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The invention relates to a process and to a device for the withdrawal of a shuttering element, in the context of the making of a wall moulded in the ground.

Walls moulded in the ground are currently manufactured by casting elementary panels in an alternate manner or in a consecutive manner.

In every case, a shuttering element designed to form a usually concave pattern all along the height of the concreted panel, is commonly fitted at the earthen side of the moulding slit trench, that is to say : at both ends of the primary panels when proceeding in the alternate manner, or at a single end of such panels when proceeding in the consecutive manner. The next following trench is then excavated and thereafter concreted against the pattern thus formed -subsequent of course to the removal of the shuttering element- thus allowing the achievement of a geometrically well-defined wall joint. The presently used shuttering elements have cross-sections of various shapes, the simplest of which is a circle. They are classifiable into two categories of radically different operation :

- the shuttering elements of the first category -of wide-spread use- are designed to be withdrawn as sliding shuttering elements, that is to say by pulling them in their lengthwise direction. It is therefore compulsory to withdraw them prior to complete setting of the concrete (or otherwise the adhesion forces would become, much too excessive to reckon on wrenching release under such circumstances), though subsequent to some degree of stiffening of the concrete (or otherwise the latter would collapse into the void resulting from the withdrawal). It will be realized that the correct selection of the favourable moment for such withdrawal is not an easy matter because it depends on numerous factors of varying impact : nature of the cement and proportion thereof, temperature, concreting speed and so on.

Furthermore, because this withdrawal system is



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5 directly related to the concreting steps, it
complicates the organization of works yards since con-
creting must compulsorily be carried out to completion
without interruption, no matter the incidents which may
occur in the meantime.

10 Lastly, the sliding shuttering elements do not
allow handy location of accessory seals of the "water-
stop" type between two consecutive panels inasmuch as
such seals often cannot withstand the withdrawal of the
shuttering element which subjects them to longitudinal
shearing stresses and therefore to risks of tearing or
wrenching, while they are just getting fastened into a
concrete which only starts setting.

15 On the other hand, the void volume left at the
end of the panel upon withdrawal of the shuttering element,
facilitates excavating the next consecutive trench, by
reason that the excavating tool (bucket) naturally guides
itself in the void volume thus reserved, ensuring geometric
continuity of the wall. It can even remove without major
difficulties concrete masses which may have worked round
the shuttering element via geometric irregularities of the
excavation in which the preceding panel has been moulded.

25 The shuttering elements of the second category also
allow achieving a generally concave pattern over the whole
height of the concreted panel, but they are not withdrawn
like the slidable shuttering panels prior to complete
setting of the concrete. A second category shuttering ele-
ment is left in situ until the concrete is set and the next
consecutive trench is excavated up to contact therewith.

30 It is then dismantled by lateral displacement for
instance as a result of inflation under pressure of flexi-
ble tubes extending over the whole height of the shuttering
element at the side thereof facing the concrete. Such a
second category shuttering element is described for example
35 in the Applicants' French patent publication N° 2473091
(see also U.S. patent N° 3564855 to Mörner).

This category of shuttering elements, in constrast





to the former category allows breaking away from casting
due to the practical conditions of panel concreting, thus
greatly simplifying the organization of yards. Besides, it
allows fitting seals of the "water-stop" type, thanks to
5 its removal by sidewise displacement.

On the other hand, shuttering elements of this
latter category being left in situ during the excavation
steps of the next consecutive trench, there is no longer
at the end of the preceding panel, any void volume permit-
10 ting to guide the excavating tool, so that there is a risk
of deflection and, hence, of defective geometric continuity
of the wall.

The choice of a concave shape for the shuttering
element portion located at the earthen side for the pur-
15 pose of reconstituting a void volume towards the following
trench to be excavated, does not offer a sufficiently re-
liable solution, because, during the concreting process,
there is a risk that concrete invades the void volume which
was to be reserved, owing to the more or less unavoidable
20 geometric irregularities of excavation. The result in such
a case is then that, not only will the contemplated guidance
be out of reach, but the elimination of such concrete
leakages gives rise to a complementary difficulty.

The object of the present invention is to provide
25 a process and device combining the advantages of both
above-mentioned categories of shuttering elements while
avoiding their respective drawbacks. A further object of
the invention is to simplify construction and operation.

This invention is designed to be practised with
30 a shuttering element having a central portion shaped to
the currently concave pattern to be formed at the end of
the manufactured panel, and two wings extending on both
sides of this central portion.

The wings may be planar or of any convenient
35 shape. They may be at an angle with the faces of the central
portion or in extension thereof.

The process of the invention comprises the following



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steps :

- providing a shuttering element of the above specified kind which protrudes above the ground surface;
- fitting on such protrusion of the shuttering element an implement comprising a body-portion and two shaped parts forming side grooves which are slidable upon the wings of the shuttering element, the lower portion of said shaped parts being bevelled so as to form a dismantling wedge;
- 10 - imparting a beating motion to the implement so as to force the wedge-shaped parts between the concreted panel and its shuttering element until their introduction therebetween;
- 15 - pursuing said beating motion so as to drive the implement deeper and deeper until complete release of the shuttering element.

The invention also covers the implement used in carrying out the above-defined process.

- According to a preferred embodiment, the body-portion of the implement presents at its lower part a blade for scraping the non-concreted side of the shuttering element; this blade may be optionally provided with teeth. The object of this blade is to eliminate all the concrete masses which might have worked round the shuttering element when the panel was cast. Besides, the blade ensures, if need be, a re-sizing of the excavation into which the following panel is to be cast.

- The implement may be reciprocated by a winch alternately raising it, then allowing it to fall with the whole of its weight. In such a case, the implement should have an important mass, for example of at least one ton, in order to be effective. It will be most often made of steel and, if desired, a lead ballast may be incorporated therein.

- The shape of the body-portion of the implement is not critical. It may be solid or hollow (for example, open at its upper and lower sides so as to allow free passage of the excavating mud).



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Alternatively, a compressed-air pile-driver could be embodied in the implement itself or an auxiliary pile-driver such as a monkey used for striking the implement and driving it progressively between the shuttering element and the concrete.

According to a further alternative embodiment, the body-portion of the implement is constituted by the excavating bucket itself. It is enough for this purpose to fit, on one of the edges of the skirt of the excavating bucket, wedge-forming grooves so as to guide the bucket on the shuttering element. The bucket is used in open position, with the leading edge scoop of the bucket adjacent the side of the shuttering element playing then the part of the above-mentioned optional scraping blade.

In the accompanying drawings :

Figure 1 is a side view of an implement according to the invention, mounted on a shuttering element;

Figure 2 is a cross-section taken along line II-II of Figure 1;

Figure 3 is a cross-section taken along line III-III of Figure 2;

Figures 4a, 4b, 5, 6a and 6b diagrammatically illustrate the process of the invention in the context of the manufacture of a wall moulded in the ground, Figures 4a, 5 and 6a being elevation views with partial cross-sections whereas Figures 4b and 6b are horizontal cross-sections taken along lines b-b of Figures 4a and 6a respectively.

Figures 1 to 3 illustrate a dismantling implement comprising a body-portion 1, for instance of solid steel and of important mass (1 ton or more), and two shaped side parts 2 integral with the body-portion 1 and forming vertical grooves which may be mounted on and slidable along the shuttering element 3, more specifically along its wings 4, as clearly shown on Figure 2. It is to be noted that the width of the shuttering element 3 must be smaller than the width of the excavation or trench so as to leave each edge a clearance of 2 to 3 cm. enabling the

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implement to slide.

The lower part of body-portion 1 is so shaped as to form a blade 5 which scrapingly engages the non-concreted side of the shuttering element 3. In their turn, the
5 implement-guiding grooves 2 cooperating with the wings 4 are bevelled at their lower part so as to constitute dismantling wedges 6.

The implement may be suspended to the cable of a winch by means of eyelets such as 7 located at the upper
10 part of body-portion 1.

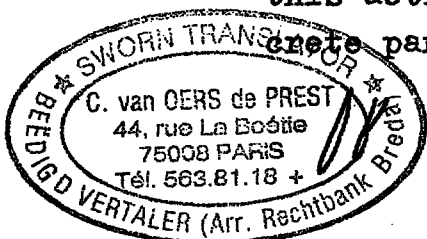
The processing of the invention by means of the implement of Figures 1-3 is illustrated on Figures 4-6.

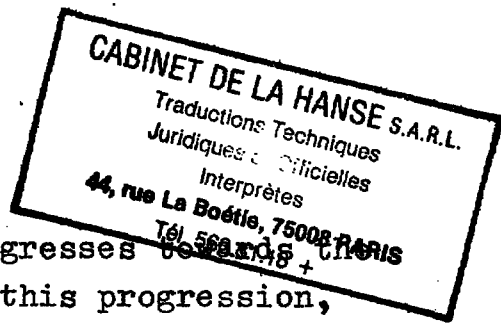
Figures 4a and 4b show a wall panel being moulded in the ground. More specifically, there is shown a panel P
15 which has just been achieved with the shuttering element 3 still in position at the end of such panel. The excavation E into which the following panel will be cast has also been formed in a conventional manner, under bentonitic mud in order to avoid possible falling in of earth. The height of
20 the shuttering element 3 is greater than the depth of excavation E, so as to protrude above ground level. A protrusion of the order of 1 to 2 metres is usually sufficient.

The subject shuttering element 3 presents a convex body-portion C designed for leaving a concave pattern in
25 the concrete of each panel P. A longitudinal slot formed in the body-portion C allows fitting in a conventional seal J of the "water-stop" type.

When the shuttering element 3 is to be withdrawn, the implement of the invention is fitted on the part of the
30 element which protrudes above ground level, the wings 4 engaging the grooves 2 to enable the implement to slide, under positive guidance, along the shuttering element 3. The implement is suspended to a winch by means of a cable 8 as shown.

35 The implement is reciprocated by raising it and then allowing to fall with its whole weight, and so on. Under this action, the wedges 6 work their way between the concrete panel P and the shuttering element 3, and cause the





- latter to separate as the implement progresses to the bottom of the trench. In the course of this progression, blade 5 destroys any concrete stray mass which may have worked round the shuttering element while panel P was being cast, which would not have already been eliminated during the execution of excavation E and which could constitute a hindrance to the withdrawal of the shuttering element. This blade also allows possible re-sizing of excavation E if the latter had slightly departed from its theoretical position.
- 10 When the implement reaches the bottom of the excavation, the shuttering element is freed over its whole height and can be easily withdrawn. It is even often necessary, before completion of this process, to retain the shuttering element at the ground level by means of a cable such as 9 in order to
- 15 prevent it from rashly toppling over into excavation E.

During the withdrawal step, seal J does not risk any damage.

Thus, within a single operation, two basic objectives are reached :

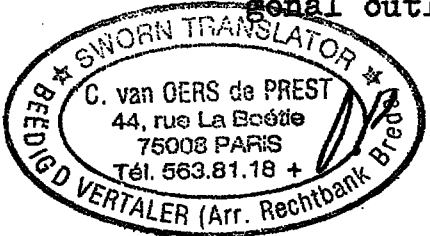
- 20 - withdrawal of the shuttering element,
- geometric continuity of the wall (the re-sizing of the excavation of the following panel by means of the implement guided along the shuttering element fitted in position when making the preceding panel, precluding any deflection in a
- 25 direction perpendicular to the general plane of the wall).

It is actually possible not to wait until the end of the excavation of the following panel, in order to use the implement of the invention, if there are important deflection risks owing to the nature of the soil. The excavation will

30 then be performed by successive vertical cuts of a few metres, in alternatively using the implement of the invention and the excavating bucket.

The withdrawal of the shuttering element and the geometric continuity of the wall can also be achieved in the

35 case wherein two consecutive wall panels must be at an angle with each other as for instance in the manufacture of polygonal outlines. It would suffice for this purpose to alter



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accordingly the shape of the implement.

Obviously, the described embodiments are examples only and it would be possible to modify them, in particular by substitution of the chemical equivalents, without departing from the scope of the invention such as defined by the claims.

It is possible to combine the process of the invention with the use of the dismantling device with inflatable tubes described in the above-mentioned French patent publication N° 2473091.



*For true and correct
translation, from
French into English,*

/ de Prest

- 1 -
C L A I M S



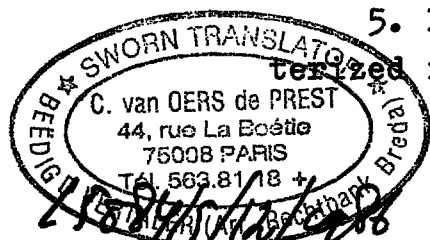
1. Process for the withdrawal of a shuttering element (3) used in making a panel (P) of a wall moulded in the ground, said shuttering element comprising a shaped central portion whose outline corresponds to the pattern to be imparted to the end of the panel to be made, and two wings (4) extending on both sides of said central portion, characterized by the following steps :
- providing such a shuttering element (3) which protrudes above the ground surface;
 - 10 - fitting on the protruding portion of said shuttering element an implement comprising a body (1) and two shaped parts (2) forming side grooves which are slidable upon the wings of said shuttering element, the lower portion (6) of said shaped parts being bevelled so as to form a dismantling wedge;
 - 15 - imparting a beating motion to the implement so as to force the wedge-shaped parts between the concreted panel and its shuttering element until their introduction therebetween; and
 - 20 - pursuing said beating motion so as to drive the implement deeper and deeper until complete release of the shuttering element.

2. Implement for carrying out the process of claim 1, characterized by a body (1) and two shaped parts (2) forming side grooves which are slidable upon the wings (4) of the shuttering element (3), the lower portion of the shaped parts being bevelled so as to constitute a dismantling wedge (6).

3. Implement according to claim 2, characterized in that its body presents at its lower end a blade (5) for scraping the non-concreted side of the shuttering element, teeth being optionally provided on said blade.

4. Implement according to claim 2, characterized in that the body of the implement is constituted by an excavating bucket.

5. Implement according to any of claims 2 to 4, characterized in that it weighs at least one ton.



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