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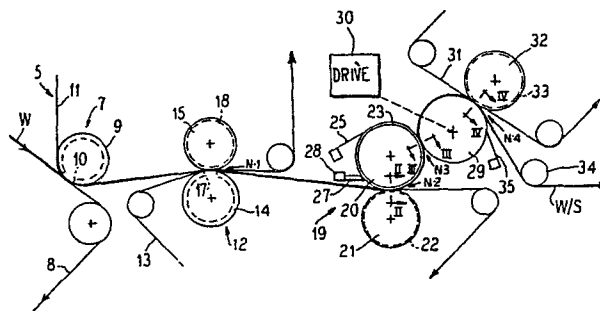
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**Press section for substantially equally pressing both sides of paper web, and method.**

In a paper making machine dewatering press section substantially equal pressing and dewatering of both faces of a freshly felted paper sheet web is effected by running the web through first press roll means providing a double action first dewatering nip between corunning porous dewatering felts, and successively thereafter running the web through a four roll stack providing second, third and fourth nips. In the second nip the web is run in dewatering felt engagement with one face of the web, and the opposite face of the web is in direct press roll engagement in such nip. In the third nip both faces of the web are in direct engagement with the press rolls, and in the fourth nip a second dewatering felt runs in engagements with said opposite face of the web and said one face of the web is in direct press roll engagement. The web leaves the press section as a paper sheet having both faces substantially equally pressed and dewatered.



**EP 0 055 206 A1**

PRESS SECTION FOR SUBSTANTIALLY EQUALLY PRESSING BOTH SIDES  
OF PAPER WEB, AND METHOD

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This invention relates to the art of pressing and dewatering freshly felted paper sheet web, and is more particularly concerned with attaining substantially equal ink, size or coating receptivity or absorption on both faces of a paper sheet resulting from such a web.

Although the art of pressing and dewatering paper web is already rather highly developed, there is still substantial room for improvement.

Prior press sections have suffered from several deficiencies among which may be enumerated undue complexity, excessively long press sections, unequal pressing and felting of the opposite faces of the web, open draws in the press section and requirement for large operating energy expenditure.

Representative of the present state of the art are the following US patents:

- 2 672 078 - has an open draw for the web and does not attain balanced sheet compaction on both faces.
- 3 023 805 - does not have a sufficient number of pressing nips for high speed pressing and dewatering for at least some paper webs.
- 3 286 360 - has fewer nips than desirable for high speed operation and in the multi-nip arrangement requires excessive machine direction space.
- 4 075 056 - does not attain equal pressing and felting of the paper web.
- 4 086 131 - does not attain equal pressing and felting of the faces of the web because one face is subjected to extra felt nips.

An important object of the present invention is to overcome the disadvantages, drawbacks, inefficiencies, short-comings and problems inherent in prior press sections and their operation, and to provide a new and improved press section and method which will attain substantially equal ink, size or coating receptivity or absorption, i.e. compaction, on both faces of a paper sheet resulting from a freshly felted paper sheet web, in a simplified manner, in compact space, free from open draws in the press section, conserves operating energy, and provides for equal pressing and felting of both

faces of the sheet.

To this end, the invention provides in a paper making machine dewatering press section for effecting substantially equal pressing and dewatering of both faces of a freshly felted paper sheet web, first press roll means providing a double action dewatering nip through which the web passes in engagement between corunning porous dewatering felts, so that both faces of the web are substantially equally pressed and dewatered in such nip; second press roll means comprising a four roll stack providing first, second and third nips through which the web runs successively; a first dewatering felt running in engagement with one face of the web through the first nip, and the opposite face of the web being in direct press roll engagement in this nip; both faces of the web being in direct engagement with press rolls in the second nip; and a second dewatering felt running in engagement with the opposite face of the web in the third nip and said one face of the web being in direct press roll engagement in this nip; so that the web leaves the press section as a paper sheet having both faces substantially equally pressed and dewatered and thereby possessed of substantially equal ink, size or coating receptivity or absorption characteristics.

The invention also provides a method of effecting, in a paper making machine dewatering press section, substantially equal pressing and dewatering of both faces of a freshly felted paper sheet web, comprising passing the web in engagement between corunning porous dewatering felts through a double action dewatering nip and in such nip substantially equally pressing and dewatering both faces of the web, and then running the web successively through first, second and third nips in a second press roll means. In the first nip of the second press roll means a first dewatering felt is run in engagement with one face of the web and direct press roll engagement effected of the opposite face of the web in this nip. Direct engagement of both faces of the web is effected in press rolls in the second nip. A second dewatering felt is run in engagement with the opposite face of the web in the third nip, while said one face of the web is run in direct

press roll engagement in the third nip.

Other objects, features and advantages of the invention will be readily apparent from the following description of a certain representative embodiment thereof, taken in conjunction with the accompanying drawing although variations and modifications may be effected without departing from the spirit and scope of the novel concepts embodied in the disclosure and in which:

Fig. 1 is a schematic side elevational view of a paper making machine press section embodying the principles of the present invention;

Fig. 2 is an enlarged fragmentary sectional detail view taken substantially along the line II-II of Fig. 1;

Fig. 3 is a fragmentary enlarged sectional detail view taken substantially along the line III-III of Fig. 1; and

Fig. 4 is an enlarged fragmentary sectional detail view taken substantially along the line IV-IV of Fig. 1.

On reference to Fig. 1, a paper making machine dewatering press section 5 in accordance with the present invention includes a pickoff device 7 adapted to be located adjacently downstream from paper web forming means and operating to lift a freshly formed, i.e. felted, paper sheet web W from a forming belt, wire or fabric 8 for further processing in the press section. For this purpose, the pickoff device 7 comprises a pickoff roll 9 equipped with a suction gland 10 and running in engagement with the upper face of an endless belt dewatering felt 11 which is pressed against the web W on the forming fabric 8 at the nip of the roll 9 with the fabric. Suction from the gland 10 causes the web W to separate from the generally upwardly facing forming fabric 8 and adhere to the generally downwardly facing surface of the dewatering felt 11 which carries the web onward to a first press roll means 12.

In the first press roll means 12, the dewatering felt 11 runs together with an endless upwardly facing second porous dewatering felt with the web W engaged therebetween through a first pressing and dewatering nip N-1 provided by and between a suction roll 14 and a grooved roll 15. In this instance the suction roll 14 is on the lower side of the nip

N-1 and the grooved roll 15 on the upper side of the nip N-1 , so that although in the nip itself substantially equal dewatering results through both faces of the web W, the suction provided by a suction device 17 in the roll 14 effects separation of the web W from the upper felt 11 so that the web W can travel onwardly in machine direction carried on top of the lower felt 13. Desirably, the upper press roll 15 may embody a structure substantially according to U.S. Patent 3 198 697, that is the perimeter of the roll is provided with a set of axially spaced annular grooves 18.

Beyond the nip N-1, the web W is caused to be further pressed and dewatered in second press roll means 19 comprising a four roll stack providing a second nip N-2, a third nip N-3 and a fourth nip N-4 , through which the web runs successively . The nip N-2 is provided by an upper porous covered press roll 20 and a lower grooved roll 21. In the nip N-2 the dewatering felt 13 engages the grooved roll 21 and the lower face of the web W, and the porous covered roll 20 engages the other or upper face of the web. By preference, the grooved roll 21 is similar to the grooved roll 15, having an axially spaced set of circumferential annular grooves 22 (Fig. 2). In addition to facilitating dewatering drainage through the felt 13, the grooves 22 avoid any tendency toward vacuum retention of the web W on the felt 13, so that the web easily releases from the web 13 at the exit from the nip N-2 for travel on the perimeter of the roll 20 to the nip N-3.

For optimum results, the press roll 20 has a porous elastomer cover 23. In a typical press roll configuration for this purpose, the cover 23 may be about 1" thick and formed from a suitable elastomer in a 5 to 30 P & J hardness range, which enables the pressing perimeter of the roll 20 to yield slightly under web pressing nipping pressure to minimize crushing the paper web fibers. The degree of hardness of the cover 23 can at least to some extent be determined by the degree of porosity of the cover, that is the size and number of porosity voids 24 in the material of the cover. As noted in Fig. 2, some of the pores 24 open outwardly at the nipping perimeter of the roll 20 and facilitate operation

of the roll 20 by capturing water pressed from the web W and thus facilitating release of the web from the roll 20 after the web passes through the nip N-3. In order to avoid excessive accumulation of water on the perimeter of the roll 20, a doctor 25 acts on the free offrunning perimeter of the roll 22 beyond the nip N-3. If desired, a felt wick 27 may engage the perimeter of the roll 20 either before or after the doctor 25, but preferably after, for applying a web release agent supplied from supply means 28 with which the wick communicates. Instead of the wick 27, a suitable spray device may be used, if preferred. It will be appreciated, of course, that the pressing perimeter porosity of the cover 23 should be of a character to avoid marring the surface of the web W in contact with the roll at the nips N2 and N3.

In the nip N-3, the web W which has travelled from the nip N-2 on the perimeter of the roll 20, is pressed between the perimeter of the roll 20 and the nipping perimeter of a hard surfaced roll 29. Although the roll 29 may have a plastic cover, it should be of bone hardness and which according to paper machine standards is equivalent to O P & J hardness. Since the nipping perimeter of the roll 29 is smooth, the softer porous perimeter of the roll 20 will easily release the web W from the perimeter of the roll 20 to follow the perimeter of the roll 29 on the offrunning side of the nip N-3. Such release may, of course, be further facilitated by treating the surface of the roll 20 with a release agent as by means of the wick 27. In a preferred arrangement, the roll 29 may be driven rotatably by suitable drive means 30 and cause driving of the other rolls in the stack in the press means 19.

In the nip N-4, the web W is engaged on its lower face directly by the perimeter of the roll 29, and on its upper face by a third endless belt dewatering felt 31 which runs through the nip N-4 with the web W and in engagement with the perimeter of a grooved press roll 32 of substantially the same type as the press rolls 15 and 21, and having a set of axially spaced annular peripheral grooves 33 (Figs. 1 and 4). AT the offrunning side of the nip N-4, the web now

substantially dewatered and densified leaves the roll 29 and the felt 31 and travels on, as for example, past a guide roller 34 as a sheet W/S which is possessed of substantially equal ink, size or coating receptivity or absorption characteristics.

Since the leading end of the web W on leaving the nip N-4 during threading of the press roll means stack 19 may tend to cling to the perimeter of the roller 29, a doctor blade 35 on the perimeter of the roll 29 adjacent to the offrunning side of the nip N-4 will effect separation of the advancing leading end, which can then be directed about the guide roller 34 and onward to a calender, winder, or the like. During normal operation, of course, the doctor 35 is adapted to maintain the perimeter of the roll substantially clean.

As will now be apparent, the substantially equal surface characteristics of the paper sheet W/S leaving the press section 5 results from the substantially equal dewatering and pressing treatment applied to each of the web faces in progressing through the press section. In the nip N-1, dewatering is effected through both of the web faces, that is, water is caused to leave through both of the faces and thus fines in the web migrate substantially equally from the core of the web toward each face.

In the nip N-2 dewatering is effected through the lower face of the web W as indicated by the directional arrow in Fig. 2, while the upper face is compacted by the perimeter of the roll 20.

On traveling through the nip N-3, the web W is substantially equally compacted by the direct nipping engagement of the rolls 20 and 29 with the opposite faces, as exemplified in Fig. 3 by the double headed arrow.

Then, in the nip N-4, the upper face of the web W is finally dewatered as indicated by directional arrow in Fig. 4, while the lower face of the web is finally compacted by the roll 29.

Therefore, not only is the web W thoroughly compact to provide a strong sheet WS, but each face of the web has substantially equal concentration of fines so that the

desirable equal receptivity or absorption characteristics are attained.

It will be understood that variations and modifications may be effected without departing from the spirit and scope of the novel concepts of this invention.

CLAIMS:

1. In a paper making machine dewatering press section for effecting substantially equal pressing and dewatering of both faces of a freshly felted paper web:

first press roll means providing a double action dewatering first nip through which the web passes in engagement between corunning porous dewatering felts, so that both faces of the web are substantially equally pressed and dewatered in such nip;

second press roll means comprising a four roll stack providing second, third and fourth nips through which said web runs successively;

a dewatering felt running in engagement with one face of said web through said second nip, and the opposite face of said web being in direct press roll engagement in this nip;

both faces of said web being in direct engagement with press rolls in said third nip;

and a dewatering felt running in engagement with said opposite face of said web in said fourth nip and said one face of said web being in direct press roll engagement in this nip;

so that said web leaves said press section as a paper sheet having both faces substantially equally pressed and dewatered and thereby possessed of substantially equal ink, size or coating receptivity or absorption characteristics.

2. A press section according to claim 1, wherein said first press roll means comprises a suction roll and a grooved roll in nipping relation.

3. A press section according to claim 1, wherein said second press roll means comprises a grooved press roll engaging said dewatering felt in said second nip, and a porous covered press roll engaging directly with the web in said second nip.

4. A press section according to claim 1, wherein said third nip is provided by and between a smooth hard-surface press roll and a relatively softer porous covered press roll.

5. A press section according to claim 1, wherein said

fourth nip is provided between a smooth hard surface roll in engagement with the web and a grooved roll in engagement with said fourth nip dewatering felt.

6. A press section according to claim 1, wherein said first press roll means comprise a suction roll and a grooved roll providing said double action dewatering nip; and said second press roll means comprise a grooved roll and a relatively soft porous covered roll providing said second nip, a smooth hard-surface roll providing with said porous covered roll said third nip, and a grooved press roll cooperating with said hard surface press roll to provide said fourth nip.

7. In a paper making machine dewatering press section for attaining substantially equal ink, size or coating receptivity or absorption on both faces of a paper sheet: a pickoff device adapted to be located adjacently downstream from paper web forming means and including a downwardly facing first porous dewatering felt and means for separating a freshly formed paper web from a generally upwardly facing forming belt onto said first felt; an upwardly facing second porous dewatering felt; first press roll means providing a first pressing and dewatering nip through which said first felt and said second felt run together with said web engaged therebetween, and said web then travelling onward on top of said second felt, and said first felt leaving said web; and second press roll means having

- (a) a porous cover roll and a grooved roll providing a second nip through which nip said second felt and said web run, with said second felt engaging said grooved roll and one face of said web and said porous covered roll engaging the other face of said web,
- (b) a hard surface roll in a third nip relation to said porous cover roll, and said web traveling on said porous cover roll from said second nip and then through said third nip and in direct face engagement with said porous and hard surface rolls,
- (c) another grooved roll in fourth nip relation to said hard surface roll,

(d) a third dewatering felt running through said fourth nip in engagement with said another grooved roll, and said web traveling on said hard surface roll and through said fourth nip, with said third felt intervening between said web and said another grooved roll and then separating from and leaving said web which travels on from the press section for further handling;

the web thus leaving said press section as a sheet with both faces substantially equally pressed and dewatered, and thereby providing for said substantially equal receptivity and absorption in the paper sheet.

8. A method of effecting, in a paper making machine dewatering press section, substantially equal pressing and dewatering of both faces of a freshly felted paper sheet web, comprising:

pressing the web in engagement between corunning porous dewatering felts through a double action dewatering first nip and in such nip substantially equally pressing and dewatering both faces of the web;

then running the web successively through second, third, and fourth nips in a second press roll means, and including:

running a dewatering felt in engagement with one face of said web in said second nip and in this nip effecting direct press roll engagement of the opposite face of the web;

effecting direct engagement of both faces of the web with press rolls in the third nip;

and running another dewatering felt in engagement with said opposite face of the web in the fourth nip while running said one face of the web in direct press roll engagement in said fourth nip;

so that said web leaves said press section as a paper sheet having both faces substantially equally pressed and dewatered and thereby possessed of substantially equal ink, size or coating receptivity or absorption characteristics.

9. A method according to claim 8, comprising running said corunning porous dewatering felts in said first press roll means first nip between a suction roll and a grooved roll.

10. A method according to claim 8, comprising in said

second nip engaging the dewatering felt with a grooved press roll and engaging the web directly with a porous covered press roll.

11. A method according to claim 8, comprising in said third nip running said web in direct engagement between a smooth hard-surface press roll and a relatively softer porous covered press roll.

12. A method according to claim 8, comprising in said fourth nip running the web in engagement with a smooth hard-surface roll and running said another dewatering felt in engagement with a grooved roll.

13. A method according to claim 8, comprising effecting double action dewatering in said first press roll means in the nip of a suction roll and a grooved roll; and in said second press roll means running the web between a grooved roll and a relatively soft porous cover roll in the second nip, running the web between a smooth hard surface roll and a porous cover roll in said third nip, and running the web between a grooved press roll cooperating with said hard surface press roll in said fourth nip.

14. In a method of attaining substantially equal ink, size or coating receptivity or absorption on both faces of a paper sheet in a paper making machine dewatering press section:

picking off freshly formed paper web from a generally upwardly facing forming belt onto a downwardly facing first porous dewatering felt at a location adjacently downstream from paper web forming means; running said web engaged between said first felt and an upperly facing second porous dewatering felt through a first pressing and dewatering nip in first press roll means, and beyond said first nip effecting travel of the web on top of said second felt and separating said first felt from the web;

and then in second press roll means

(a) running said web and said second felt through a second nip between a porous cover roll and a grooved roll with said second felt engaging said grooved roll and one

face of said web and said porous cover roll engaging the other face of said web,

(b) effecting travel of said web on said porous cover roll from said second nip and through a third nip between said porous cover roll and a hard surface roll and contacting the web directly in engagement with said porous and hard surface rolls,

(c) running said web through a fourth nip between said hard surface roll and another grooved roll,

(d) in said fourth nip running a third dewatering felt in intervening relation between said another grooved roll while said web continues traveling on said hard surface roll,

and then beyond said fourth nip effecting separation of the third felt from the web and causing the dewatered and pressed web to travel on from the press section for further handling;

the web thus leaving said press section as a sheet with both faces substantially equally pressed and dewatered, and thereby providing for said substantially equal receptivity and absorption in the paper sheet.

Fig. 1

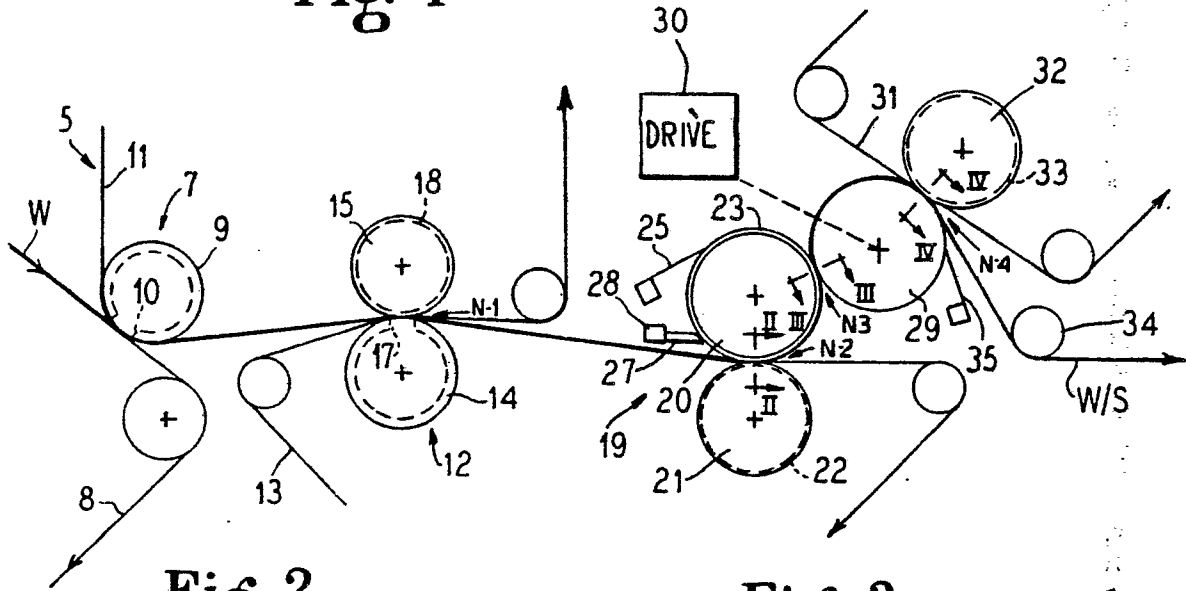


Fig. 2

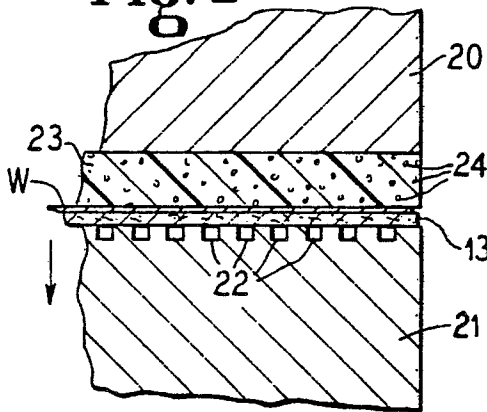


Fig. 3

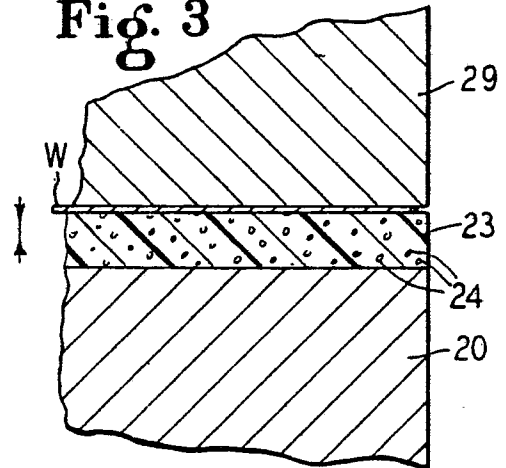
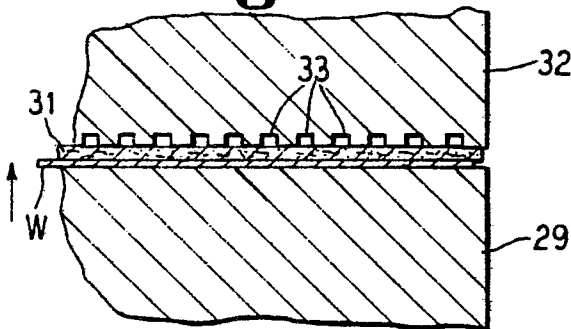


Fig. 4





European Patent  
Office

EUROPEAN SEARCH REPORT

0055206

Application number

EP 81 63 0083

| DOCUMENTS CONSIDERED TO BE RELEVANT |   |                           | CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)   |
|-------------------------------------|---|---------------------------|--|
| Category                            | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim         |  |
| A                                   | <u>GB - A - 697 774</u> (HEYS)<br>* The whole document *                      | 1,7,8,<br>12,14           | D 21 F 3/04  |
|                                     | --  |                           |  |
| A                                   | <u>GB - A - 1 381 360</u> (VALNET OY)<br>* The whole document *               | 1,2,5,<br>7,8,9,<br>12,14 |  |
|                                     | --  |                           |  |
| A                                   | <u>US - A - 4 188 262</u> (KANKAANPAA)<br>* The whole document *              | 1,2,5,<br>7,8,9,<br>12,14 | TECHNICAL FIELDS SEARCHED (Int.Cl. 3)  |
|                                     | --  |                           |  |
| A                                   | <u>DE - C - 273 783</u> (RUDIGER)<br>* The whole document *                   | 1,7,8,<br>12,14           | D 21 F   |
|                                     | --  |                           |  |
| A                                   | <u>US - A - 3 268 390</u> (ELY SR.)   |                           |  |
| A                                   | <u>US - A - 3 198 693</u> (JUSTUS)  |                           |  |
| A                                   | <u>FR - A - 2 343 858</u> (NEYRPIC)   |                           |  |
|                                     |   |                           | CATEGORY OF CITED DOCUMENTS  |
|                                     |   |                           | X: particularly relevant if taken alone<br>Y: particularly relevant if combined with another document of the same category<br>A: technological background<br>O: non-written disclosure<br>P: intermediate document<br>T: theory or principle underlying the invention<br>E: earlier patent document, but published on, or after the filing date<br>D: document cited in the application<br>L: document cited for other reasons |
|                                     |   |                           | &: member of the same patent family, corresponding document  |
| X                                   | The present search report has been drawn up for all claims                    |                           |  |
| Place of search                     | Date of completion of the search  | Examiner                  |  |
| The Hague                           | 24-03-1982  | DE RIJCK                  |  |