(51) International Patent Classification: B28B 7/30 // 11/00
(11) International Publication Number: WO 98/42484
(30) Priority Data: 9701043-3 21 March 1997 (21.03.97) SE
(21) International Application Number: PCT/SE98/00425
(22) International Filing Date: 10 March 1998 (10.03.98)
(43) International Publication Date: 1 October 1998 (01.10.98)
(44) Requested Language: SE
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(54) Title: DEVICE AND METHOD FOR MOULDING A CONCRETE ELEMENT

(57) Abstract

The present invention relates generally to a device and a method for casting concrete elements or slabs. The invention concerns especially a method for casting concrete elements comprising the steps of: preparing a base (1) for casting; placing a mould (5) on the base (1); pouring fresh concrete (7) into the mould (5), which in curing forms the concrete element (8); and allowing the fresh concrete (7) to cure until at least a predetermined minimum shape permanence of the concrete element (8) has been achieved. The invention is characterized by the steps of, when the concrete element (8) has achieved said shape permanence, raising it from the base (1) to temporarily disengage its underside therefrom to essentially eliminate the forming of any shear stresses as the concrete element (8) shrinks, thereby preventing the occurrence of any shrinkage cracks; and, after the concrete element (8) has essentially finished shrinking, lowering it onto the base (1) to be used.
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DEVICE AND METHOD FOR MOULDING A CONCRETE ELEMENT

The present invention relates generally to a device and a method for moulding or casting concrete elements or slabs. The invention concerns especially a method for casting concrete elements comprising the steps of preparing a base for casting; placing a mould on the base; pouring fresh concrete into the mould, which in curing forms the concrete element; and allowing the fresh concrete to cure until at least a predetermined minimum shape permanence of the concrete element has been achieved.

Background Art

Concrete elements such as concrete slabs or floors for use, for instance, as pavement or as floor surface in industrial buildings or dwellings, are today in most cases formed according to the principle "floor construction laid directly on the ground". A "floating floor" is essentially formed in the same manner as a "floor construction laid directly on the ground" and is increasingly used in dwelling houses and office buildings since this construction has excellent vibration-absorbing properties. The most common construction, however, is a "floor construction laid directly on the ground". The present invention can be used in both cases.

A problem in connection with the casting of concrete elements, such as concrete floors, according to the prior-art technique is caused by cracks forming when the concrete shrinks as water disappears. The occurrence of so-called shrinkage cracks can be explained in a simplified way by the fact that the base on which the floor has been cast exerts an external force on the concrete floor when this strives to shrink, which leads to tensile stresses exceeding the strength of the concrete being applied owing to shear stresses on the underside of the
floor. These stresses which are caused by the shrinkage of the material are often greater than the stresses which the floor is intended to absorb from loads. Thus, these shrink stresses often determine the dimensions of the floor. The cracks cause, among other things, a lower load capacity of the floor and reduced wear resistance and resistance to chemical and mechanical attacks. Moreover, dirt which is difficult to wash away can easily collect in the cracks. Therefore the cracks are found to be negative also from the aesthetical point of view and may add hygienic problems. Considerable resources are used today for the reconditioning of floors which have degraded prematurely owing to shrinkage cracks.

Today a number of different prior-art techniques are available to prevent the occurrence of cracks or reduce their negative effect. One method is to choose a mix proportion which yields little shrinkage, i.e. mainly by choosing low water and cement contents. This, however, results in a small effect on the shrink stresses and therefore provides no solution to the problem. According to another technique, joints are made in the floor at small intervals, which makes it possible to direct the shrink movements of the floor to these joints. The making of joints, however, is an expensive operation and may cause new problems, for example, reduced load-absorbing capacity and degradation resistance. In another method, non-tensioned reinforcement of the floor is arranged to promote the occurrence of a great number of fine cracks. Reinforcement of floors is expensive and besides the reinforcement limits merely the width of the cracks, not their occurrence. Another solution to the problem of shrinkage cracks is the mixing of fibres into the concrete. This, too, is expensive and besides, owing to the varying orientation of the fibres, all fibres will not be of use in the absorption of forces causing the cracking. In a further method prestressing steel is inserted in the floor to prevent the occurrence of the cracks. Prestress-
ing steel, however, is both expensive and complicated to insert.

A common feature of all types of reinforcing operations is that they include heavy work and, thus, cause danger to the health in the building work.

A further problem in the casting of, for instance, concrete floors, especially floors laid directly on the ground, is the so-called edge-rising phenomenon. The reason for edge rising is that the concrete shrinks more on the upper side than on the underside, which depends on the fact that the amount of water disappearing from the upper side is larger than on the underside of the cast concrete floor. Edge rising problems also arise in joints and cracks in the floor.

With a view to preventing edge rising problems, there are a number of established techniques. One method is the choosing of a mix proportion causing little free shrinkage (which can be achieved by choosing a mix proportion with low water and cement contents). A further method is the limiting of the floor thickness. Another method is the arranging of joints in the floor. Finally, it is also possible to subject the floor to vacuum treatment according to conventional technique. In most cases, however, all these techniques yield a poor result and/or are time consuming and expensive.

One more problem of prior-art technique is that the construction times for concrete floors and the like are often very long owing to the time it takes for the concrete to dry. This may result in the concrete not being allowed to dry completely before a flooring material, for instance, a plastic carpet, is laid on the floor. There is thus a risk that remaining moisture is confined under the flooring, which may cause damage due to moisture and emission problems. A known solution to this problem is the using of so-called self-drying concrete, but this solution gives in many cases a poor result.
US-A-3,040,411 discloses a method of making a structural concrete construction. The method comprises the steps of casting the construction on the ground and then raising it to working height by means of inflatable containers arranged under the concrete construction. The invention is directed to a method for making a construction which is positioned above the base, and does not solve any of the above-mentioned problems.

US-A-5,426,896 discloses a method of preventing settlement damage in building constructions. To this end, the method comprises the step of arranging elements which are filled with liquid and on which the construction rests. Thus, if the ground should rise in a location, the container in this location would be punctured, whereby the building construction would still stand on an even base. Nor does this patent disclose a solution to the above-mentioned problems.

There is thus a need for an improved method of casting concrete elements and a device for carrying out this method which obviate the above-mentioned problems.

An object of the present invention therefore is to provide a method and a device for casting concrete elements which substantially prevent the occurrence of shrinkage cracks.

One more object of the present invention is to provide a method and a device for casting concrete elements which substantially prevent the occurrence of edge rising phenomena.

A further object of the present invention is to provide a method and a device for casting, which result in quicker drying of concrete elements and, consequently, shorter construction times.

**Summary of the Invention**

The above-mentioned objects are achieved by a method and a device which have the distinguishing features stated in the appended claims.
According to one aspect of the invention, a method is provided for casting concrete elements, which is essentially characterised by the steps of:

when the concrete element has achieved said shape permanence, raising it from the base in order to temporarily disengage its underside therefrom in order to essentially eliminate the formation of any shear stresses as the concrete element shrinks, thereby preventing the occurrence of any shrinkage cracks; and

after the concrete element has essentially finished shrinking, lowering it onto the base to be used.

According to another aspect of the present invention, a device is provided for casting concrete elements, for carrying out the inventive method, comprising a mould which is adapted to be placed on a prepared base, the device being essentially characterised by:

a lifting device comprising a container means adapted to expand by supplying pressurised fluid, the container means being adapted to be arranged on the base before fresh concrete is poured into the mould for raising it, when the concrete element has achieved said shape permanence, by said supply of fluid, from the base to temporarily disengage its underside therefrom in order to essentially eliminate the formation of any shear stresses as the concrete element shrinks, thereby preventing the occurrence of any shrinkage cracks.

Further developments of the method and the device will appear from the features that are stated in the sub-claims.

By at least a predetermined minimum shape permanence is meant in the present application that the concrete element has sufficient strength for remaining deformations and cracking essentially not to arise when the concrete element is raised from the base and is maintained in the raised position. As a rule, such strength can already be achieved after about a day.
Several advantages are achieved by the new method and device for casting concrete elements. For example, it is possible to use concrete with a higher water-cement ratio since a higher water content can be compensated for by evaporation of water from the concrete element both from the upper side and from the underside. This results in both economical and environmental advantages. The fact that the element can be made to dry also from the underside also yields shorter building times, which is another advantage. The drying time can be reduced to a quarter by drying out the concrete element from the underside as well as the upper side. This corresponds in prior art to a drying time for an element which is half as thick.

One more advantage of the present invention is that a thus cast floor can be raised at a later stage to permit relaxation of any residual stresses.

Another important advantage is that since lower demands are placed on the strength of the concrete owing to the fact that less consideration must be paid to shrink stresses, for instance, recycled concrete can be used to a greater extent. Recycling has become more and more important since aggregate, mainly gravel, has turned into a commodity in short supply. Moreover, the dumping fees for concrete material have risen and will probably be further increased in the future. This, too, leads to a more economical and environmentally acceptable manufacture. Besides, less reinforcement is in many cases required for the concrete, which is also due to the lower strength demands. Less reinforcement work gives great advantages from working environment aspects and also shorter production times and lower costs for e.g. the production of floors.

Further advantages and distinguishing features will be evident from the following specification.
Brief Description of the Drawings

The present invention will now be described in more detail by way of examples and with reference to the accompanying drawings, in which

Fig. 1 is a schematic perspective view of an edge form prepared with a lifting device in the form of a plurality of parallel inflatable tubes;

Fig. 2 is a schematic broken-out section of the floor and the base in Fig. 1 after the pouring of concrete;

Fig. 3 is a schematic broken-out section showing the concrete floor in a raised state;

Fig. 4 is a schematic broken-out section which shows how air has been discharged from some of the tubes;

Fig. 5 is a schematic broken-out section showing the concrete floor in a lowered state and prepared to be used;

Fig. 6 is a schematic section of the edge form and shows a lifting device with a single container;

Fig. 7 is a schematic section of the edge form and shows an alternative embodiment of the lifting device in Fig. 6;

Fig. 8 is a schematic perspective view similar to that in Fig. 1, showing a further embodiment of the lifting device;

Fig. 9 is a schematic section of the edge form and shows one more embodiment of the lifting device; and

Fig. 10 is schematic section of the edge form and shows a further embodiment of the lifting device.

Detailed Description of Preferred Embodiments

With reference to Figs 1-5, the method and the device, according to a currently preferred embodiment of the present invention, for the casting of a concrete floor on the ground will be described. In a first step, a base 1 for the casting of a concrete floor is prepared in a conventional manner. In this embodiment, a well com-
pacted bed 2 of gravel or crushed aggregate has been prepared. The bed 2 is then covered with a perforated plastic sheeting or geotextile 3, on which a layer of sand 4 is arranged to provide an even and flat surface. The geotextile 3 is intended to hold the sand separated from the bed 2 of crushed aggregate. Finally, a mould or an edge form 5 is placed on the base 1.

In a second step, the edge form 5 and the base 1 are provided with a release layer in the form of a plastic sheeting 6 arranged to prevent the fresh concrete, which is to be poured, from adhering to the edge form 5 and the base 1. The release layer may also consist of a coating with, for instance, wax or form oil on the edge form 5 or the plastic sheeting 6. By using the plastic sheeting 6 as release layer, the concrete can be prevented from drying out from below during curing, which consequently prevents the concrete slab from beginning to shrink at the lower part. Moreover, there is arranged in the edge form 5 and on top of the plastic sheeting 6 a lifting device in the form of a tubing system or flexible tubes 10 which extend in parallel with each other from one edge of the form to the opposite. The tubes 10 comprise a textile fabric which is coated with rubber on the inside as well as the outside. Each tube 10 is preferably provided at each end with a controllable valve. Moreover, the tubes 10 communicate with each other. Also the tubes 10 may, if so desired, be provided with a corresponding release layer so as not to adhere to the fresh concrete. The tubes 10 can easily be "tied off" at an optional length, e.g. by means of a tube clip, to adjust their length to the size of the edge form 5 (not shown).

In a third step, the edge form 5 is filled with the fresh concrete 7, which is then processed in accordance with prior-art technique. The curing of the concrete 7 starts. In prior art there are a number of methods available for carrying out the curing of the concrete 7, for instance, the concrete surface can be watered continuous-
ly or coated with a coating layer which prevents water from evaporating from the concrete. As long as the concrete does not lose water to the surroundings, it does not shrink noticeably.

In the fourth step, the curing is terminated, for example, by removing the coating layer when a predetermined minimum shape permanence or sufficient strength of the formed concrete slab or floor has been achieved. As a rule, such shape permanence is achieved after one or two days. Subsequently air is pumped into the tubes, which expand and raise the concrete floor from the base according to Fig. 3. By a minimum predetermined shape permanence is meant that the concrete floor has such a strength that cracking and permanent deformations do not arise when the concrete floor is to be raised from the base by means of the tubes. The edge form is held in place on the base to provide stability during raising. Optionally, the edge form can be anchored to the concrete floor and accompany this as the tubes raise the floor from the base. By the tubes communicating with each other, they apply a uniformly distributed force to the floor. In this step, also the plastic sheeting can be arranged between the tubes and the sand can be removed to be optionally reused, according to Fig. 4. If the plastic sheeting is removed as shown in Fig. 4, a certain degree of drying from the underside of the floor is permitted also when this is lowered against the base. When the floor is raised, drying can be further accelerated by using, for instance, a fan which produces an air current under the floor and dries the underside of the floor in the air gaps between the tubes. In case a tube should be punctured, it can readily be isolated from the others and be replaced if necessary.

In the fifth and last step, the concrete floor has essentially finished shrinking and is ready to be lowered towards the base. As a rule the floor is allowed to
stay in the raised state for a certain period. Before lowering the floor 8, some of the tubes 10 can optionally be recycled by, for instance, discharging air from every second tube 12, according to Fig. 4, and subsequently removing these from the base. In this state, the remaining tubes 11 maintain on their own the concrete floor 8 in the raised state. The removed tubes 12 can thus be reused for use in the casting of another floor.

Then the concrete floor 8 can, according to Fig. 5, be lowered to rest against the base 1. When the concrete floor 8 has been lowered, it can be used immediately or be further treated, e.g. be painted or coated with a carpet.

It is also possible to once more raise the floor 8 at a later stage to relax stresses, if any. One more possibility is allowing the floor 8 to shrink in the raised state during a plurality of short periods. For example, it is possible to let the floor 8 rest against the base in the daytime when it is used and raise it at night to allow shrinking, thereby avoiding cracking and edge raising.

Fig. 6 shows an alternative embodiment of the lifting device. The lifting device comprises in this case a single large and flexible container 15 which can be expanded by, for instance, pumping in air. This single container 15 is arranged, in the same way as the tubes 10, in the edge form on the base 1, whereupon the fresh concrete 7 is poured. Using a single large container 15 has the advantage of uniformly distributing the lifting forces over the underside of the entire concrete floor 8.

By the container 15 in Fig. 6 covering the underside of the entire concrete floor 8, the advantageous possibility of allowing the concrete floor 8 to dry from both sides, however, is not achieved. Fig. 7 shows a container 15' of the same type as in the preceding Figure, but here the container is provided with separately inflatable "ribs" 16 on the upper side. The ribs 16 can
thus be inflated when the drying of the concrete floor 8 from below is desirable.

Fig. 8 shows one more embodiment having expandable containers. This embodiment comprises a plurality of inflatable bags 18 which have been arranged on the base 1 before casting. The bags 18 are connected to each other by means of tubes 19 for applying, like the tubes 10, a uniformly distributed lifting force. In principle, the bags 18 can be given any form whatever. The bags 18 are not necessarily connected to each other, but can also be imagined to be separate elements.

A plurality of different fluids can be used to expand the containers 10, 15, 15', 16 and 18 described above, for instance, water or a gas. The currently most advantageous fluid, however, is compressed air since it is usually available on most building sites.

The described containers are preferably made of a flexible membrane, e.g. rubber or rubber-coated textile. The membrane material should preferably not be too rigid since this may possibly cause comparatively great, negatively affecting shear forces between container and concrete floor. The important thing is, however, that the containers are able to maintain the concrete floor 8 raised by means of the fluid used. Besides, to reduce said shear forces, two plastic sheetings can be placed one upon the other between the containers 10, 15, 15', 16 and 18 and the concrete floor.

Instead of the technique of using expandable containers, it is possible to use other devices and methods for raising the concrete slab or floor 8. Fig. 9 shows a device having a plurality of vertically displaceable cylinders 21, which are uniformly distributed under the concrete slab 8. The cylinders 21 are in their upper portions fitted with roller bearings 22 which engage the concrete slab 8, thereby not applying any shear forces to the concrete slab 8. Moreover, the cylinders 21 are oper-
able to be displaceable in the vertical direction and, thus, raise the concrete slab 8 from the base 1.

Fig. 10 shows a concrete slab 8 which in connection with the casting has been provided with a plurality of lifting eyelets 25 which are uniformly distributed over the upper side of the concrete slab 8. When the concrete slab has obtained sufficient strength, it is raised from the base by means of straps or belts 26 which are attached to the eyelets 25, by means of some lifting device, e.g. a travelling crane, and is allowed to shrink freely.

It goes without saying that also other concrete elements than floors can be cast by means of the method described above, e.g. various wall elements. The method for casting upright concrete walls differs insignificantly from the method for casting floors. There may be differences in the choosing of the base, which, when casting walls, can in many cases be a concrete base, and the mould can have an essentially greater vertical extent when casting walls than in connection with concrete floors. Besides, different demands are placed on lifting force in, for instance, the tubes.

It is also conceivable to manufacture wall elements extended horizontally by casting them on a base according to the method described above. Then these so-called prefabricated wall elements can be transported to the desired building site.

The invention is not limited to that described above or shown in the drawings and can be modified within the scope of the appended claims.
CLAIMS

1. A method for casting concrete elements (8) comprising the steps of:
   preparing a base (1) for casting;
   placing a mould (5) on the base (1);
   pouring fresh concrete (7) into the mould (5), which in curing forms the concrete element (8); and
   allowing the fresh concrete (7) to cure until at least a predetermined minimum shape permanence of the concrete element (8) has been achieved, characterised by the steps of:
   when the concrete element (8) has achieved said shape permanence, raising it from the base (1) to temporarily disengage its underside therefrom in order to essentially eliminate the formation of any shear stresses as the concrete element (8) shrinks, thereby preventing the occurrence of any shrinkage cracks; and
   after the concrete element (8) has essentially finished shrinking, lowering it onto the base (1) to be used.

2. A method for casting concrete elements (8) according to claim 1, characterised by the step of:
   when the concrete element (8) has been raised, making its underside dry to prevent the occurrence of any edge rising phenomena and provide a shorter drying time.

3. A method for casting concrete elements (8) according to claim 1 or 2, characterised by the step of:
   providing the base (1) and/or the mould (5) with a release layer (6) arranged to essentially prevent the fresh concrete (7) from adhering to the base (1) and the mould (5).
4. A method for casting concrete elements (8) according to any one of the preceding claims, characterised by the step of:

arranging on the base (1) a lifting device (10, 15, 15', 16, 18, 21, 22), which is adapted to essentially absorb forces of pressure, the fresh concrete (7) being cast on top of the lifting device (10, 15, 15', 16, 18, 21, 22) and the raising of the concrete element (8) being carried out by means of said lifting device (10, 15, 15', 16, 18, 21, 22).

5. A method for casting concrete elements (8) according to claim 4, characterised by the step of:

providing the lifting device (10, 15, 15', 16, 18, 21, 22) with a release layer arranged to essentially prevent the fresh concrete (7) from adhering to the lifting device (10, 15, 15', 16, 18, 21, 22).

6. A method for casting concrete elements (8) according to claim 4 or 5, characterised by the step of:

raising the concrete element (8) by supplying pressurised fluid to a flexible container means (10, 15, 15', 16, 18) of the lifting device, the container means (10, 15, 15', 16, 18) being adapted to expand in the vertical direction to raise the concrete element (8).

7. A method for casting concrete elements (8) according to claim 6, characterised by the step of:

arranging said container means, in the form of elongate, flexible tubular elements (10), essentially in parallel with each other on said base (1).

8. A method for casting concrete elements (8) according to claim 7, characterised by the step of:

discharging fluid from some (12) of said tubular elements (10) while the remaining tubular elements (11) are maintained pressurised by means of the fluid to maintain-
tain the concrete element (8) raised from the base (1) until the first-mentioned tubular elements (12) have been removed from the base (1) for possible reuse.

9. A method for casting concrete elements (8) according to any one of the preceding claims, characterised in that the concrete element is adapted to be oriented horizontally.

10. A method for casting concrete elements (8) according to any one of the preceding claims, characterised in that the concrete element is adapted to be oriented vertically.

11. A device for casting concrete elements (8), for carrying out the method according to any one of claims 1-10, comprising a mould (5) which is adapted to be placed on a prepared base (1), characterised in that it also comprises:

a lifting device comprising a container means (10, 15, 15', 16, 18) adapted to expand by supply of pressurised fluid, the container means (10, 15, 15', 16, 18) being adapted to be arranged on the base (1) before fresh concrete (7) is poured into the mould (5) for raising it, when the concrete element (8) has achieved said shape permanence, by said supply of fluid, from the base (1) to temporarily disengage its underside therefrom to essentially eliminate the formation of any shear stresses as the concrete element (8) shrinks, thereby preventing the occurrence of any shrinkage cracks.

12. A device for casting concrete elements (8) according to claim 11, characterised in that the container means comprises a plurality of tubular elements (10) to provide a uniformly distributed lifting effect on the concrete element (8) while the major part of the underside of the concrete element (8) is uncovered in the raised state to allow liquid to dis-
appear to prevent the arising of any edge rising phenomena and achieve a shorter drying time.

13. A device for casting concrete elements (8) according to claim 12, characterised in

that said tubular elements (10) are in fluid communication with each other to allow a uniform distribution of pressure between the tubular elements (10).

14. A device for casting concrete elements (8) according to claim 12 or 13, characterised in

that at least some (12) of said tubular elements (10) are arranged to allow fluid to be discharged there-from while the remaining tubular elements (11) are arranged to be maintained pressurised by means of the fluid, to maintain the concrete element (8) raised from the base (1) until the first mentioned tubular elements (12) have been removed from the base (1) for possible reuse.

15. A device for casting concrete elements (8) according to claim 11, characterised in

that the container means comprises a first container element (15') and a second container element (16) comprising a plurality of rib elements, to optionally achieve a uniformly distributed lifting effect by means of the first container element (15') or to uncover the major part of the underside of the concrete element (8) in the raised state, to allow liquid to disappear, by means of the second container element (16).

16. A device for casting concrete elements (8) according to claim 11, characterised in

that the container means comprises a plurality of container elements (18) to achieve a uniformly distributed lifting effect on the concrete element (8) while the major part of the underside of the concrete element (8) is uncovered in the raised state to allow liquid to disappear.
17. A device for casting concrete elements (8) according to any one of claims 11-16, characterised in that the container means is made of a flexible material, preferably a rubber-coated textile.

18. A device for casting concrete elements (8) according to any one of claims 11-17, characterised in that the lifting device comprises a pump means which is adapted to supply compressed air as fluid to said container means (10, 15, 15', 16, 18).
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B28B 7/30 // B28B 11/00
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)

IPC6: B28B, E02D, E04F

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

SE, DK, FI, NO classes as above

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>US 2749592 A (K.O. VARTIA), 12 June 1956 (12.06.56), figure 3</td>
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<tr>
<td>A</td>
<td>US 3040411 A (C.B. MESSENGER), 26 June 1962 (26.06.62), column 2, line 28 - line 43, figures 2, 3</td>
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<td>A</td>
<td>US 3364632 A (P. ISAAC), 23 January 1968 (23.01.68), figure 1, abstract</td>
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\[ Further documents are listed in the continuation of Box C. \]

\[ See patent family annex. \]

Date of the actual completion of the international search: 23 April 1998

Date of mailing of the international search report: 14-05-1998
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