Dec. 9, 1930. H. FABRE 1,784,422

PLANT FOR THE VERTICAL MOLDING OF CONCRETE WORK

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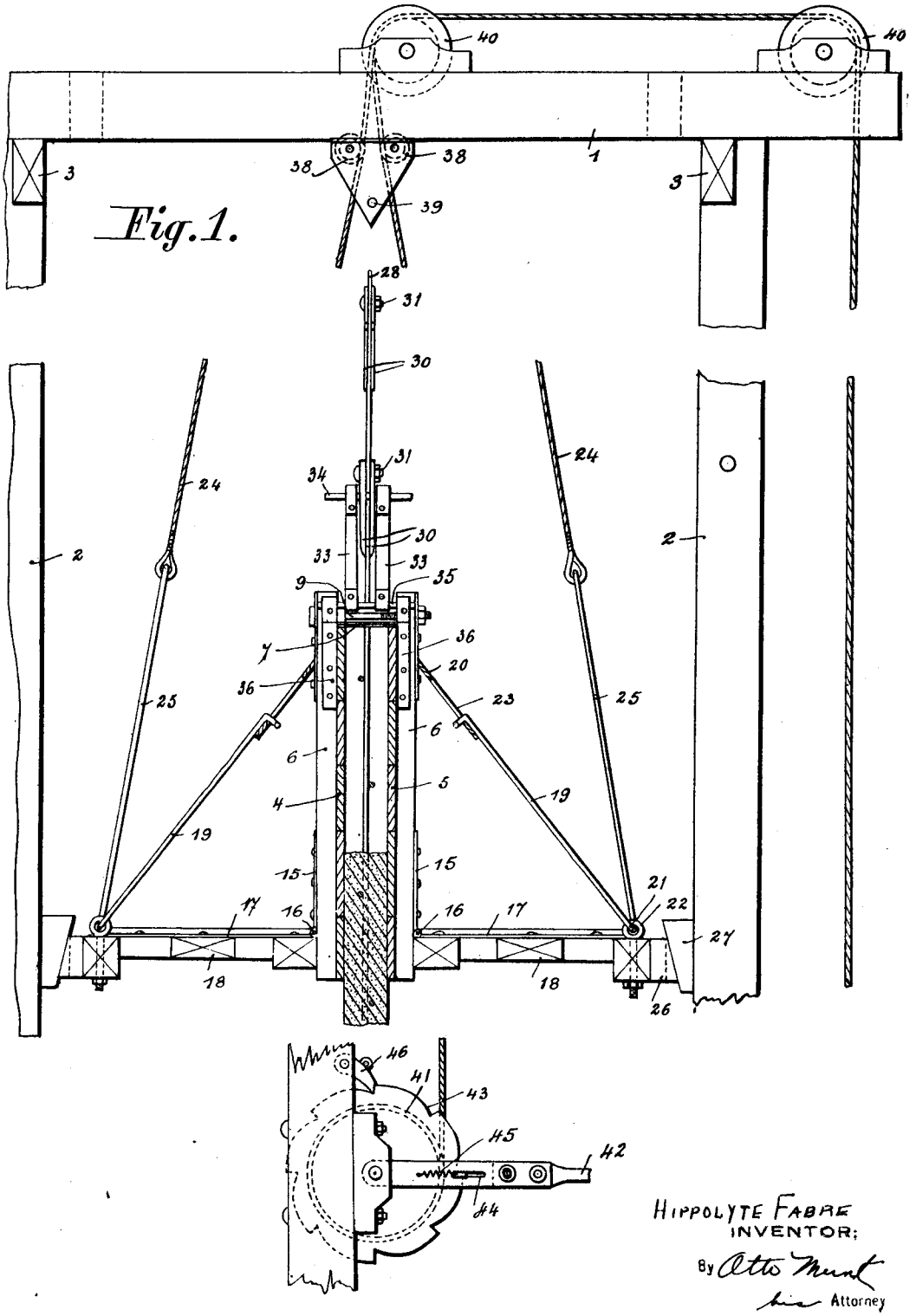


Fig. 1.

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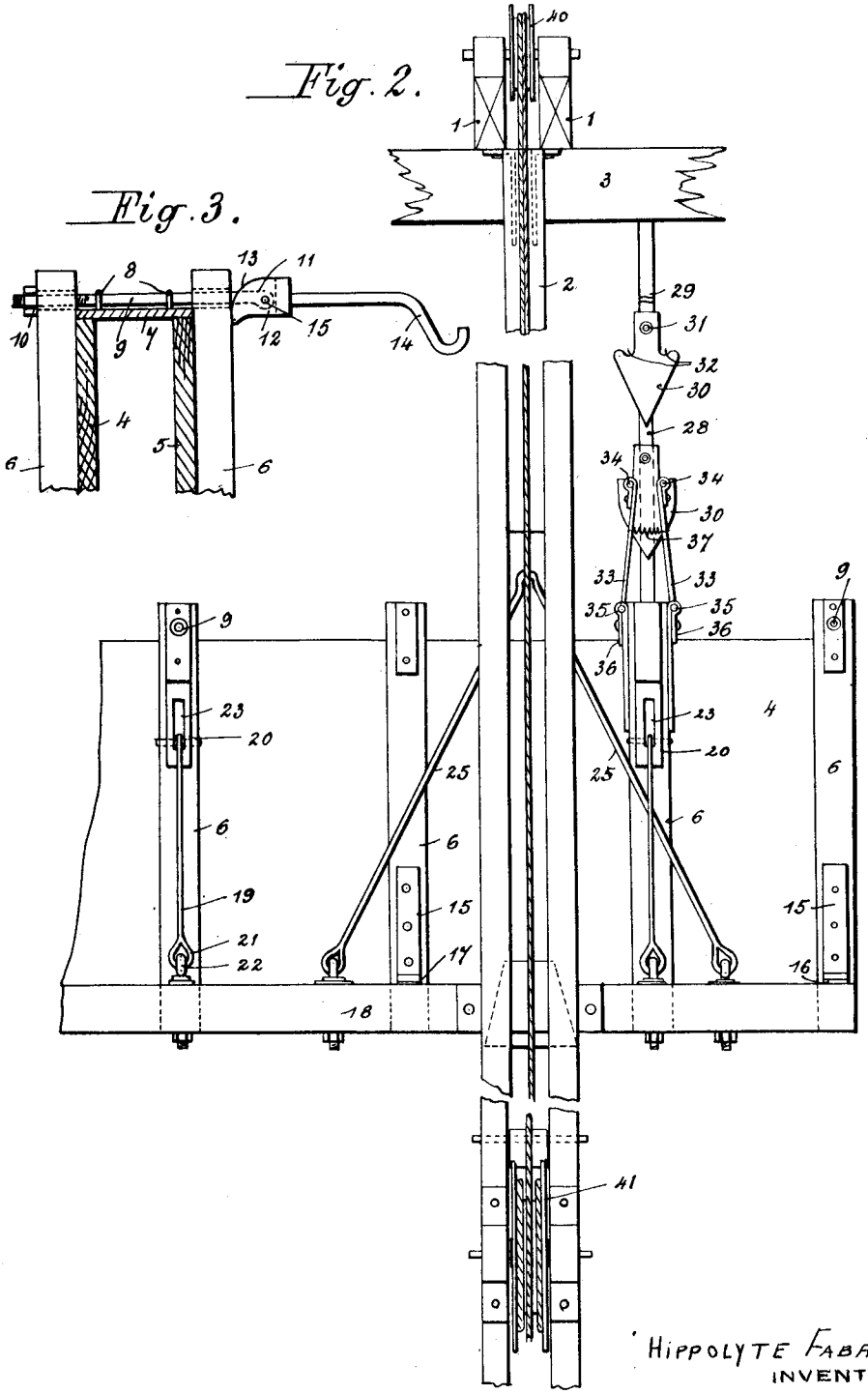
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Fig. 2.

Fig. 3.



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UNITED STATES PATENT OFFICE

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PLANT FOR THE VERTICAL MOLDING OF CONCRETE WORK

Application filed August 7, 1928, Serial No. 298,077, and in France August 9, 1927.

This invention relates to apparatus for building concrete walls and has been so devised as to allow of using in connection with reinforced concrete the same methods of building which are employed for raising walls made of a cofferwork of earth or clinker.

The apparatus forming the subject-matter of the invention is essentially characterized by the fact that the panels forming the sheeting and between which the concrete is received are combined with mechanical lifting means acting from outside, so that the molded wall can be of any thickness having due regard to the resistance of materials and the loads which are to be supported.

In the accompanying drawing and by way of example:

Fig. 1 is a cross sectional view of the apparatus.

Fig. 2 is a corresponding part longitudinal view.

Fig. 3 shows, on a larger scale, a detail of mounting.

The apparatus, forming the object of the present invention, is supported by a double horizontal cross-beam 1 bearing upon two poles 2. Every apparatus comprises two or more similar supporting systems. All these systems are tied together at their upper parts at 3.

In its main parts, the apparatus for molding concrete is composed:

a. Falsework casing or sheeting

Of two vertical falsework casings 4, 5.

This casing is made of boards or planks connected together upon cross beams or uprights 6 forming the frame of the falsework casing and the spacing of which can be varied according to the length of the mold and the thickness of the boards. These vertical casings will be hereinafter termed sheeting and the operation consisting in putting them in position for molding the concrete will be called the sheeting operation while the reverse operation will be called the removal of the sheeting.

The uprights 6 of the sheeting project at their upper part beyond the falsework casings 4, 5. This projection is adapted to receive:

1. A sheeting spacing cross beam 7 resting upon the falsework casing proper and carrying two small rings 8 into which are threaded the fastening bolts 9 (Fig. 3).

2. Above this member 7 is arranged the bolt 9 by means of which the casings 4, 5 may be secured against the member 7. This bolt 9 is introduced into a hole provided in each of the uprights 6 of the sheeting and into the two small rings 8 of the member 7. The fastening can vary according to the width which is to be allowed for the spacing cross member and which naturally depends upon the thickness of concrete which is to be obtained.

One end of the bolt 9 is provided with a threaded portion which, by means of a nut 10, will allow of varying the useful length of the bolt 9. The other end of bolt 9 is flattened for about half its length and the end of this flattened part carries an eyelet 11. This flat part passes between two parallel arms of a cap 12 which are rounded at their free end according to a certain radius, so as to form a cam 13; their other end is fixed to a controlling lever 14. Between the two parallel arms of the cap 12 is secured a pin 15 through which freely passes the eyelet 11 of the flat part of the fastening bolt 9.

The free and rounded part of this cam 13 bears upon the upright 6 of the sheeting.

When the lever arm 14 of cap 12 is brought to horizontal position, the rounded part 13 of the two arms will press against the eyelet 11 of the bolt 15, and push back the upright 6, pulling upon the bolt 9 and thus automatically securing the fastening of the sheeting 4, 5, 7.

b. Attendance bridge

To the lower end of the upright 6 4, 5 is vertically secured one of the arms 15 of a hinge 16 having a removable pintle; the other arm 17 of the said hinge is secured to an attendance bridge or temporary gangway 18 which is capable of being angularly displaced about the pintle of the hinges 16.

In the position of use, the plane of bridge

18 is perpendicular to the corresponding sheeting 4, 5.

The bridge 18 is composed of a frame in the form of a truss upon which is nailed a platform for the workman.

The internal sleeper of bridge 18 bears exactly against all the uprights 6 of the sheeting and acts as a stiffener for the lower part of same; the plates 7 and fastening bolts 9 act as stiffeners for the upper part thereof. For this reason broad fastening plates are provided in order to avoid a parallel shifting of the two sheeting members 4, 5.

In order to allow bridge 18 to remain in a horizontal position, its external sleeper is suspended from the upper part of the uprights 6 through the medium of a supporting rod 19, 20.

The part 19 of this rod carries, at its lower end, an eye 21 which passes through the eye 22 of a bolt secured to the external sleeper of the bridge 18. The other end of part 19 is normally bent to form a hook which can slide in a groove 23 provided in one end of the flat part 20 whose other end is secured to the corresponding upright 6 of the sheeting frame.

To the external sleeper of the bridge 18 is also secured, by means of eyelet bolts, the position of which can vary, the lifting cable 24 through the medium of an inverted V-shaped lifting rod 25. This form has been adopted not only because it permits of having two fastening points to the bridge 18 but also for the purpose of reducing the free overhang of the external sleeper of this bridge and of reducing its size while maintaining its rigidity.

Adjacent each supporting pole 2, this external sleeper of the bridge 18 is provided upon its vertical external face with a shoe 26 whose external face is inclined. This face acts as a bearing for a wedge 27 interposed between the shoe 26 and the corresponding pole 2.

This wedge 27 serves to press the bridge 18 and consequently the sheeting against the part of concrete already finished, as hereinafter more fully described.

The wedges 27 are sufficiently large to leave play between the sheeting and the poles 2.

c. Suspension of the apparatus

The suspension means for the molding apparatus can be divided into two parts, one of which is fixed and permits the filling and setting of the concrete and the other of which is movable and provides for mounting of the mold.

1. The stationary part comprises a bar of flat iron 28, the sizes of which vary according to the height of the wall which is to be raised. This bar is adapted to be used as a support and to serve as a guide for the apparatus. It is for this purpose provided with holes 29 the spacing of which is substantially equal to ⅔ of H (H representing the height of the sheeting or height of the mold). Into these holes 29 is secured, according as the raising proceeds, the keying or nogging support formed of two sheet iron plates 30 (one upon each face of the guiding support) which are in the form of a harpoon the upper part of which is provided with a hole through which passes a bolt 31 securing the two said plates 30 to the supporting guide 28. In the upper part of the swell of said harpoon 30 are provided two recesses 32, one on each side of the bolt hole 31. These recesses 32 are adapted to receive during the operation the suspension pins of the small keying or nogging apparatus.

This apparatus consists of two pairs of duplicate iron blades 33. The two blades 33 of each pair are connected together at their upper parts by suspension pin 34 the portion of which comprised between the two blades, enters during the operation of mounting into the cavity or recess 32 provided in the upper part of the swell or harpoon 30, and at their lower end, the two blades carry a pin 35 which secures this keying or nogging apparatus, through the medium of two stirrups 36, to one of the uprights 6 of the sheeting frame.

The two pairs of double blades are connected together by a coil spring 37 which serves to maintain the two suspension pins 34 in the cavities or recesses 32 of the harpoon 30.

These two springs 37 allow the two pairs of double blades 33 to move apart one from the other when meeting the swell of the harpoon 30 while the apparatus is being erected or fitted up.

2. The second part of the molding apparatus suspension is used for the erection of the apparatus.

The same consists of a lifting cable 24 which is fastened to each one of the two lifting rods 25 secured to each end of the two attendance bridges 18. This double cable is formed by each one of the cables secured on both sides of the sheeting to the ends of the two bridges 18. They are of course separate one from the other, their connection being effected by means of two small tackles 38 acting as a guide, coupled together upon two spindles.

The position of this device can be varied: In case the mold is to be displaced horizontally, the same is secured to the upper cross member 1 of the two supporting poles 2 so as to leave space for the cores of reinforced or armoured concrete. On the contrary if, as will be the more often the case, the mold rises in a vertical direction, the guide is placed close to the mold and is then secured to the latter by a cable, one end of which

is fixed into the eyelet 39 of the said device, the other end being attached to one of the fastening bolts 9 of the molding apparatus, with a view of reducing the required length of the double cable.

These two lifting cables 24, after having passed between the said two tackles 38 are brought nearer the one or the other and pass over the transmission pulleys 40 arranged upon the supporting frame of the apparatus.

The said transmission pulleys 40, as shown in the figure, first engage a double cable then a single cable, so that it can be wound about the pulley secured to the lower part and between the two poles 2 which support the mold. The said winding pulley 41 controlled by means of a lever 42 comprises a ratchet wheel 43.

The bifurcated lever 42 is provided, between its arms, with a stop or catch 44 which, under the action of a spring 45, secured to each of the lever arms, meshes with the teeth of the ratchet wheel 43.

This ratchet wheel is moreover combined with a pawl 46 articulated to the poles 2.

Erection of the plant

The supporting poles 2 are first raised and disposed within a few centimeters of each other. The concrete cores are then suspended between the poles 2 and the position of the wall to be raised. The only iron parts which require to be positioned in a very adequate manner consist of the keying or nogging guiding supports 28.

One of the ends of this vertical core must be embedded in the foundation concrete so as to maintain the iron parts in the position they are to occupy. Then, the two sheeting planks 4, 5, between which the concrete will be cast are put in position vertically and in parallelism. For the first sheeting, wooden cross-bars are placed upon the foundation concrete, these cross-bars having the same width as the molding in order to maintain the required spacing in the lower part. In the upper part of the sheeting are placed, the cross-bar 7 and the fastening bolts 9.

Before these bolts are fastened tightly, the rotation and fastening axis of the blade keying or nogging apparatus 33 is put into position and the bolts are then tightly fastened. The bridge 18 for each sheeting content is then put in place by positioning the hinge pin 16 and hooking the supporting rods 19. The lifting cables 24 are then caused to pass into the grooves of pulleys 38, 40. The fastening wedges 27 are then applied and driven into position, so that the lower part of the mold will be tightly pressed against the spacing cross members placed upon the foundation concrete.

These bottom cross members are only necessary with the first sheeting operation, as subsequently it will be the cast or run-in concrete which will be used as a spacing medium whereas only one part of the height of the molds serves for the filling of the following sheeting operations.

Gravel sand or super-cement concrete is then cast into the mold.

Operation of the apparatus

For the first sheeting, there is no need to make use of the harpoon 30 acting as a support for the keying or nogging operation. In the subsequent operations, this harpoon is put in position and the removal of the molds is then effected by (*a*) loosening the fastening bolts 9 by a vertical lifting motion of lever 14.

The bolts being loosened, the sheeting planks 4, 5 are dismantled automatically by virtue of the reaction which takes place due to the fact that the bottom of the sheeting planks is always fastened by the wedges 27.

(*b*) Removal of the fastening wedges 27.

(*c*) Dismantling of falsework or removal of the molds from the concrete by slightly lifting the two bridges or gangways 18 by means of the lever 42 acting upon the winding pulley 41, after its pawl or catch 46 has been raised. After the raising of the bridges 18 which have assumed an inclined position relatively to the sheeting planks or boards 4, 5 it is only necessary to leave the lever 42 to allow the two working bridges 18 to reassume their original horizontal position.

In this movement of the bridges 18 which have passed from the horizontal position to an inclined position, and have then come back to the horizontal position, every curved head of the parts 19 of the supporting rods or bars has moved into the mortise 23 of the sloping part of the flat iron member 20 which is secured to the uprights 6 of the sheeting planks.

The raising or lifting of the bridge 18 stops when the head of the rods 19 strikes against the upper part of the mortise 23 which has stopped its sliding motion. When the lever 42 of the winding pulley 41 is left to itself, the weight of the bridge 18 causes the same to return to its original horizontal position this being determined by the fact that the heads of the rods 19 have come against the lower part of the corresponding mortises 23. The striking of the head of rod 19 against the upper part in the frame of the falsework-casing will produce an impact upon the top of the sheeting planks which will tend to detach the concrete from the falsework casing, but the striking against the lower part of the mortise 23 will have a much greater effect as it will cause a powerful impact upon the sheeting planks 4, 5 which will tend to open of their own accord and consequently leave the concrete. More than two operations of this kind will seldom be necessary for entirely dismantling the falsework casing or removing the molds.

(*d*) Erection and setting in position of the mold for a new casting. The sheetings 4, 5 being dismantled, their upper part will open so as to allow the concrete to dry more rapidly. This operation will be effected in the following manner which is but the continuation of the preceding operations.

First of all, the pawl 46 will be returned to position, then by means of the lever 42 of the winding pulley 41, a pull will be exerted upon the erecting cables 25, the bridges 18 will reassume their inclined position. The head of the rods or bars 19 will bear against the top of the mortises 23 and at this moment as the cables 24 continue to pull, and as the bridge 18 is no longer capable of pivoting about the hinges 16, the sheeting planks 4, 5 are drawn through the medium of their hinges 16. The sheeting 4, 5 will therefore open from the bottom in pivoting about the fastening bolts 9.

When the concrete has sufficiently set, the erection of the apparatus by means of the lever 42 of the winding pulley 41 is proceeded with. When the apparatus has reached the required height, the keying or nogging device of the sheeting planks 4, 5 begins to operate.

The arms or branches 33 of this apparatus, after having moved apart to allow the passing of the rounded part of the harpoon 30, engage their upper axes 34 into the cavities 32 provided in the upper part of the harpoon 30, by virtue of the horizontal pulling stress exerted by the two coil springs 37.

At this time, it will only be necessary to lift the pawl 46 of the winding pulley 41 and to release the lever 42 while maintaining the same so that the bridges 18 will again be positioned at right angles to the sheeting 4, 5.

The latter, by virtue of the weight of the bridges 18 to which the overhang is added automatically bear tightly against the concrete which has been poured.

The sheeting planks 4, 5 being vertically disposed, the only thing to do is to fasten their upper part which can be done by horizontally moving down the levers 14.

The fastening of the sheeting 4, 5 against the concrete, will be effected by placing and driving the wedges 27. This driving operation must be a simultaneous one for the wedges of the same end of the mold, as although the concrete already presents a great resistance, it is always necessary to avoid too sudden shocks which always produce a certain shaking.

At this moment, one can without fear tread upon the attendance bridge or gangway 18 for casting the new sheeting content and the placing of the horizontal cores which can only be put in place at this moment, as they would otherwise hinder the erection of the mold.

In order to make the angles of walls, it is only necessary to place a sheet iron plate against the internal wall of the ends of the sheeting planks. These sheet iron plates are of an angular shape, that is to say they are bent according to the angle it is desired to obtain. They can even present two angles when it is desired to make a small cut off corner.

The same can also be fixed externally when it is desired to have a projecting angle.

It is also easy to fix them from outside in case it is desired to obtain a projecting angle.

Within the angle 11, it is also easy to obtain a reinforcement in placing a two angle plate near the ends of the internal sheeting planks. It is also possible to build wall reinforcing piles by placing a bent plate at the ends of the sheeting, the latter being spaced apart the width of the reinforcing pile. In case empty spaces are to be provided for in the wall in course of construction (such as doors, windows, ornamentations, and the like) it is only necessary to dispose a suitable framing between the two branches or arms.

Claim:

Means for constructing a relatively thin vertical retaining wall of concrete, comprising cross pieces forming an overhead bridge, lifting cables operating from the bridge, a mold suspended from said cables and comprising superposed planks, means for stabilizing the mold, movable transverse spacing members between the upper-most planks, bolts for attaching the members to the planks, cams for adjusting the bolts to clamp the planks, a harpoon-shaped member depending from the cross piece and having hooks fastened to said palnks at variable elevations in accordance with the progress of the construction of the retaining wall, an attendance-bridge pivotally mounted on the lower end of said planks and connected at its ends to said lifting cables, inclined telescoping stays between the planks and last named bridge to support and allow same to fold against planks, said attendance bridge having shoes at its ends provided with inclined faces, and wedges for insertion between the uprights of the overhead bridge and said inclined faces of the attendance-bridge.

In testimony whereof I affix my signature.

HIPPOLYTE FABRE.