

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN SLIPFORM TYPE FORMWORK

(71) We, N. F. BROOKER PTY. LIMITED, a Company incorporated in the State of New South Wales, of 159 Gibbes Street, Chatswood, New South Wales 2067, Commonwealth of Australia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to formwork for use in the construction of concrete walls and more particularly to formwork of the slipform type.

Typical slipform equipment for the forming of concrete walls comprises two vertical steel panels, each located with two upright waler assemblies. Each waler assembly normally consists of two parallel horizontal rolled steel joists, each disposed with its web horizontal, the joists being spaced vertically and connected by spaced vertical spacing tubes, each bolted at its ends to the webs of the adjacent joists. Panels faced with sheet steel are secured to one side of the waler assembly. The securing is by means of clamps engaging the panels to the joists.

In use such assemblies, one for each side of the wall to be formed, are spaced and connected by yokes and well known means are provided for coupling the yokes to jacks so that the assemblies may be gradually lifted as the placement of the concrete in the wall progresses. The rate of lift and the concrete placement rate are adjusted so that no part of the concrete already placed is uncovered by upward movement of the slipform assemblies until the concrete so exposed is sufficiently set. To ensure ease of lifting, the assemblies are set with a taper in the vertical plane.

The above described existing slipform equipment has many disadvantages, it allows the faces of the slipform panels to spread excessively when subjected to variable pressures induced by the varying height of fluid or plastic concrete to be supported. The degree of spread is further

accentuated, with increased pressure, when the concrete is vibrated. Furthermore, due to the inherent weaknesses in the design of present yokes the amount of over working space between the concrete level and the underside of the yoke cross heads is restricted, greatly limiting the amount of horizontal reinforcement steel that can be placed in advance of concrete operations at any one time. Also, adjustments to formwork "taper" using present equipment cannot be easily achieved which places limitations on the quality of performance. In addition the degree of obstruction to horizontal reinforcement created by the yoke heads where they straddle the wall creates a degree of difficulty in satisfactorily locating horizontal reinforcement. Finally when existing yoking assemblies are set up to facilitate the placement of concrete in a wall corner or wall "T" junction the working area is greatly reduced and working conditions become congested and undesirable.

The present invention overcomes the abovementioned disadvantages by providing slipform equipment which allows greater working area for the placing of reinforcing steel and concrete and movement of personnel and allows the setting of correct formwork taper at wall corners.

The present invention further overcomes the previously mentioned disadvantages by minimising the spreading of the forms due to concrete pressure by making each leg of the assembly a relatively stiff vertical frame, and by pretensioning or preloading the assembly.

Accordingly the present invention provides apparatus for use in the continuous construction of concrete walls, said apparatus comprising first and second support members adapted to be positioned in vertically disposed relationship on opposite sides of an area in which a wall is to be formed, a first header bar assembly adapted to be positioned at the uppermost ends of said support members, first and second fasteners adapted to secure the ends of said first header bar assembly to

respective ends of said support members, a second header bar assembly adapted to be positioned intermediate the ends of said support members, third and fourth fastening means adapted to secure the ends of said second header bar assembly to respective ones of said support members; at least one of said support members comprising a load bearing framework having a first adjustable abutment adapted to engage said first header bar assembly to restrict angular motion thereof relative to said one support member, transversely adjustable means adapted to receive the respective one of said third and fourth fastening means whereby the angular relationship between said first and second support members may be set according to the requirements of the user, and second adjustable abutment means adapted to engage said second header bar assembly to limit angular motion thereof relative to said one support member during use; said first and second support members each having a portion of the lowermost end thereof adapted to be engaged by slip form panel supporting means whereby first and second slip form panel means can be fixedly secured thereto to enclose the area in which the wall is to be formed; said apparatus further including means for mounting vertical lifting means thereon to move said apparatus vertically during the continuous construction of a wall.

According to a further aspect the invention provides apparatus for use in the continuous construction of concrete walls; said apparatus comprising first and second support members disposed in vertically disposed relationship on opposite sides of an area in which a wall is to be formed, first and second header bar assemblies positioned in vertically spaced substantially parallel relationship at the upper portions of said support members, respective fasteners securing the end portions of the uppermost one of said header bar assemblies to respective ones of said support members, adjustable abutment means to restrict relative angular motion between said uppermost one of said header bar assemblies and said support members, respective fasteners securing the end portions of the lowermost one of said header bar assemblies to fixing stations on said support members, means to adjust the position of said fixing stations transversely relative to said apparatus whereby said support members may be adjusted to compensate for angular movement under the influence of loads applied thereto during construction of said wall, adjustable abutment means to restrict relative angular motion between said support members and said lowermost one of said header bar assemblies, clamp means adapted to fixedly

mount slip form panel means on the lowermost portion of each support member, and means to move said apparatus in a vertical direction during construction of a wall.

According to yet a further aspect the invention provides apparatus for use in the construction of concrete walls, said apparatus comprising first and second support members adapted to be disposed in vertically disposed relationship on opposite sides of an area in which a wall is to be formed, a first header bar assembly adapted to be secured to the uppermost portions of said support members to connect said support members in predetermined spaced relationship with respect to the thickness of the wall to be formed, each said support member including a portion at the lowermost end thereof adapted to be engaged by formwork panel mounting means to fixedly mount a formwork panel assembly thereon, a second header bar assembly adapted to be disposed intermediate of said first header bar assembly and said lowermost portion, each said support member having fixing means adapted to be engaged by means to fixedly connect said second header bar assembly thereto, said fixing means on at least one of said support members being adjustable whereby said support members may be angularly adjusted with respect to each other, and adjustable abutment means on at least said one support member to limit angular motion of said header bar assemblies with respect to said support members and means for mounting vertical lifting means to progressively lift said apparatus with said formwork panels mounted thereon during the progressive construction of said wall.

Several preferred forms of the invention will now be described with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is an elevational view of one form of the present invention;

Figure 2 is a view of the concealed components in area A of Figure 1;

Figure 3 is an enlarged view of Detail B of Figure 1;

Figure 4 is a perspective view of a corner post;

Figure 5 is a perspective view of one form of head support;

Figure 6 is an elevational view of another form of the present invention used in the construction of a wall corner and using the post and support of Figures 4 and 5;

Figure 7 is a plan view of the apparatus of Figure 6;

Figure 8 is a perspective view of yet another possible form of the invention used in the construction of a wall "T" junction;

(B)

Figure 9 is a plan view of the apparatus of Figure 8;

Figure 10 is an elevational view of still another possible form of the invention used in the construction of a wall "T" junction; and

Figure 11 is a plan view of the apparatus of Figure 10.

Wherever possible the same numerals have been used in the diagrams to designate similar components.

Referring to Figure 1 of the drawings, a yoke assembly or support 1 is provided on each side of the wall to be poured. Each yoke assembly 1 comprises an inner upright 30, an outer upright 31, horizontal stiffeners 32 and diagonal stiffeners 33 connecting the two uprights. Above the section of the wall 13 to be poured, two pairs of horizontal steel head plates or connectors 5 and 7 interconnect the yoke assemblies. The plates of each pair are located on opposite sides of each yoke assembly 1, and each plate has a series of holes 6 equispaced along the centreline of the plate. By selection of appropriate holes in the head plates 5 and 7 the spacing between the yoke assemblies 1, 1 may be set according to the thickness of the wall to be poured. The upper pair of head plates 5 are secured to the upper part of each yoke assembly 1 by passing a bolt 17 through the appropriate hole 6 of the first of the head plates, through a hole in the uppermost horizontal stiffener and finally through a cooperating hole of the other head plate. In like fashion, the adjacent yoke assembly is fastened to head plate pair 5 to locate the uppermost ends of the yoke assemblies in their desired transversely spaced relationship and the whole assembly is then tightened by a conventional nut and washer on each bolt 17.

The second pair of head plates 7 are disposed in parallel relationship to the first head plates 5 at a point spaced below the first head plate pair. The manner in which the second pair of head plates 7 are secured to the yokes 1, 1 differs in that the bolts 17A are each located through an adjustment block slidably located between horizontal bars 14, 14A.

As may be more clearly seen in Figure 2 the horizontal bars 14, 14A are disposed in vertically spaced parallel relationship and secured to the uprights 30, 31 to provide a channel like arrangement in which a slide block 15 is retained. This block 15 is provided with a first hole 16 through which the bolt 17A is passed to secure the head plates 7.

The purpose of the slide block 15 is to provide a means whereby the completed yoke assembly may be pretensioned to resist splaying of the yoke assemblies under the influence of outwardly directed forces

during use. This pretensioning is achieved by means of an adjuster bolt 8 the threaded shank 8B of which is passed through a hole 31' in the upright 31 and located in a threaded hole 16A in the block 15 whereby by rotational movement of the bolt 8 the block 15 can be moved along the channel.

The bolt 8 is retained against axial movement in one direction by its hexagon head while collar 8A prevents movement in the other direction.

The slider block arrangement permits the yoke assembly to be angularly adjusted and provides a pretensioning facility to combat unwanted splay of the yoke assemblies under load.

The innermost upright 30 of each yoke assembly 1 is adapted to receive waling members 2 and formwork panels 11. These components are adjustably mounted by means of bolts 4 and 9A which should be adjusted before the slider block assemblies are adjusted.

To provide the necessary rigidity to the whole assembly, a housing 10 with its associated set screw 9 is attached to the inner upright 30 such that the set screw 9 abuts and restrains each of the head plates 5 and 7 from any unwanted movement.

As may be best observed from Figure 3, clamps 3 are conveniently mounted onto the inner upright 30 of each yoke leg 1 and fastened thereto by bolts 4. Formwork panels 11, 11, the distance between which defines the wall cavity, contain recesses or slots which are adapted to engage the clamps 3. The taper between the forms 11 is controlled by upper and lower clamps 3 and associated set screws 4 and 9A. Each clamp is U shaped and encloses the member 30. Its legs have hooked ends which engage in slots in the panel 11 and the set screw 4 passes through the U base and engages against the upright 30. The position of the panel 11 in relation to the upright 30 is established by set screw 4 and the parts are then locked in position by the lower set screw 9A in a boss 10A on the upright 30. Since each formwork panel 11 extends the full length of the wall, to provide adequate rigidity RSJ walers 2 which also extend the full length of the wall are mounted on and between the clamp 3 and the inner upright 30 of each yoke leg 1.

Each slipform 11 is mounted on a frame comprising a pair of vertically spaced walers 2 which are connected by horizontally spaced vertical struts 2A, each secured at each end to a waler 2.

To enable the whole apparatus to be lifted vertically a climbing hydraulic jack 18 is securely attached to the centre of the lower pair of head plates 7. On actuation, the jack 18 steadily climbs up a steel rod 19 which is set into the concrete wall. Although it is convenient to have the steel rod 19 set

into the wall, it is possible in cases where special rods have to be utilised to retract the rod prior to the concrete permanently setting.

5 Where working space is at a premium such as at a wall junction or corner, the apparatus of the present invention may be modified as described hereinafter, to allow relatively free access in such normally cramped situations.

10 Figure 4 is a perspective view of a corner post 21 which is an alternative form of yoke leg and which has a particular advantage when used in limited working areas such as corners or wall junctions. As may be observed the corner post 21 is made from square section tubular steel of substantially the same length as the yoke leg 1. The upper portion of the corner post is drilled with a series of holes 22 aligned along each of the four faces. To the lower portion of the post are welded upper and lower pairs of waler support plates 23 which are the same distance apart as the spacing between the walers attached to the previously mentioned yoke legs 1, 1.

15 Figures 6 and 7 illustrate one alternative arrangement of the present invention comprising the use of one yoke leg 1 as previously described in conjunction with the corner post 21. In this situation a pair of specially constructed head plates may be used. As may be seen from Figure 5, there are two similar parallel opposed head plates 25, each having one end welded to a support plate 26 having a face perpendicular to the head plates 25. Two of these head plate assemblies are bolted, one above the other, to the upper portion of a corner post by means of bolts 27 passing through an upper and lower hole in each of the two support plates 26. The support plates 26 are of similar face width to a face of the corner post 21. To the other end of the two pairs of head plates 25 is attached in the same manner as earlier described, a yoke leg 1 supporting two RSJ walers 2 and steel slipform panels 11. To the lower portion of the corner post 21, on the other side of the wall cavity is attached a pair of similar RSJ walers 2 to which are attached steel panels 11 in opposed relation to the slipform panels attached to the yoke leg 1. The corner post 21 is situated at the inside corner of the cavity and supports two pairs of walers 28, and slipform panels 11, at right angles to each other which define the inside corner of the wall cavity 24. A climbing jack 18 is attached conventionally to the head plate assembly 25 to cause lifting of the assembly as required. If two jacks are required for lifting then a second head plate and yoke leg assembly may be bolted to the upper portion of the corner post in the same manner as the first mentioned head plate and yoke leg

assembly but at 90° to the first mentioned assembly. A jack may then be mounted conventionally to the second head plate assembly. This latter arrangement is particularly suitable where thicker corners are required.

Another alternative of the present invention is illustrated in Figures 8 and 9 and comprises one yoke leg 1 as previously described and two corner posts 21, 21, also similar to the corner post previously described. This combination may be used at a wall "T" junction to alleviate working area congestion in the corners. The two corner posts 21, 21 are situated in the opposing inside corners of the "T" junction and each supports walers 28 and panels 11 in the same manner as the corner post of the previous embodiment. The upper portions of the two corner posts 21, 21 are attached to each other by means of upper and lower head frames 33 which straddle the wall cavity. To the mid section of each head frame 33 is bolted a pair of head plates 25 similar to those described in the previous embodiment. The pairs of head plates 25 extend one above the other at right angles to the corner posts 21 and in the direction of the wall cavity corresponding to the upright of the "T". To the other end of the two pairs of head plates 5 and 7 is attached, in the same manner as described in the two previous embodiments, the yoke leg 1. A climbing jack 18 is mounted conventionally between the two pairs of head plates 5 and 7 to lift the entire assembly as required.

As shown in Figures 1 and 8 the yoke assemblies 1 are constructed so that the upper portion of the inner uprights are offset inwardly with respect to the lower portions thereby reducing the beam length of head plates 5 and 7. This in effect reduces the tendency for head plates to flex providing a more rigid structure.

Where it is not required to support an exterior slipform at the exterior of a "T" wall intersection, the head plates 5 and 7 and yoke leg 1 assembly of the previous embodiment may be eliminated. This situation is more clearly illustrated in Figures 10 and 11 wherein the climbing jack 18 is located between the upper and lower head frames for lifting the right angled slipforms at the two inner corners of the "T" intersection.

In operation then, the apparatus is appropriately assembled and positioned relative to the nature of wall to be constructed, as described hereinbefore in the various embodiments. The exterior and interior panels of the slipform define the boundaries of the wall. At each appropriate assembly a long steel rod is passed through the centre of the climbing jack such that the bottom end makes contact with the ground

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within the wall cavity whilst the upper end extends vertically from the jack. Preferably concrete is poured into the wall cavity from several locations around the cavity such that the wall level remains even throughout the building procedure. As the concrete is poured the lower pair of head plates are forced into tension because of the force exerted by the concrete, whilst the upper pair of head plates are forced into compression. This force distribution has a further tendency to create a "natural" taper on the wall to provide for easy upward movement of the equipment when required. When the level layer of concrete is sufficiently set the whole assemblage is lifted vertically by activation of the climbing hydraulic jack and the whole cycle repeated.

It will be apparent to one skilled in the art that various modifications may be employed without departing from the scope of the invention as disclosed herein, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

The following are some such variations:

Although the corner post 21, (Figure 4 and elsewhere), has been described as of square section tubular steel, it may be of other sections.

In a typical case, e.g., the pouring of the four walls of a rectangular room, the slipform supports have to provide for (1) straight lengths of wall running, e.g., between a wall corner and a wall "T" junction, (2) two walls meeting at a corner, (3) two walls meeting at a "T" junction and (4) two walls intersecting each other. For (1) pairs of support units or yoke assemblies such as 1 of Figure 1 spaced along the wall are employed. For (2) a post 21 bolted to the two inside slipform frames 2, 2A meeting at right angles is used as one rigid support and on the outside of the outer slipforms are located two yoke assemblies 1, each opposite the post 21 and one for each wall. Each pair of head plates is connected at one end to the post 21 and at the other end to the yoke. Pretensioning and locking components are provided only where the head plates are secured to the yoke.

For (3) as shown in Figure 8, two corner posts 21 are used; bolted to the frames 2, 2A one on each side of the "T" stem. They are connected by one or more fixed head frames 33' so as to provide a single slipform support. A support yoke 1 is clamped to the outside slipform frame 2, 2A opposite the connected posts and midway between them. A connector such as head plates 7 is non-adjustably connected to the head frame 33' at one end and adjustably secured for

pretensioning to the yoke 1 at its other end.

For (4) four posts 21 are employed, one in each corner and no yoke 1. The inherent rigidity of such a junction makes pretensioning unnecessary.

The important features of the present invention are the provision of means for locating the smooth concrete contacting surfaces of cooperating slipforms such as 11 at the correct distance from each other, means for pretensioning the lateral connectors such as 7 so as to take up slack, means such as the set screws 9 for maintaining the connectors 7 in their pretensioned condition, means such as a selection of spaced bolt receiving holes 6 in the connectors 7 for allowing for a reduction in wall thickness at higher levels by bringing the slipforms 11 closer together and means such as the components 3, 4, 9A, 10A for providing a taper between the slipforms 11 and for varying the taper.

WHAT WE CLAIM IS:—

1. Apparatus for use in the continuous construction of concrete walls, said apparatus comprising first and second support members adapted to be positioned in vertically disposed relationship on opposite sides of an area in which a wall is to be formed, a first header bar assembly adapted to be positioned at the uppermost ends of said support members, first and second fasteners adapted to secure the ends of said first header bar assembly to respective ends of said support members, a second header bar assembly adapted to be positioned intermediate the ends of said support members, third and fourth fastening means adapted to secure the ends of said second header bar assembly to respective ones of said support members; at least one of said support members comprising a load bearing framework having a first adjustable abutment adapted to engage said first header bar assembly to restrict angular motion thereof relative to said one support member, transversely adjustable means adapted to receive the respective one of said third and fourth fastening means whereby the angular relationship between said first and second support members may be set according to the requirements of the user, and second adjustable abutment means adapted to engage said second header bar assembly to limit angular motion thereof relative to said one support member during use; said first and said second support members each having a portion at the lowermost end thereof adapted to be engaged by slip form panel supporting means whereby first and second slip form panel means can be fixedly secured thereto



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within the wall cavity whilst the upper end extends vertically from the jack. Preferably concrete is poured into the wall cavity from several locations around the cavity such that the wall level remains even throughout the building procedure. As the concrete is poured the lower pair of head plates are forced into tension because of the force exerted by the concrete, whilst the upper pair of head plates are forced into compression. This force distribution has a further tendency to create a "natural" taper on the wall to provide for easy upward movement of the equipment when required. When the level layer of concrete is sufficiently set the whole assemblage is lifted vertically by activation of the climbing hydraulic jack and the whole cycle repeated.

It will be apparent to one skilled in the art that various modifications may be employed without departing from the scope of the invention as disclosed herein, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

The following are some such variations:

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For (3) as shown in Figure 8, two corner posts 21 are used; bolted to the frames 2, 2A one on each side of the "T" stem. They are connected by one or more fixed head frames 33 so as to provide a single slipform support. A support yoke 1 is clamped to the outside slipform frame 2, 2A opposite the connected posts and midway between them. A connector such as head plates 7 is non-adjustably connected to the head frame 33 at one end and adjustably secured for

pretensioning to the yoke 1 at its other end.

For (4) four posts 21 are employed, one in each corner and no yoke 1. The inherent rigidity of such a junction makes pretensioning unnecessary.

The important features of the present invention are the provision of means for locating the smooth concrete contacting surfaces of cooperating slipforms such as 11 at the correct distance from each other, means for pretensioning the lateral connectors such as 7 so as to take up slack, means such as the set screws 9 for maintaining the connectors 7 in their pretensioned condition, means such as a selection of spaced bolt receiving holes 6 in the connectors 7 for allowing for a reduction in wall thickness at higher levels by bringing the slipforms 11 closer together and means such as the components 3, 4, 9A, 10A for providing a taper between the slipforms 11 and for varying the taper.

WHAT WE CLAIM IS:—

1. Apparatus for use in the continuous construction of concrete walls, said apparatus comprising first and second support members adapted to be positioned in vertically disposed relationship on opposite sides of an area in which a wall is to be formed, a first header bar assembly adapted to be positioned at the uppermost ends of said support members, first and second fasteners adapted to secure the ends of said first header bar assembly to respective ends of said support members, a second header bar assembly adapted to be positioned intermediate the ends of said support members, third and fourth fastening means adapted to secure the ends of said second header bar assembly to respective ones of said support members; at least one of said support members comprising a load bearing framework having a first adjustable abutment adapted to engage said first header bar assembly to restrict angular motion thereof relative to said one support member, transversely adjustable means adapted to receive the respective one of said third and fourth fastening means whereby the angular relationship between said first and second support members may be set according to the requirements of the user, and second adjustable abutment means adapted to engage said second header bar assembly to limit angular motion thereof relative to said one support member during use; said first and said second support members each having a portion at the lowermost end thereof adapted to be engaged by slip form panel supporting means whereby first and second slip form panel means can be fixedly secured thereto

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5 to enclose the area in which the wall is to be formed, said apparatus further including means for mounting vertical lifting means thereon to move said apparatus vertically during the continuous construction of a wall.

10 2. Apparatus as in Claim 1 wherein said transversely adjustable means comprise a block disposed slidably in transversely extending channel means, a hole in said block adapted to receive said fastening means, and threaded drive means to move said block transversely relative to said apparatus.

15 3. Apparatus as in Claim 1 or Claim 2 wherein said lifting means comprise fluid powered jack means.

20 4. Apparatus as in any previous claim wherein said slip form panel means comprise first and second walers positioned in vertically spaced relationship at the lowermost portion of each support member, a slip form panel positioned on each pair of walers and secured to the respective ones of

25 said support members by clamp means.

5. Apparatus as in any previous claim including means for adjusting the angular relationship between each slip form panel and its associated support member.

30 6. Apparatus for use in the continuous construction of concrete walls, said apparatus comprising first and second support members disposed in vertically disposed relationship on opposite sides of an area in which a wall is to be formed, first and second header bar assemblies positioned in vertically spaced substantially parallel relationship at the upper portions of said support members, respective fasteners

35 securing the end portions of the uppermost one of said header bar assemblies to respective ones of said support members, adjustable abutment means to restrict relative angular motion between said

40 uppermost one of said header bar assemblies and said support members, respective fasteners securing the end portions of the lowermost one of said header bar assemblies to fixing stations on said

45 support members, means to adjust the position of said fixing stations transversely relative to said apparatus whereby said support members may be adjusted to compensate for angular movement under

50 the influence of loads applied thereto during construction of said wall, adjustable abutment means to restrict relative angular motion between said support members and said lowermost one of said header bar

55 assemblies, clamp means adapted to fixedly

mount slip form panel means on the lowermost portion of each support member, and means to move said apparatus in a vertical direction during construction of a wall.

7. Apparatus as in Claim 6 wherein innermost lower portions of said support members are spaced wider apart than the innermost upper portions.

8. Apparatus substantially as herein before described with reference to Figures 1 to 9 of the accompanying drawings.

9. In plant and equipment for use in the continuous construction of a walled concrete structure, a quantity of slip form panel assemblies arranged and disposed to define a continuous cavity in which the walls of said structure are to be formed, said panels being fixedly mounted on apparatus adapted to move said panels uniformly in a vertical direction during construction of said walls, said apparatus comprising a plurality of apparatuses as defined in any preceding claim.

10. Apparatus for use in the construction of concrete walls, said apparatus comprising first and second support members adapted to be disposed in vertically disposed relationship on opposite sides of an area in which a wall is to be formed, a first header bar assembly adapted to be secured to the uppermost portions of said support members to connect said support members in predetermined spaced relationship with respect to the thickness of the wall to be formed, each said support member including a portion at the lowermost end thereof adapted to be engaged by formwork panel mounting means to fixedly mount a formwork panel assembly thereon, a second header bar assembly adapted to be disposed intermediate of said first header bar assembly and said lowermost portion, each said support member having fixing means adapted to be engaged by means to fixedly connect said second header bar assembly thereto, said fixing means on at least one of said support members being adjustable whereby said support members may be angularly adjusted with respect to each other, and adjustable abutment means on at least said one support member to limit angular motion of said header bar assemblies with respect to said support members and means for mounting vertical lifting means to progressively lift said apparatus with said formwork panels mounted thereon during the progressive construction of said wall.



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