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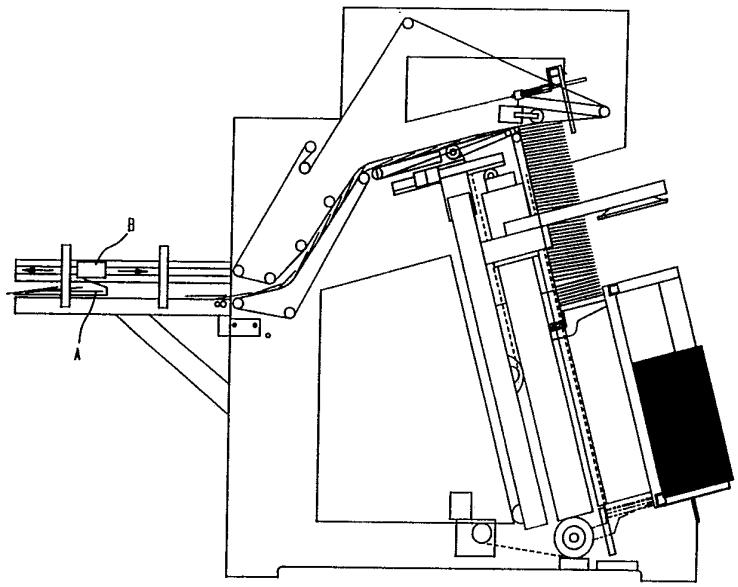
(54) Title: STACKER



(57) Abstract

Packing device for an overlapping stream of sheets on an incoming conveyor belt comprising a device for intermittent production of gaps in such a stream, said device having a locally situated conveyor belt advancing with a lower speed than the incoming conveyor belt, and a gripping device for at least one sheet in the sheet stream, said gripping device advancing with the same speed as the local conveyor belt thus producing a larger local overlapping of each sheet in the sheet stream, but where piling of sheets with completely overlaying leaves are avoided. It is also disclosed devices for monitoring of the growth rate of sheet stacks, devices for placing ending plates on such sheet stacks as well as driven transport and securing devices for such stacks for transfer to a wrapping machine (strapper).

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STACKER

The present invention concerns a device for stacking sheets, especially signatures, of the kind which is specified in the preamble of claim 1.

There is previously known packing machines for sheets where the sheets (signatures) enter the machine in an even flow (overlapping current) and become packed into stacks with a certain number of sheets in each stack.

The general problem which arises by such a stacking is when one stack has achieved a sufficient number of sheets and the stack is to be removed from the packing machine, there being necessary with a form of interrupt mechanism separating the last sheet in the first stack from the first sheet in the next stack. This has e.g. previously been done with a sword striking down between the sheets and thus separating the overlapping flow of sheets.

The problem which however arises at such a division is that the flow if incoming sheets is not lessened so that the sheets will pile up at the upper edge of the sword and "climb", producing an inclining forward edge of the sheets in the following stack resulting in difficulties with a correct forming of the following stack, and may in many cases lead to halt in the production.

As explained above, such a solution of the splitting of the incoming sheets (signatures) attack the problem at the stacking of the sheets and not earlier in the feeding chain of the sheets.

The present invention attack, however, the problem earlier in the feeding chain, there being understood that it is necessary with a splitting of the leaf/sheet-flow in such a way that the flow of incoming sheets is not lessened, there being produced a gap between the last sheet in the first

stack and the first sheet in the next stack, as there simultaneously is avoided a jamming (climbing) of the retarded sheets.

These goals are according to the invention achieved by the incoming flow of sheets/leaves/signatures at a certain point being withheld or delayed in their advancing movement there being produced a gap between the sheets in the overlapping flow. Such a delay may preferably be achieved by the feeding speed of the last part of the feeding section being halved for incoming sheets. This may optionally be combined with the feeding speed for the last number of sheets being increased, e.g. doubled, producing a further increase in the gap between the signatures.

By such a process the above mentioned problems will be avoided as there simultaneous will be unnecessary with any net decrease of the feeding speed of the signatures.

To further illuminate this aspect of the invention, a device for such a splitting of the signature flows will be disclosed below under reference to the attached drawings wherein:

Fig. 1 shows a packing machine with an intercept device according to the invention mounted.

Fig. 2 shows another embodiment of a packing machine with the intercept device situated in a different place on the incoming flow of signatures, where there in addition is mounted a registering device for the height of the sheet stack, a device for adding ending plates to the sheet stack and wherein there also exist a possibility for automatically driven removal of a finished stack of sheets from the packing machine to a wrapping device (strapper).

The packing machine is in itself of a conventional type, of which there are several available commercially, and it will

be simple for a person skilled in the art to choose a packing machine which is suited for the relevant purpose. E.g. it may be mentioned that in such packing machines a conventional speed for incoming sheets/leaves/signatures is in the range of 10 - 50.000 sheets per hour, said range being conventional to use with devices according to the present invention as well. even if greater and lesser speeds also may be used.

To a conveyor belt for feeding signatures 2 there is i a conventional manner connected a leading belt 3 for leading signatures in the packing machine. The flow of signatures stacks in the machine on a number of forks 4 descending according to the incoming flow of signatures, the growth of the signature stack being smooth and dependent on the incoming speed from the conveyor belts 1 and 3. This descending speed of the fork(s) 4 depends in addition on the sheet thickness of the fed sheets, which inter alia is depending on the water contents of the fed sheets, the packing hardness etc., and this is a point to which the disclosure will return later in the description.

To achieve the above mentioned splitting of the sheet flow, there is now according to the invention mounted a second belt 5 above the conveyor belt 3, the speed of which is less than the speed of the conveyor belt 3, preferably half the speed. This extra belt may at any convenient time be lowered towards the conveyor belt 3 and grip at least one of the sheets moving in the signature flow for thus lowering the advancing speed thereof to the same speed as the belt 5. Simultaneously, a hook or lance advancing with the same speed as the belt 5 will descend towards the conveyor belt and grip the foremost sheet of the following row of sheets. Alternatively, the speed of the conveyor belt 3 may be increased for proceeding the preceding sheets more rapidly, thus increasing the gap between each signature flow. Since the signature flow in this way is not halted completely as in previous technique, the signatures on the conveyor belt 3

will not pile up as before but will get an overlapping area of about double of the overlapping area being present in the incoming belt 1 because the feeding belt 1 still will be driven at full speed, and such an overlapping will be even and controlled in relation to the speed of the belt 5, and the problem with "growing" of the signature pile will be completely eliminated.

From the above disclosure several possibilities for modification of the sheet feeding according to the above mentioned principles will be possible, e.g. by forming the conveyor belt as a number of belts intermittently with spaced speed-reduction belts 5 and an ascending abutting device for the first speed-reduced sheet where the speed-reducing belt and the abutting device may be lifted at the wanted gripping time. This will, however, represent a more complicated solution than the previously disclosed, and is thus not preferred.

Additionally, it is obvious for a person skilled in the art that a delaying/intercepting device for the signature flow according to the present invention may be situated at any suitable position on the flow of incoming signatures, e.g. as shown in fig. 2, where the delay device (intercept) is placed outside the packing machine (stacker) proper.

Another aspect of the present invention concerns the regulation of the speed by which the forks 4 descend.

As mentioned above the forks 4 descend with a speed which is adjusted to the quantity of fed sheets/signatures from the feeding belt 3. There are, however, several parameters which dictate this speed of descending, whereof two have been mentioned above. Even small variations in the thickness of each sheet will add up in large stacks so that manual adjustment of the lowering speed previously has been required.

It is an object for the present invention to eliminate such manual control by adding automatical control of the lowering speed of the forks 4. It is evident that both a too large and too small lowering speed is undesirable for the production since sheets in the first case will be shot into the room and in the second case will pile up with a possible production stop as a result.

To achieve an automatical regulation of the descending speed of the forks 4 there may be added a monitoring device for level and/or tension of the speed-regulating belt 5, preferably over the stacking area for the signatures in the stacker, or optionally on a separate belt or with a feeling lance, said monitoring device being equipped to adjust the lowering speed so that if the tension/displacement of the feeling belt 5 increases, the feeler will send a signal to the lowering device for the forks 4 to increase the speed, and oppositely when the tension/displacement decreases under a certain level, a signal is sent to decrease the lowering speed of the forks 4.

To mount a device measuring the level/tension/stretch of an extra belt is not previously known to the art, and must in this connection be regarded together with the above disclosed speed-regulating device for the incoming signatures. Evidently, such a monitoring device, being of a type determining the tension/stretch, may also be situated on other suitable places on the speed-reducing belt 5 or on another accompanying belt without departing from the disclosed inventive concept.

For not damaging the first and last sheets in the stacks being produced by the above disclosed stacker, there is usually placed ending plates in each end of the produced stacks. Such a placing of end plates has previously been necessary to perform manually since the exact height of each sheet stack has been impossible to determine exactly for a machine to place correctly on top of the stack.

To be able to place such end plates automatically according to the invention, something being possible by there being produced a gap between each signature stack by the delay mechanism disclosed above, there is mounted an arm with a suction cup on the frame of the stacker with a corresponding stock of end plates (see fig. 2). The arm with the suction cup is mounted on a movable bearing so that the suction cup (or corresponding securing device for end plates), before or when the gap between incoming signatures is produced, grips an end plate, raises said end plate to a position above the upper edge of a ready signature stack, and when the signature stack is sufficiently large, the arm with the ending plate will pivot into position above the signature stack and there liberate the ending plate. This operation is performed after the forks with the signature stack has been lowered to a level below the uppermost incoming level of the arm with an ending plate.

A corresponding operation is performed when placing an ending plate in the bottom of the signature stack, the ending plate then being placed before any signatures have arrived to the holding forks and when the holding forks are in their uppermost position in the stacker device.

From a stacking machine (stacker) for sheets/leaves as disclosed above, the sheet stack is to be transferred to a binding machine (strapper). By such a transfer there is being handled stacks of sheets not yet bound together, and it is accordingly important that the handling of said stacks is performed as safely as possible.

For this reason the ready sheet stacks are according to the invention driven by a propelling system of rolls where the rolls have a free-shifting effect so that they in the rolling direction may roll freely when the rotational speed exceed the advancing speed of the rolls.

To secure the signature stacks there is mounted to the rolls

a holding arm pressing the signature stacks together until they have been secured on the binding station (strapper) and secured with a wrapping band or tape.

From the wrapping station (strapper) the signature stacks are in a conventional manner led to a righting table (tilt table) for further conventional treatment.

C l a i m s

1. Process for producing gaps in a stream of sheets/leaves-/signatures, said stream comprising an overlapping stream of partly overlaying sheets,
c h a r a c t e r i z e d i n that the stream of sheets are sectioned at a given point by decreasing the advancing speed of the overlapping stream intermittently, preferably to half of the initial speed, for thus producing a greater overlapping area of each sheet in the overlapping stream, but preventing piling of sheets on any given point.

2. Process according to claim 1,
c h a r a c t e r i z e d i n that the advancing speed of the incoming overlapping stream of sheets at a position downstream from the speed-decreasing point of the sheets, is increased, preferably to twice the initial speed.

3. Process according to claims 1 or 2,
c h a r a c t e r i z e d i n that there is used an overlapping stream of sheets with a speed of about 10 - 50.000 sheets per hour.

4. Process according to claims 1 - 3,
c h a r a c t e r i z e d i n that when decreasing the speed of the overlapping stream of sheets there is performed a measurement of the growth speed of a produced stack of sheets.

5. Process according to claims 1 - 4,
c h a r a c t e r i z e d i n that there between each produced gap in the stream of sheets is placed an ending plate.

6. Device for packing of leaves/sheets/signatures comprising an incoming conveyor belt for a stream of sheets and a number of forks supporting a stack of leaves/sheets/signatures,

characterized in that the device further comprises a movable intermittent speed-reducing device for the incoming stream of sheets, said speed-reducing device comprising a locally overlaying conveyor belt over the incoming conveyor belt, said local conveyor belt running with a lower speed, preferably half of the incoming conveyor belt, and a gripping device for at least one sheet in the sheet stream, said gripping device moving with the same speed as the local conveyor belt between two extreme locations to produce a gap in the incoming stream of sheets.

7. Device according to claim 6,
characterized in that it additionally comprises a device for control of the growth rate of a produced stack of sheets on the supporting forks, comprising an arm being situated for laying against the top of the produced sheet stack and which will give a signal to the descending speed of the supporting forks in accordance with the growth rate of the sheet stack outside certain given limits.

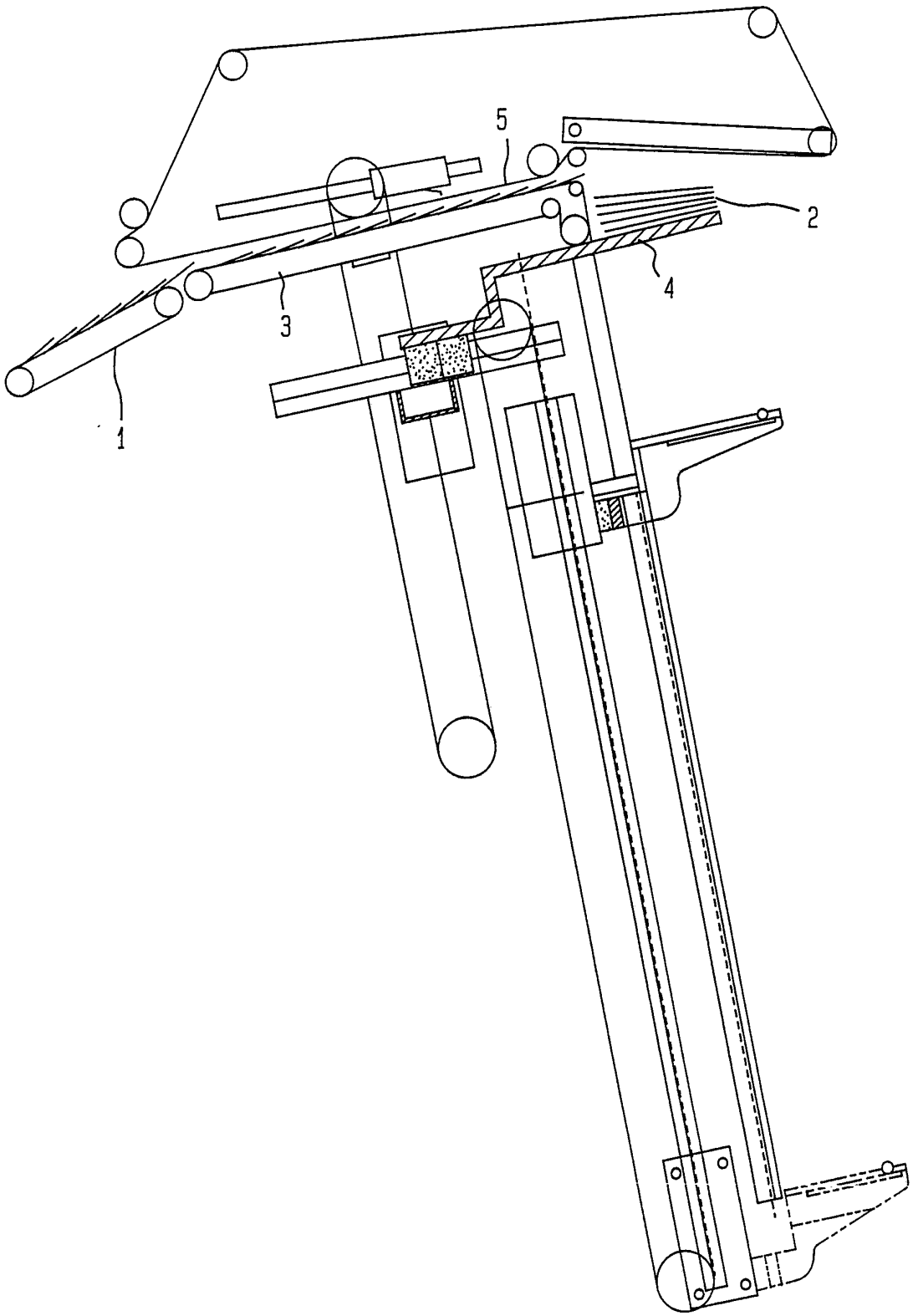
8. Device according claims 6 or 7,
characterized in that it additionally comprises a movable arm for placing ending plates on the produced stack of sheets, said arm being movable from a stock of ending plates preferably situated at the frame of the stacking machine, to a position above the centre of the supporting forks in the horizontal direction, and which in addition is movable vertically over at least the complete length of the working space of the supporting forks, said arm comprising gripping devices, preferably suction cups, for the ending plates, and preferably being guided by signals from the speed-reducing device for the incoming stream of sheets.

9. Device according to claims 6 - 8,
characterized in that it additionally comprises a transporting device containing driven rolls upon

said rolls the stack of sheets are advanced, said rolls having a free-gear effect in the movement of the stack being greater than the driven advancing speed of the rolls.

10. Device according to claim 9, c h a r a c t e r i z e d i n that the transport device additionally comprises holding arms for transport of a completed stack of sheets.

FIG. 1



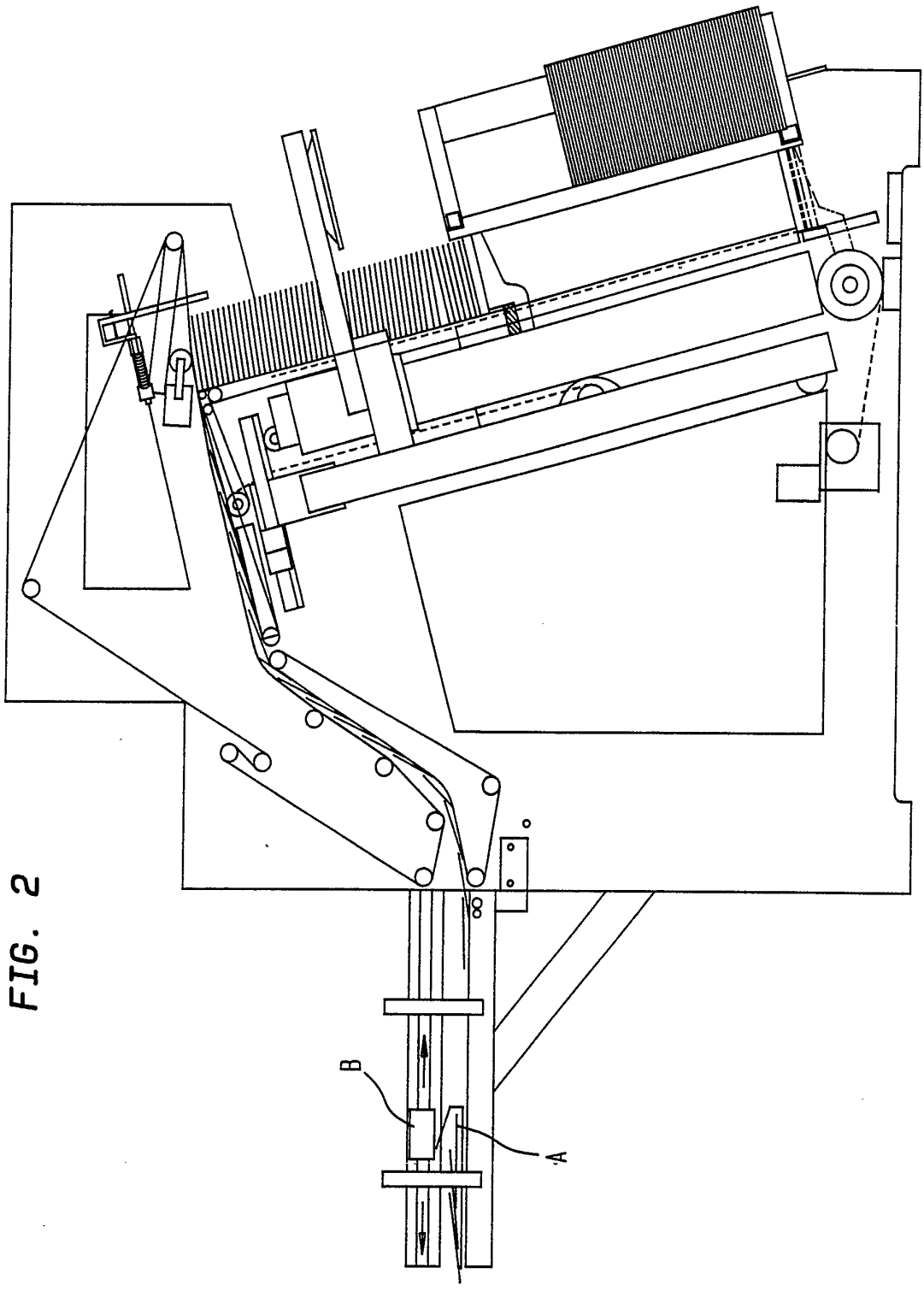


FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No PCT/NO 91/00061

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 65 H 33/12

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 65 H

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO 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]
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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
19th July 1991	1991 -07- 24
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Kjell Lundahl

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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

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