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## (54) Prestressed concrete units and method of manufacture

(57) This invention relates to prestressed concrete units, to a method of manufacture of prestressed concrete units and to a mould system for use in such a method. The invention provides a method of manufacturing a prestressed concrete unit using a mould system comprising an elongate mould containing at least one prestressed element and an elongate hopper having an aperture, comprising the steps of locating at least one reinforcing element in a substantially perpendicular orientation to said mould; filling the elongate mould with concrete to form a first portion of the unit; locating the hopper over said reinforcing element in a substantially perpendicular orientation with the mould; and filling the hopper with concrete such that the concrete flows through the aperture to contact the concrete of the first portion.

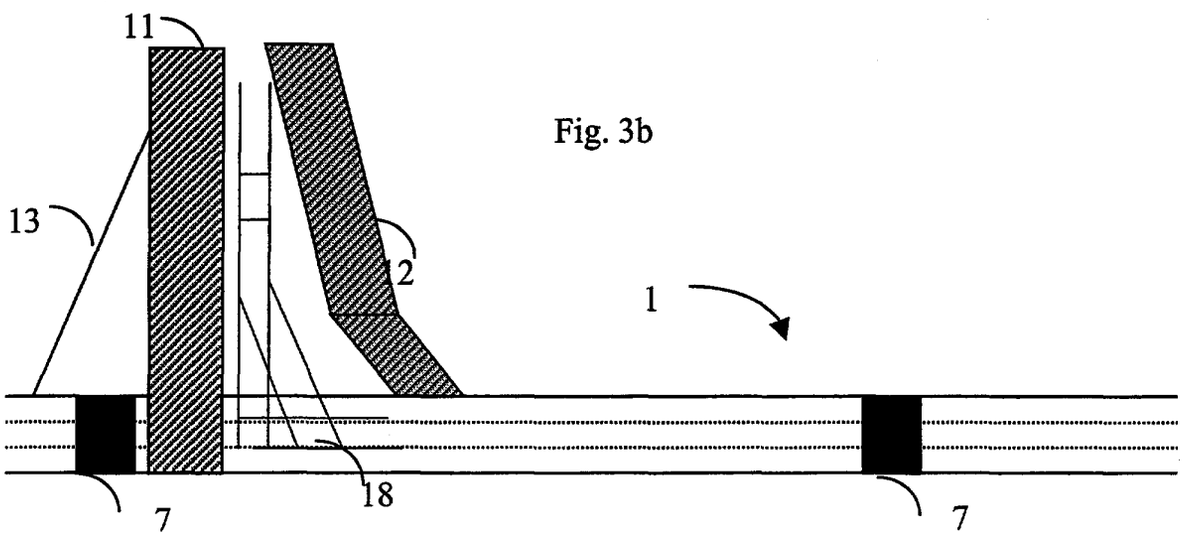


Fig. 3b

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## Description

**[0001]** This invention relates to prestressed concrete units, to a method of manufacture of prestressed concrete units and to a mould system for use in such a method.

**[0002]** Concrete units for walling are conventionally produced in an 'L' shape so that they may be self-supporting, although other shapes are also known. Units are generally manufactured by pouring concrete into a mould which contains reinforcing bars. The concrete is usually vibrated to force any trapped air to rise to the surface of the mould.

**[0003]** The open portion of the mould into which concrete is poured, generally forms a side of the resulting unit.

**[0004]** The disadvantages of such known units include the fact that the reinforcing bars are generally manufactured in a cage like structure which is expensive to produce. Reinforced concrete units are generally weaker than prestressed units due to the fact that concrete is weak in tension, but is very strong in compression. Furthermore, it is not possible for such units to be manufactured with co-operating mating surfaces on the sides of the units, as one side of the unit is created at the open portion of a mould, and thus it is difficult to form into any shape other than a flat surface. Another disadvantage is that if a unit is required of a differing height or shape then a new mould needs to be manufactured.

**[0005]** Prestressed units overcome some of the aforementioned disadvantages, but prestressed units are only available in generally longitudinal shapes such as panels, tubes and the like, so prestressed units suitable for use as self supporting walling have been previously unavailable.

**[0006]** Therefore, there remains the problem of manufacturing a unit which is cheaper and stronger than conventional units, and which can be formed in shapes other than generally longitudinal, and in particular which comprise two portions which are generally perpendicular to one another, so that they may form part of a self supporting wall.

**[0007]** According to the invention there is provided a method of manufacturing a prestressed concrete unit using a mould system comprising an elongate mould containing at least one prestressed element and an elongate hopper having an aperture, comprising the steps of locating at least one reinforcing element in a substantially perpendicular orientation to said mould; filling the elongate mould with concrete to form a first portion of the unit; locating the hopper over said reinforcing element in a substantially perpendicular orientation with the mould; and filling the hopper with concrete such that the concrete flows through the aperture to contact the concrete of the first portion.

**[0008]** The method may further comprise steps of vibrating the concrete of the first portion; and vibrating the concrete of the second portion.

**[0009]** An improved method includes the steps of inserting a gate between the hopper and concrete in the mould prior to vibrating the concrete of the second portion; and removing said gate after vibrating the concrete of the second portion.

**[0010]** The concrete of the first portion may be vibrated prior to filling the hopper with concrete.

**[0011]** According to a second aspect of the invention there is provided a prestressed concrete unit, comprising an elongate prestressed first portion; and an elongate reinforced second portion which is substantially perpendicular to the first portion.

**[0012]** Preferably the first portion forms a substantially vertical wall and the second portion forms a substantially horizontal foot at the bottom of the wall to form an 'L' shaped unit.

**[0013]** It is advantageous if a side of the first portion is formed to co-operate with a side of a second concrete unit. For example, a side of the first portion may have a tongue to co-operate with a groove of another unit, and another side of the first portion may have a groove to co-operate with a tongue of another unit.

**[0014]** According to another aspect of the invention there is also provided a mould system for use in the manufacture of prestressed concrete units comprising an elongate mould with two sides having means for locating at least one prestressed element therein; an elongate hopper; means for locating at least one reinforcing element in a substantially perpendicular orientation to said mould; and means for locating the hopper in a substantially perpendicular orientation with respect to the mould over said reinforcing element.

**[0015]** It is an advantage if a side of the mould has a tongue and another side has a groove such that a unit formed in the mould system has a tongue on one side to co-operate with a groove of another unit, and a groove on the other side to co-operate with a tongue of another unit.

**[0016]** Preferably the mould system further comprises a gate for insertion adjacent the hopper for retention of concrete in the hopper during vibration thereof.

**[0017]** Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1a shows a perspective view of a conventional bed for manufacture of prestressed concrete units;

Figure 1b shows a longitudinal cross section of part of the bed shown in Figure 1;

Figure 2a shows a vertical cross section of a hopper;

Figure 2b shows a horizontal cross section of the hopper of Figure 2a;

Figure 3a, 3b and 3c show a cross section of a mould system according to the invention;

Figure 4a shows a vertical cross section of a prestressed concrete unit according to the invention;

and

Figure 4b shows a horizontal cross section of the prestressed unit of Figure 4a.

**[0018]** Referring now to Figure 1a, a conventional bed 1 for the manufacture of prestressed concrete panels is shown. The bed 1 comprises a number of elongate mould sections 2 separated from each other by partitions 3. Two sidewalls 4 together with two partitions 3 form a mould for production of a panel. Wires 5, which comprise 9.3mm strand, for example, are stretched along the length of the bed 1 and secured at each end 6 of the bed. The wires 5 are stretched, for example, they may be stretched to 80% breaking point.

**[0019]** Concrete is poured into one or more mould sections 2 to form a required number of panels. Once the required number of mould sections 2 have been filled, the concrete in each mould section 2 is vibrated, for example using a conventional poker vibrator, so that any trapped air rises to the surface of the mould. The concrete is then allowed to set before the wires 5 are cut, and the resulting panels lifted from the mould.

**[0020]** The partitions 3 are relocatable so that panels of differing lengths may be manufactured by simply moving one or more partitions 3 to a different location, so different customer requirements can be met without the requirement for different moulds for different size panels.

**[0021]** Figure 1b shows a vertical cross section of the bed 1. It can bee seen that each partition 3 comprises two dividing plates 7, 7', with a space 8 therebetween so that the wires 5 may be cut once the concrete has set. The wires 5 pass through apertures 9 in the partitions, the apertures being small enough so that a substantial amount of concrete does not leak through before the concrete has set.

**[0022]** Figure 2a and 2b illustrate a hopper 10 which forms part of the mould system of the present invention. The hopper 10 has a rear wall 11 and a front wall 12. The lower part of the rear wall 11 extends so that when in use the lower part of the rear wall 11 replaces the dividing plate 7'. Fins 13 extend from the rear wall to support the wall. The front wall 12 and the rear wall 11 are detachable from one another and are secured to each other in operation, using bolts 14. The hopper 10 has an aperture 16 at the top and an aperture 17 at the bottom.

**[0023]** A method according to the present invention will now be described with reference to Figures 3a, 3b and 3c which illustrate a mould system according to the present invention.

**[0024]** Figure 3a illustrates the bed 1 together with the rear wall 11 of the hopper 10 which has been located next to dividing plate 7 such that the lower part of the rear wall 11 replaces the dividing plate 7'. A reinforcing cage 18, for example, fabricated from high tensile 8mm steel bars, is placed by the rear wall 11 so that it will be located in the interior of the hopper 10 when the front wall 12 is secured to the rear wall 11. The bars of the reinforcing cage may be secured to the prestressed wires 5, or may simply be secured once the concrete hardens around the cage 18 and the wires 5 in the vicinity of the cage 18.

**[0025]** After prestressing the wires 5, concrete is poured into the mould section 2 to form a first portion of a concrete unit. Concrete in the mould section 2 is vibrated in the conventional way to release any trapped air.

**[0026]** The front wall 12 of the hopper 10 is then lowered into place adjacent the rear wall 11, and over the reinforcing cage 18, and the two parts are secured together using bolts 14. The hopper 10 is then filled with concrete through the top aperture 16, the concrete flows through the bottom aperture 17 of the hopper 10 and mixes with the concrete in the mould 2. The concrete in the hopper is then vibrated, to release any trapped air in the concrete which has been poured into the hopper. The concrete in the hopper forms a second portion of the concrete unit.

**[0027]** It will be appreciated that the concrete in the mould and the concrete in the hopper may be vibrated in the sequence described above, or concrete forming each part may be vibrated in any sequence once both parts of the mould system have been filled.

**[0028]** Figure 3c illustrates an improved version of the mould system described above, which also includes a removable gate 19 which serves to retain concrete in the hopper 10 whilst concrete in the hopper is vibrated. The gate 19, has means, for example slots, to avoid the prestressed wires 5. The gate 19, may be fabricated from 5cm thick foamex board for example. Once the concrete in the hopper 10 has been vibrated the gate 19 is removed so that the concrete forming each portion of the concrete unit may meld together to form a bond.

**[0029]** Figures 4a and 4b illustrate cross sections of a reinforced concrete unit produced according to the method described above. Referring now to Figure 4a, in this embodiment of the invention a wall portion 20 formed in the mould section 2 and the foot portion 22 is formed in the hopper 10. The wall portion is approximately 2.4m high (indicated by H) and the foot portion is approximately 1 m long (indicated at L). Each portion is about 10cm thick (indicated by T), although at the thickness increases to about 15cm (indicated by T3), and at the join the thickness is about 30cm (indicated by T2).

**[0030]** It will be appreciated that the dimensions above are provided for illustrative purposes only, and that many other shapes and sizes of unit may be manufactured according to the method of the invention described above.

**[0031]** Referring to Figure 4b, it can be seen that the wall portion 20 has a tongue portion 23 and a groove portion 24, which are designed to co-operate with corresponding tongue and groove portions of another concrete unit, so that a wall may be created in which units

are aligned with one another using corresponding tongues and grooves. In the particular embodiment described above, the tongue and the groove measure approximately 30mm and are located centrally in the wall.

**[0032]** In the forgoing description, numerous specific details are set forth in order to provide a through understanding of the invention. It will be obvious, however, to one skilled in the art that the present invention may be practiced without using these specific details. In other instances, well-known methods and structures have not been described in detail so as not to unnecessarily obscure the present invention.

## Claims

**1.** A method of manufacturing a prestressed concrete unit using a mould system comprising an elongate mould (2) containing at least one prestressed element (5) and an elongate hopper (10) having an aperture (17), comprising the steps of

locating at least one reinforcing element (18) in a substantially perpendicular orientation to said mould; filling the elongate mould (2) with concrete to form a first portion (20) of the unit;

locating the hopper (10) over said reinforcing element (18) in a substantially perpendicular orientation with the mould (2); and

filling the hopper (10) with concrete such that the concrete flows through the aperture (17) to contact the concrete of the first portion (20) and form a second portion (22).

**2.** A method according to claim 1, further comprising the steps of

vibrating the concrete of the first portion (20); and

vibrating the concrete of the second portion (22).

**3.** A method according to claim 2, further comprising the steps of

inserting a gate (19) between the hopper (10) and concrete in the mould prior to vibrating the concrete of the second portion (22); and

removing said gate (19) after vibrating the concrete of the second portion (22).

**4.** A method according to claim 2 or claim 3, wherein the concrete of the first portion (20) is vibrated prior to filling the hopper (10) with concrete.

**5.** A prestressed concrete unit, comprising

an elongate prestressed first portion (20); and

an elongate reinforced second portion (22) which is substantially perpendicular to the first portion.

**6.** A prestressed unit according to claim 5, in which the first portion (20) forms a substantially vertical wall and the second portion (22) forms a substantially horizontal foot at the bottom of the wall to form an 'L' shaped unit.

**7.** A prestressed unit according to claim 5 or claim 6, in which a side of the first portion (20) is formed to co-operate with a side of a second concrete unit.

**8.** A prestressed unit according to any one of claims 5 to 7, in which a side of the first portion (20) has a tongue (23) to co-operate with a groove of another unit, and another side of the first portion (20) has a groove (24) to co-operate with a tongue of another unit.

**9.** A mould system for use in the manufacture of prestressed concrete units comprising

an elongate mould (2) with two sides having means for locating at least one prestressed element (5) therein;

an elongate hopper (10);

means for locating at least one reinforcing element (18) in a substantially perpendicular orientation to said mould; and

means for locating the hopper (10) in a substantially perpendicular orientation with respect to the mould (1) over said reinforcing element (18).

**10.** A mould system according to claim 9, in which a side of the mould (2) has a tongue and another side has a groove such that a unit formed in the mould system has a tongue on one side to co-operate with a groove of another unit, and a groove on the other side to co-operate with a tongue of another unit.

**11.** A mould system according to claim 9 or claim 10, further comprising a gate (19) for insertion adjacent the hopper (10) for retention of concrete in the hopper (10) during vibration thereof.

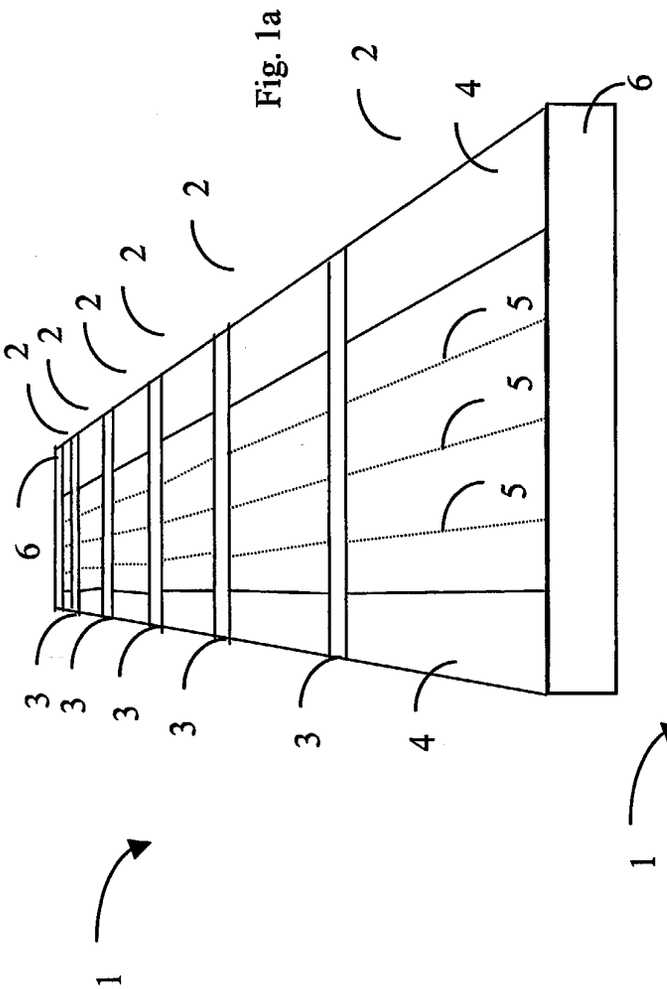



Fig. 1a

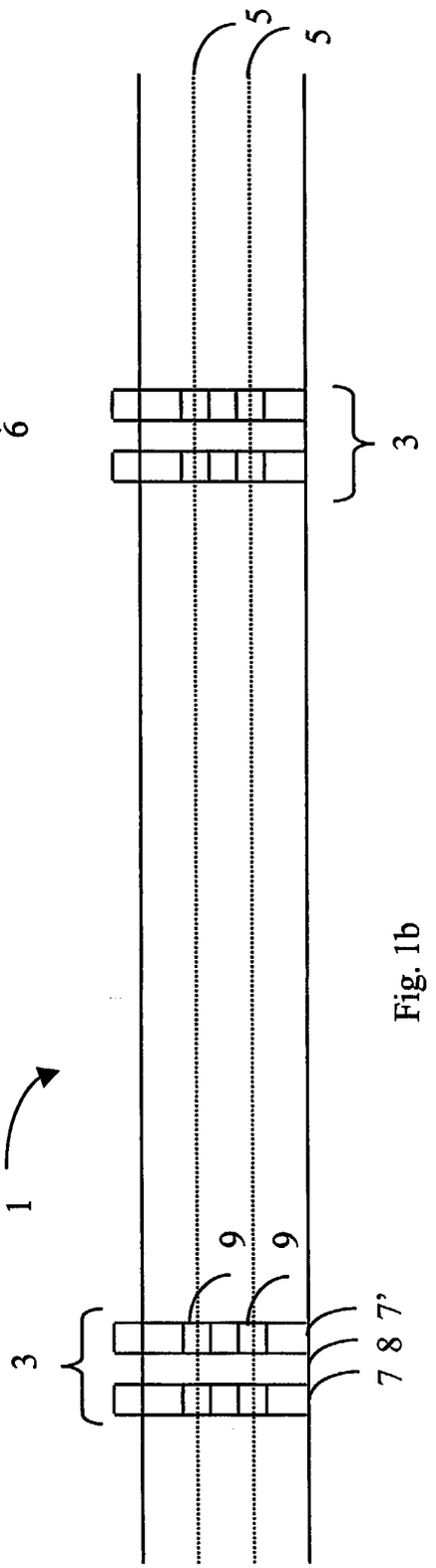



Fig. 1b

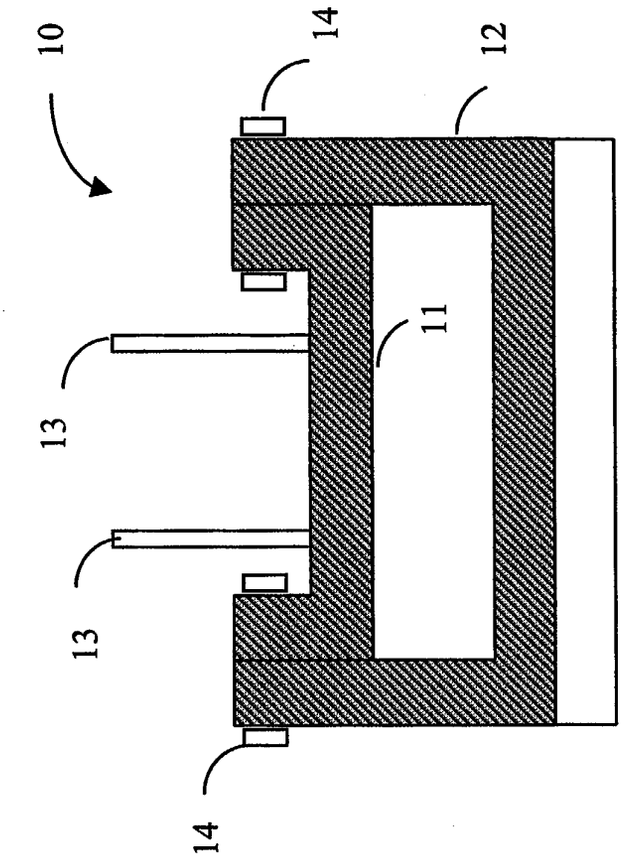



Figure 2b

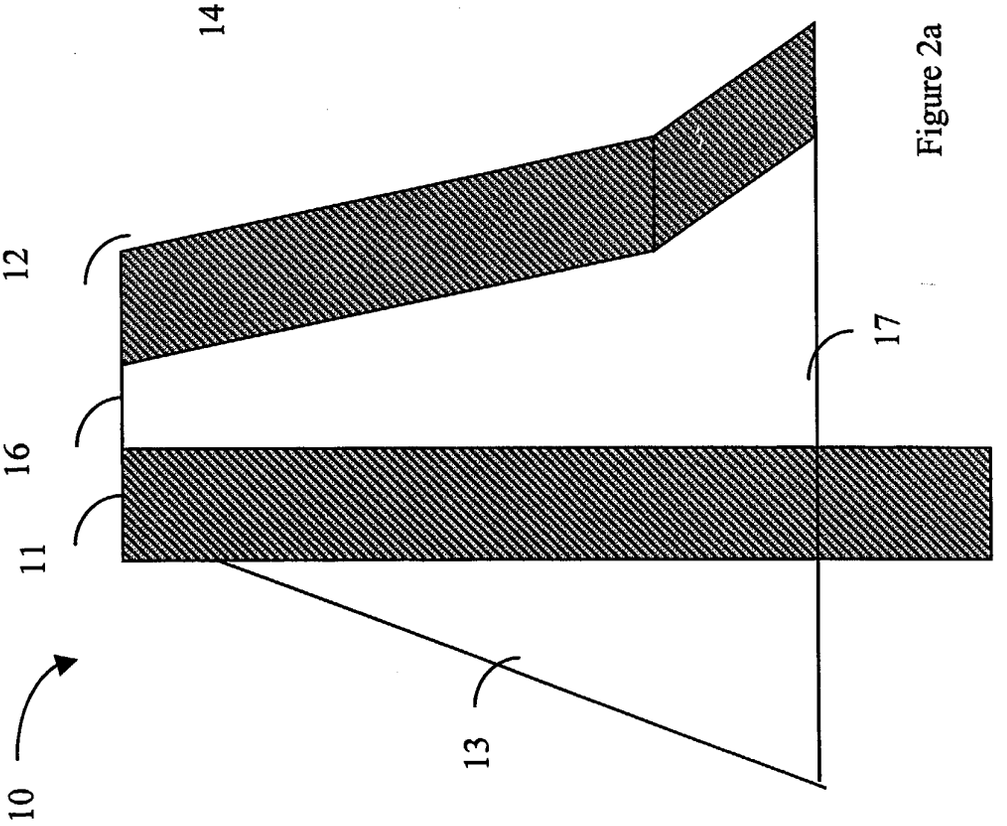



Figure 2a

Fig. 3a

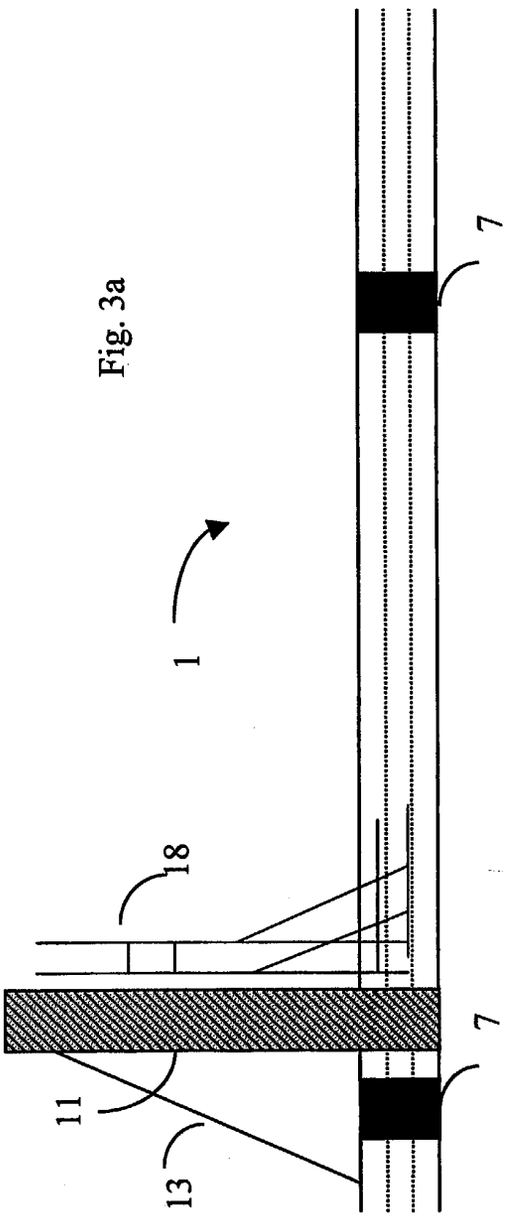
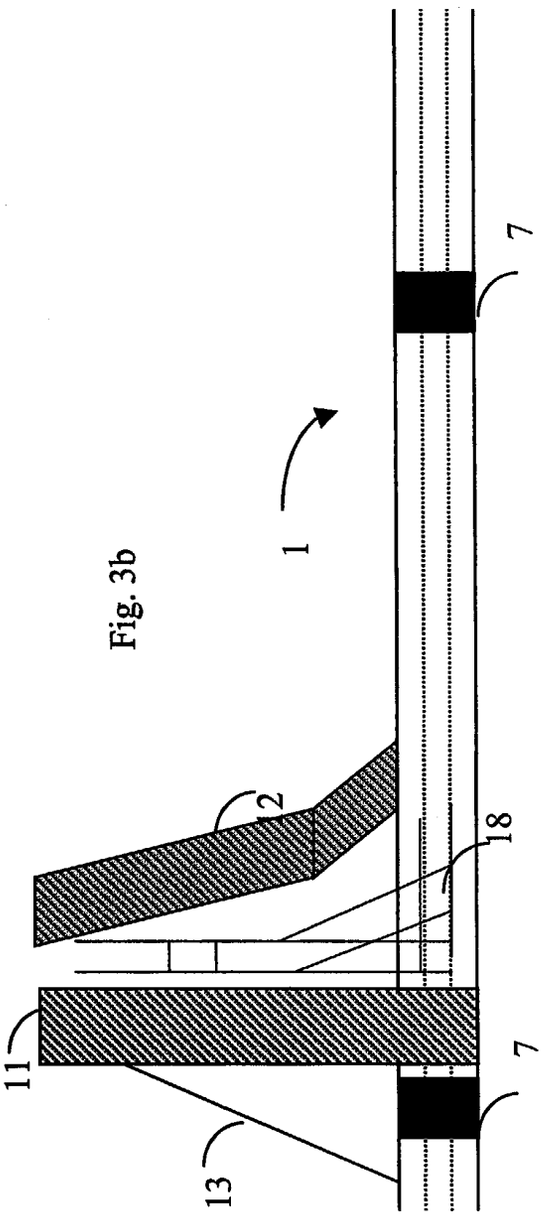



Fig. 3b



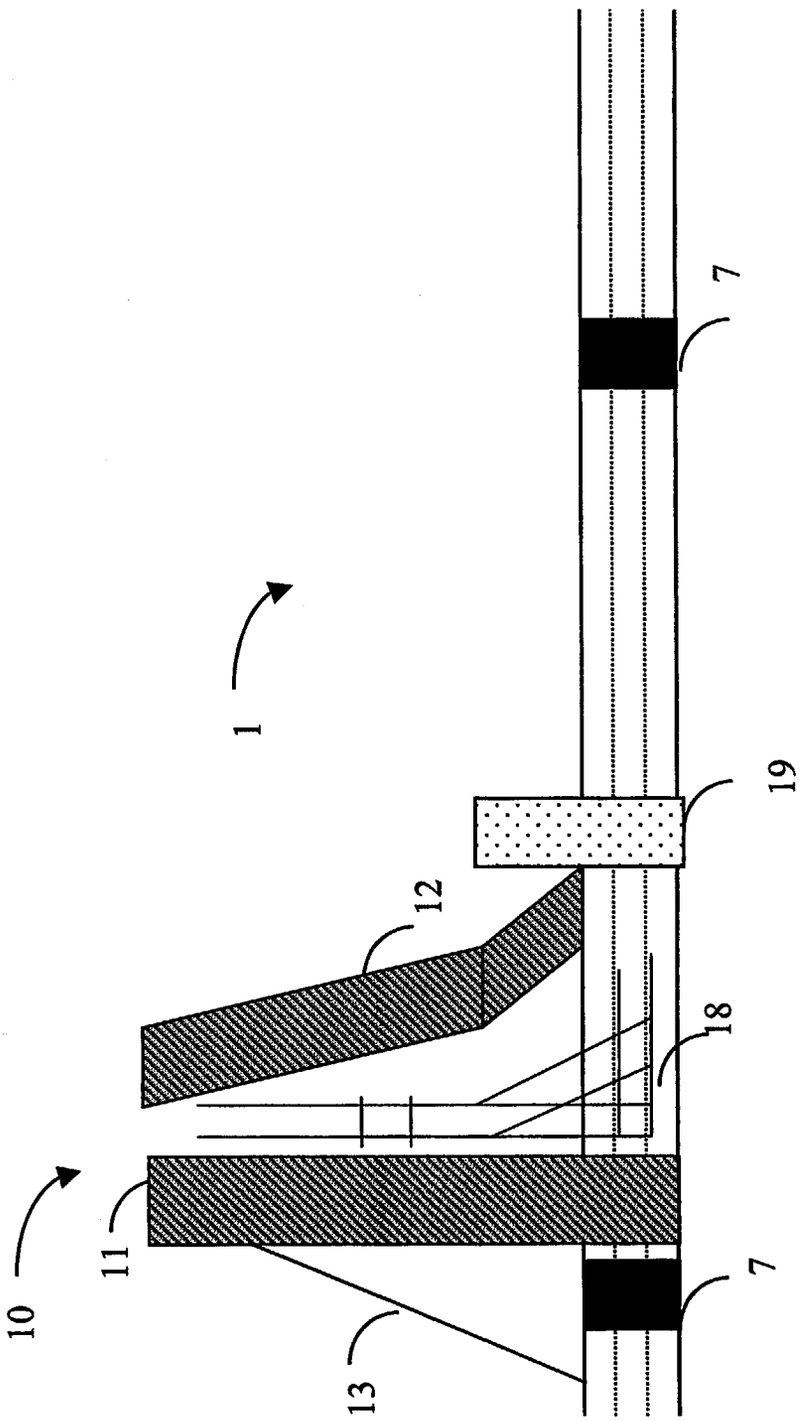



Fig. 3c

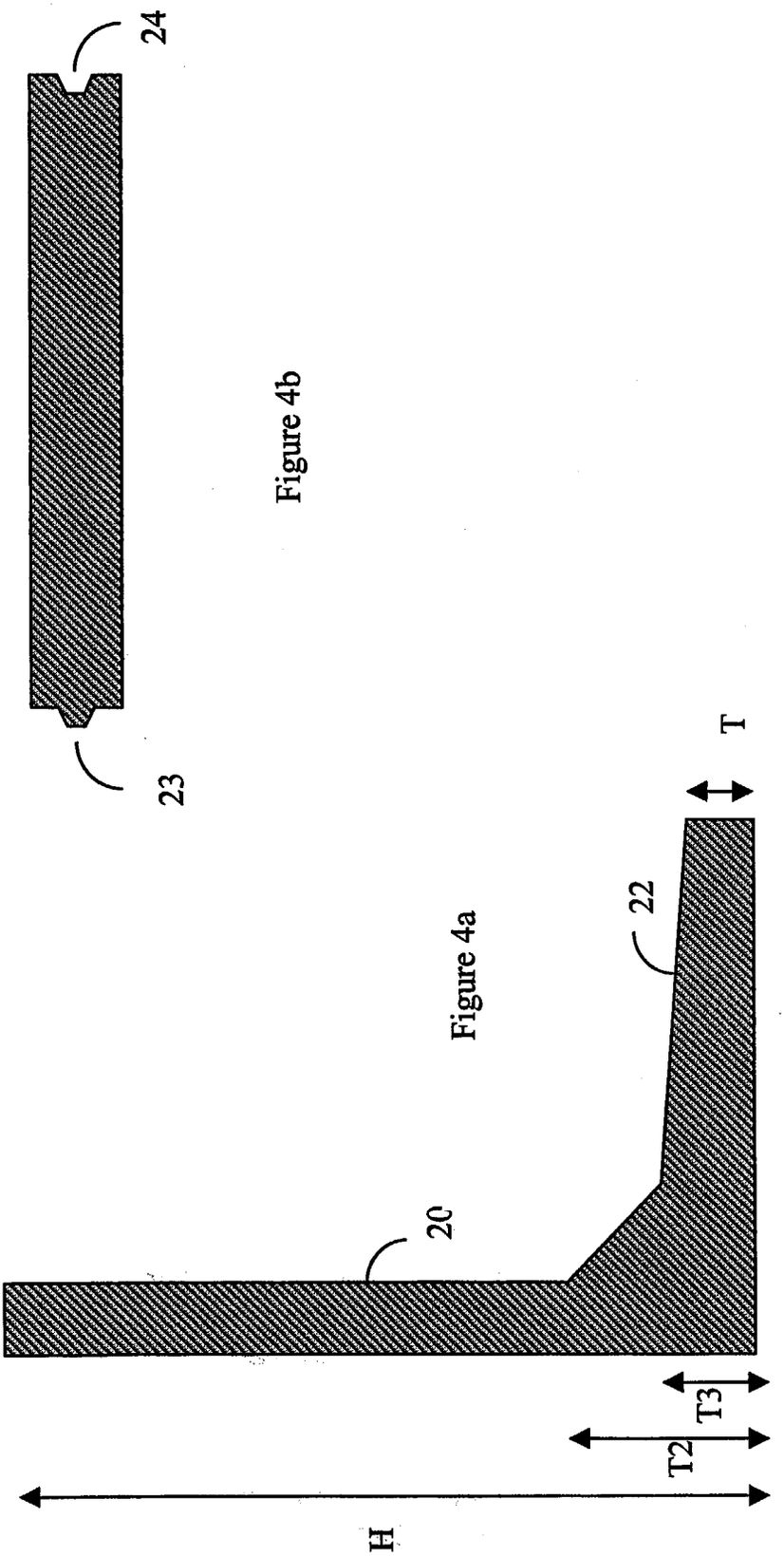



Figure 4b




Figure 4a