1 October 1946	1
A	US, A, 2 633 441 (G A BUTTRES) 31 March 1953	1
A	US, A, 3 143 026 (D W AKERSON) 4 August 1964	1
Y	US, A, 3 248 977 (P F SCHNEIDER) 3 May 1966 see col 2, lines 40-53	1,2
X	US, A, 3 461 754 (C W GRIFFEN) 19 August 1969 & GB, 1186018 DE, 1708001 .../...	1
* Special categories of cited documents: 10 "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document 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 "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		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
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International Searching Authority	Signature of Authorized Officer	
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FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II

Fields Searched (cont)

US Cl 83: 2, 8, 670, 679-696, 867, 881;
156: 39-46;
125: 23, 40, 41;
181: 33, 284-294

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹

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

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

2. ☐ Claim numbers....., 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. ☐ Claim numbers....., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ²

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

3. ☐ 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 claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

- ☐ The additional search fees were accompanied by applicant's protest.
☐ No protest accompanied the payment of additional search fees.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US, A, 3 538 797 (H P WAGTSKJOLD) 10 November 1970	1
X	US, A, 3 656 394 (McCUTCHEON) 18 April 1972	3,4,5