Nov. 11, 1958 J. H. PEARCE 2,859,884

METHOD AND MEANS FOR THE ERECTION OF TIP UP WALLS

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FIG. 2

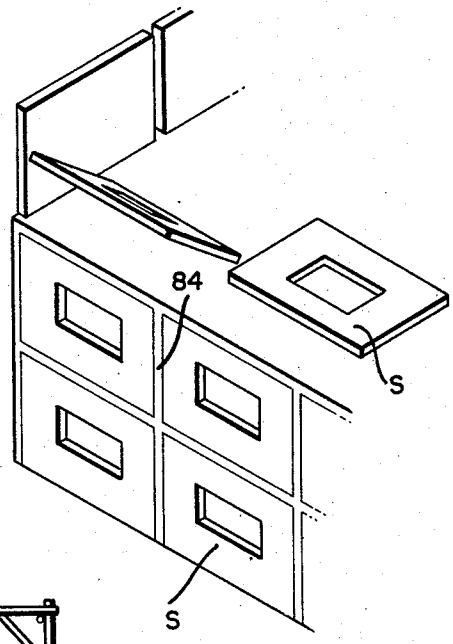


FIG. 1

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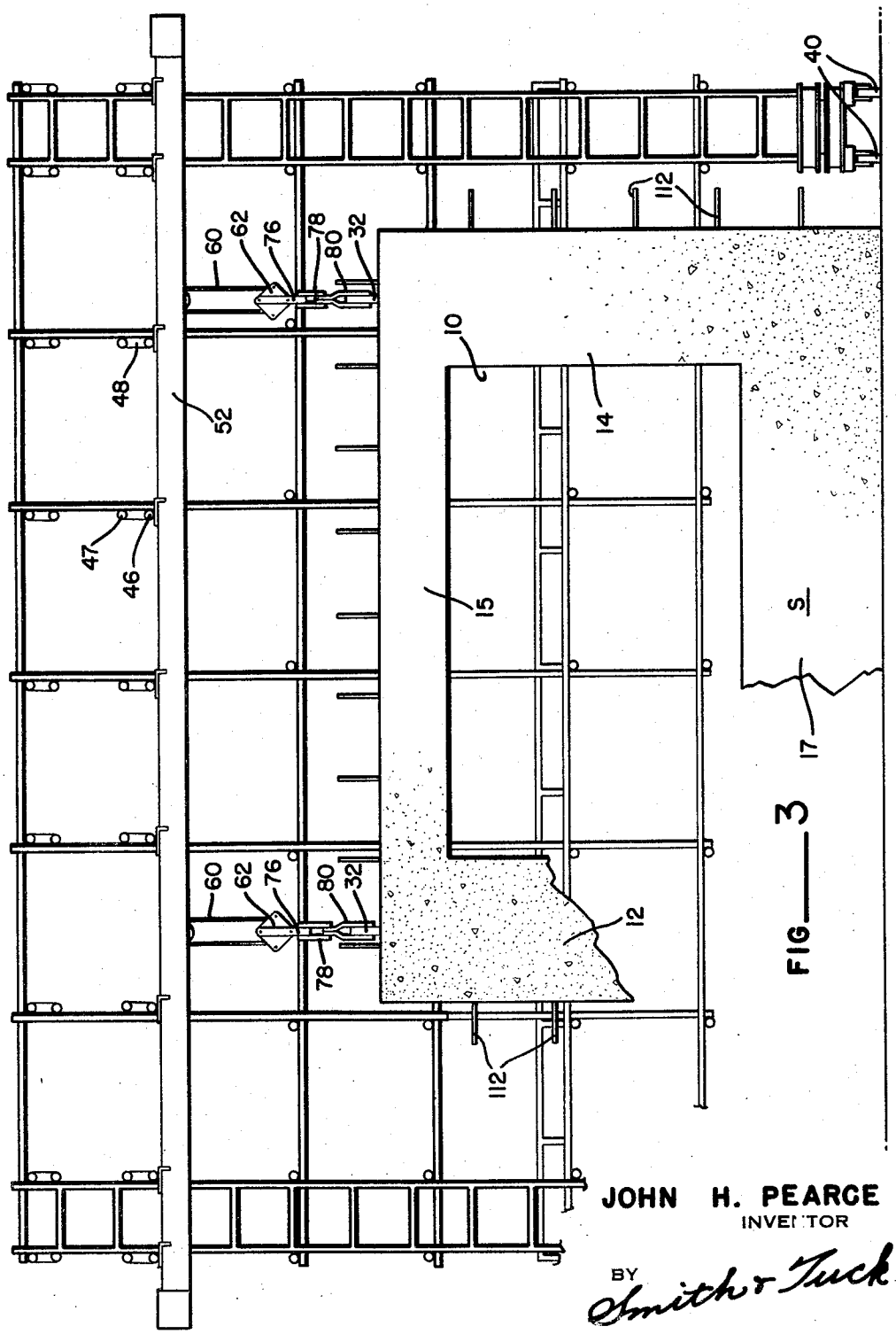


FIG. 3

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METHOD AND MEANS FOR THE ERECTION OF TIP UP WALLS

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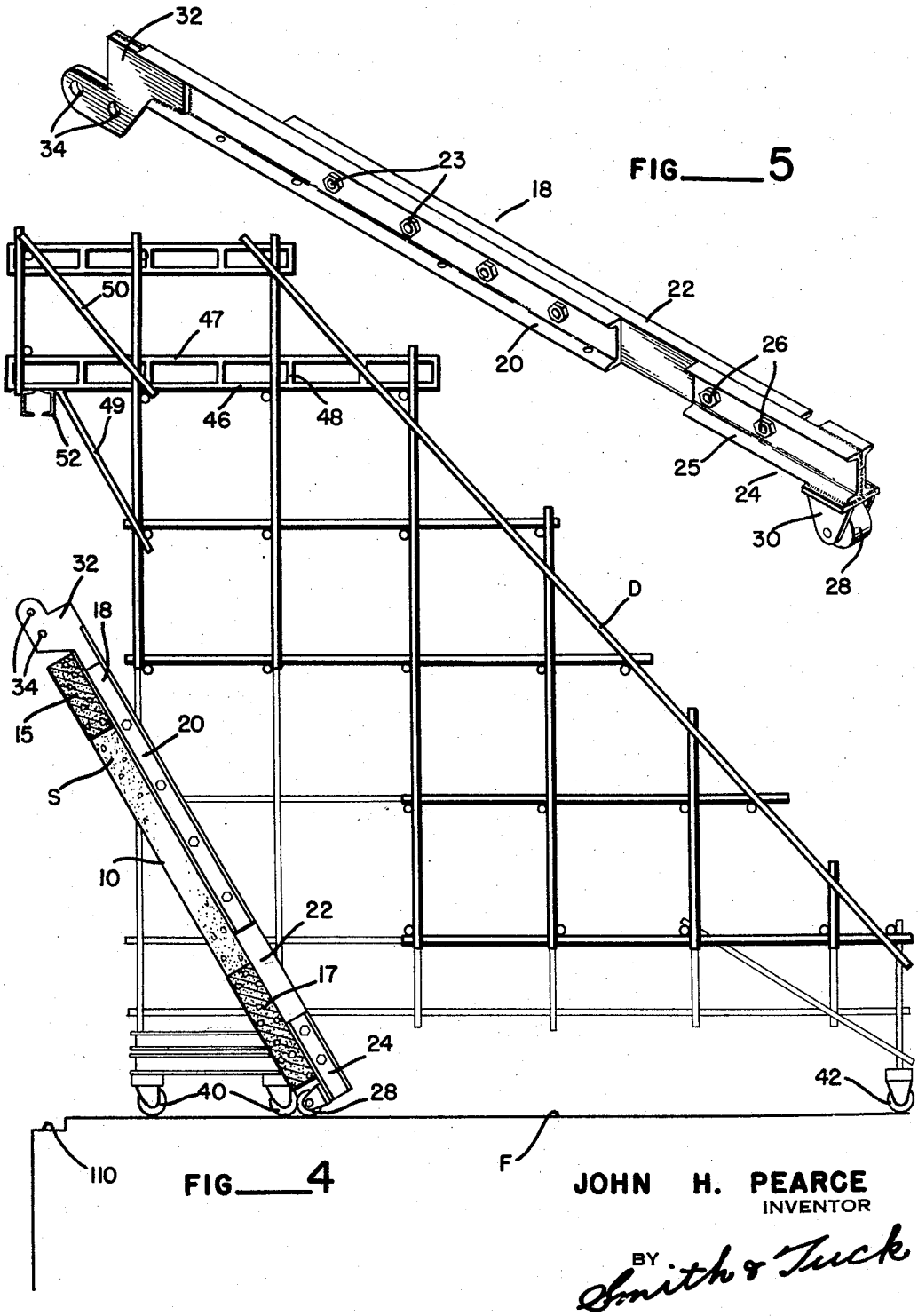


FIG. 5

FIG. 4

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METHOD AND MEANS FOR THE ERECTION OF TIP UP WALLS

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FIG. 6

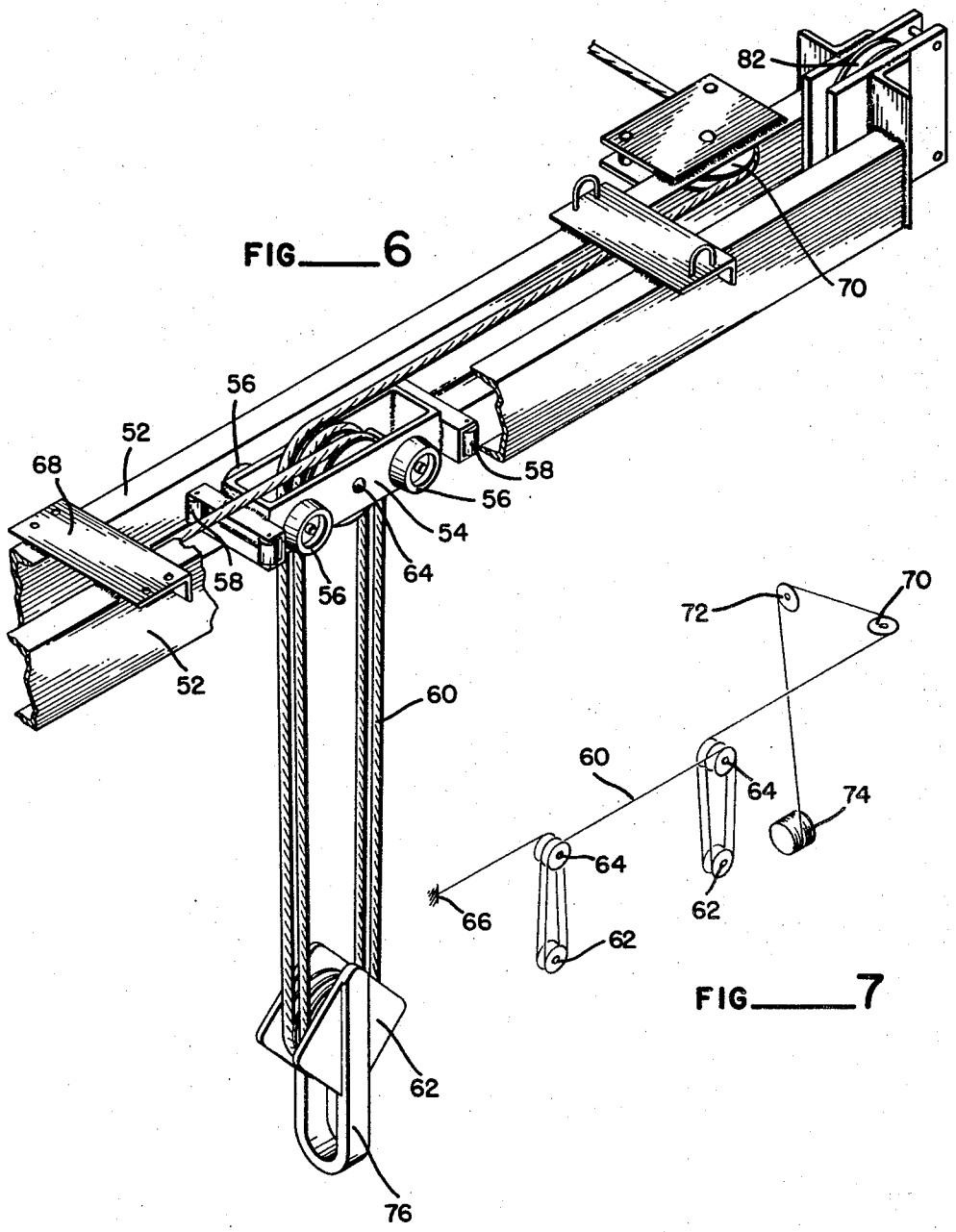


FIG. 7

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METHOD AND MEANS FOR THE ERECTION OF TIP UP WALLS

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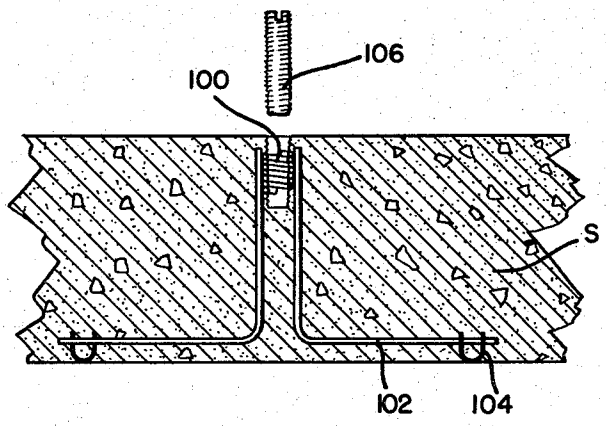


FIG. 9

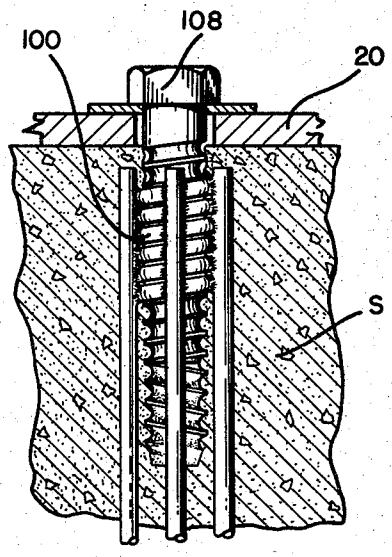


FIG. 10

FIG. 8

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United States Patent Office 2,859,884 Patented Nov. 11, 1958

2,859,884

METHOD AND MEANS FOR THE ERECTION OF TIP UP WALLS

John H. Pearce, Seattle, Wash.

Application April 6, 1953, Serial No. 346,986

5 Claims. (Cl. 214—1)

This present invention relates to the general art of concrete building construction and more particularly to a novel method and the essential means required to accomplish this method. This invention solves the problem of tip up concrete wall structures by casting the wall section with the outer surface of the wall on the bottom of the slab as it is cast; again, in common distinction from the usual methods, raising the upper margin of the slab which is close to the final resting place, vertically, and providing antifriction means for permitting the lower margin of the slab to follow the upper margin of the slab until the entire slab is in a vertical position above its final resting place. The antifriction means, usually consists of wheeled means which are then removed, and the wall slab lowered into its final resting place. To achieve this end result a supporting framework is assembled from pipe or similar lightweight units so that it is readily portable from job to job and can be moved about on the job under construction. Hoisting means, normally manually operated, are provided for raising the slab slowly into the vertical position so that the whole operation is a slow, smooth one which avoids shock to the supporting structure and most especially to the slab itself during the raising period.

In recent years the construction of concrete buildings is making increased use of the well known plan of casting a wall section on the building floor with the use only of marginal forms and then raising this wall slab into position where it is securely joined to the adjacent wall slabs, usually by pouring a concrete joiner portion to join together the intertwined ends of the protruding reinforcing bars, and means is thus provided to give adequate security to the slab to retain it in the vertical position. The absence of expensive forms on each side of the wall slab makes this a most economical way of building structures from poured concrete. In the past, however, the raising of such slabs in place has required very expensive and powerful equipment and in those cases where the bottom of the slab is close to its final resting place required extreme skill on the part of the erectors to prevent shock to the slab especially as it approached the near vertical position. This was due in part to the fact that the heavy cranes usually used are not themselves subject to the niceties of control desired in such an operation, and the operators themselves are too far away from the actual work to be able to control the operation so as to prevent shock to the slab.

It is normal in tip up wall structures to employ a previously finished floor of the building as the curing surface upon which the new slab is formed. Parting means are disposed upon the floor usually in the form of paper especially treated with any of a variety of parting agents, and then marginal forms are provided, and the slab formed, and then struck level with the marginal forms to form the wall section. It will be understood it is believed that very quickly the entire working floor is largely filled with these wall portions that are curing. It is therefore very desirable to put the walls in place

with the minimum curing time, and this condition in turn creates one of the hazards in this form of structure, namely, the handling of a slab that has not had the benefit of thirty days or so of curing time. It is under certain conditions that my present method, which insures the most careful handling of the slab, shows especial appreciable gain over the methods previously used in this line of construction work.

The principal object of my present invention therefore is to provide a method and means for raising cast wall sections from the horizontal to the vertical position with a minimum of shock to the slab and with the minimum of equipment involved.

A further object of this invention is to provide a method and means for raising the edge of a pre-cast wall slab nearest its final resting place and raising it substantially in a vertical plane to its final upright position.

A further object of my invention is to provide means to facilitate moving the trailing edge of a pre-cast wall section as it is moved into the vertical position with the minimum of friction or vibration.

A further object of this invention is to provide a skeletonized dolly which can be easily assembled to meet the conditions of the moment and will carry all the hoisting equipment necessary to raise a wall section so that the section may be kept under the intimate control of the operator of the hoisting equipment at all times and with which the slab can be moved a considerable distance from its casting position.

Further objects, advantages and capabilities will be apparent from the description and disclosure in the drawings, or may be comprehended or are inherent in the device.

In the drawings:

Figure 1 is an end elevation of a cast concrete wall slab as it is being raised into position and shows the supporting and maneuvering dolly employed therewith;

Figure 2 is a perspective view showing, in a diagrammatic manner, the general method employed in forming walls of tip up slab when using the principles of this present invention;

Figure 3 is a front elevational view, partly broken away, illustrating some of the equipment used in this method and the general mode in which the wall slab is handled;

Figure 4 is a transverse sectional view through the dolly employed with this method and showing a slab in a partially raised position without the attendant hoisting equipment which has been eliminated in the interest of clarity of the illustration;

Figure 5 is a perspective view showing a lifter or strong-back member, and a portion of the hoisting equipment used in perfecting this method;

Figure 6 is a fragmentary view, in perspective form, illustrating the general arrangement of the hoisting gear used with this equipment;

Figure 7 is a diagrammatic sectional view illustrating the employment of the hoisting cable 60;

Figure 8 is a perspective view illustrating in diagrammatic form the two carriages employed to move the wall section longitudinally and also illustrating the cable used to control the same;

Figure 9 illustrates in vertical, sectional view, one of the spiders, of which a plurality is used, to engage the wall section; and

Figure 10 is an enlarged, fragmentary view showing a portion of Figure 9 and showing the connection as made to the strong-back which braces the wall section.

Referring more particularly to the disclosure in the drawings, the reference character S designates a typical wall section or slab. For certain types of building these may be a complete slab, or, more commonly, they take the

form illustrated in Figure 3 wherein a large window opening 10 is provided and this reduces the wall section to a frame as it were, having the opposite end portions as 12 and 14, the top portion 15, and the bottom portion 17. Secured to slab S by a plurality of bolts which are embedded in the slab or pass through the same, are two or more lifting members 18. Members 18 are preferably formed of two channel members as 20 and 22 which are bolted together by a plurality of bolts 23 so that the overall length as a unit can be varied as occasion requires. At its lower end lifter 18 is provided with a dolly portion 24. This is preferably formed of channel members as 25 similar in size to members 20 and 22 and it is bolted preferably to member 22 by bolts 26 so that the same may be removed when desired. The under side of dolly 24 is provided with supporting wheels 28 which are usually mounted on anti-friction bearings so that friction will be reduced to a minimum and smoothness of operation will be assured. Wheels 28 are suitably supported from panel 25 as by bracket members 30. At its upper end lifter 18 is provided with the hanger member 32. This member is preferably fixedly secured to channel 20 as by welding thereto and is provided with a plurality of lifting openings 34 which are offset with respect to channels 20 and 22 so that they will be on the line of the combined mass of slab S and the lifter 18. This will permit the wall slab to hang in a perfertcly upright position which is very desirable during the final stages of setting the same in place.

In order to provide means that will overcome the deficiencies of the cranes, derricks, lifting booms and the like that have been used in the past, it has been found most expeditious to employ a built-up dolly D such as is illustrated in Figures 1, 3, and 4. In using this form of equipment the usual structural shapes employed in scaffolding of the demountable type can be successfully employed. These are usually formed of tubing or pipe sections which have clamped members, not illustrated, which securely fasten the vertical and horizontal members together at their intersections in a secure, but demountable manner. Demountable scaffolding of this order has been in common use for quite a period and many different plan arrangements have been employed which may be used in this structure. This built-up dolly is provided with a plurality of wheeled members, some of which may be constructed as caster wheels for more convenience in handling. For this present use it has been found most satisfactory to provide a plurality of wheels at each of the front ends of the dolly. These are indicated at 40. At the rear margin of the dolly, single wheel units as 42 may be employed spaced along the rear margin as they only need to carry usually the weight of the open framework which is a very light load, plus such counterbalance as is required. This counterbalance is indicated at 44 in Figure 1 and can most conveniently be made up of bags of sand or cement which are usually readily available on such works. Then too, the amount of the counter-balance can be quite closely adjusted so as to be ample without needless weight.

At its uppermost extent the dolly is provided with preferably two mutually supporting beams. Each beam, following the practice well known in demountable scaffolding, is usually provided as a unitary structure involving spaced members 46 and 47, with an adequate number of spacing members 48, so that the whole unit is one of great structural strength considering the weight involved. It is often found desirable to use diagonal bracing as 49 and 50 to further support the lifting trackage 52. The lifting track 52 is conveniently made from channels which face each other after the showing of Figures 1 and 6 so that travelling carriages as 54 may be employed and be capable of longitudinal movement therein. This arrangement has been found very desirable in that in placing the slab in its final position it is very commonly necessary to move the same lengthwise to its exact resting position.

A preferred arrangement of the lifting gear is illustrated in Figures 1, 6 and 7. Disposed within trackage 52 are two or more lifting carriages 54. These are provided with opposed and spaced bearing wheels 56 and are further provided with the guide rollers 58 so as to prevent the carriages from binding within trackage 52. A practical ararngement of the lifting cable 60 is shown in Figures 6 and 7 and in this arrangement it will be noted that the lifting blocks 62 are provided with two sheaves so that a mechanical advantage of four is obtained. Such an arrangement requires the use of three separate sheaves in carriage 54. However they may all be supported on a single shaft 64. In use one end of the cable is anchored fixedly as at 66 as to one of the cross members 68 formed as part of the trackage assembly 52. The other end of the cable after leaving the last carriage usually passes over a horizontal sheave 70 and then a vertically disposed sheave 72 where it is directed to the drum 74 of a suitable winch. For all practical purposes this winch can be manually operated as indicated in Figure 1 although it is apparent of course that any of the small forms of power driven hoists might also be similarly employed. The becket 76 of block 62 is connected by the usual double linkage formed of members 78 and 80 to through openings 34 in hanger 32. The arrangement of the carriage shifting cable which makes it possible to move the slab endwise for considerable distance is illustrated in Figure 8. For all ordinary work it is necessary to employ at least two carirages 54 and any adidtional number may be employed to hang a single slab if the same are necessary. It will be noted for instance in reference to Figure 7 that cable 60 is continuous from its anchorage 66 to the drum 74 which controls it. The cable could of course pass through a plurality of sheaves 62 and 64, and as it is continuous, the same lifting strain will be available on all the various pulleys 62. For the same reason the center to center distance of the sheaves supported on shafts 64 can be changed to meet the requirements of the moment without in any way disturbing the lifting ability of cable 60 or its ability to place equal strain on the various pulleys or blocks 62. It is desirable to have a connector between carriages 54 and to have it reasonably fixed for each job. This is usually accomplished by providing cable clamps to clamp the cable 90 into its engagement with each of the carriages and for convenience a turnbuckle for final adjustment, as 91, may be employed.

To control the longitudinal movement of carriages 54 within trackway 52, a single cable 93 is employed. This is normally secured near its midpoint to drum 94 and is led over a plurality of sheaves 95 so as to finally properly engage sheaves 82 and 83 which are fixtures within trackway 52. With such an arrangement it will be apparent that turning crank 96 in either direction will have the effect of moving carriages 54 together with their appended hoisting equipment and that the slab S itself will be moved.

In most constructions of this order there will be reoccurring window openings and many of the slabs will not have within themselves very great structural strength. Therefore special pains must be employed to assure equal distribution of the lifting load. A very good attachment means is illustrated in Figures 9 and 10 in which a spring bushing 100 is employed and to it is welded, preferably, a plurality of spider arms as 102. These spider arms radiate out from the axis of bushing 100 and are normally provided with what in effect are chaplets 104 which space them well within the slab S. As the slab is poured a removable plug 106 is inserted within the bushing 100, and after the slab is set the required minimum after pouring, screw 106 is removed and in place thereof a cap screw 108 is employed. This cap screw is provided with an arcuate thread which will engage in the threadlike arrangement the inner helical surface provided by bushing 100. A plurality of these units is employed to engage each strong-back or lifter 18. This arrangement gives the whole unit a degree of elasticity that, when a number are used in coaction, assures that the strains are well distributed throughout the slab.

Method of operation

Using this equipment and the method related thereto, the dolly D is maneuvered over the horizontal slab or wall section S. This slab of necessity must have cured sufficiently so that it can be handled without danger of cracking. The lifting members **18** are suitably secured, by a plurality of bolts **108**, to what will be the inside wall of the slab or the top of the slab as it lies horizontal in the position where it is was cast. Blocks **62** through their linkage **78** and **80** are connected to one of the openings **34** in the hanger members **32**. Power is then applied to drum **74** and the top portion of the slab S is raised from the casting floor F. At is is raised the center part of the slab will move toward its final resting place with the bottom end of the same supported on wheels **28** of lifter dolly **24**. It will be noted, particularly in Figure 4, that the frame means of dolly D is arranged to overhang the lower end of slab S so that the slab can be swung through the course it will naturally take when it is raised. It is desired to point out that a relatively slow raising operation is desirable and for most work a single man can provide the motive power required after the showing of Figure 1. This workman is in a favorable position to observe the movement of the slab. This operation provides the slow smooth movement required to avoid shock to the slab and this is particularly important as the slab will not have normally reached its full strength through curing. When the slab has reached the vertical position it will hang truly vertical if its positioning in respect to holes **34** has been properly determined.

The whole weight of the slab S and lifter **18** is now on the carriages **54** and their supporting trackage **52**. At this time the lifter dolly **24** on each lifter **18** can now be disconnected by removing bolts **26**, thus freeing the bottom edge **80** of slab S. The main dolly D is now moved until slab S is in axial alignment with its final position in notch **110**. Endwise placement of slab S is difficult to achieve with dolly D and the second cable **93** is now brought into use by operating winch **94**. The slab may then be moved endwise on trackage **52** by suitable handling of winch **94** which moves cable **93** through sheaves **82** and **83**, one at each end of the trackage. When the proper endwise position has been reached, the slab **10** can be lowered in place. It will be noted in Figure 3 that the lifters **18** are disposed somewhat back from the ends of slab S so that the joining means may be cast in place to include the protruding steel bar ends **112**, or clamp means may be employed to temporarily hold the slab in position until its final securing means is provided.

It is to be observed that in raising the slab in the manner illustrated it can be done with a minimum of shock to the slab and further by providing the lifting members as **18** in association with the movable dolly D this technique may be employed in multiple storied buildings without any regard to the ground line of the building. This is an important advantage of this building technique.

It is believed that it will be clearly apparent from the above description and the disclosure in the drawings that the invention comprehends a novel construction of a method and means for the erection of tip up walls.

Having thus disclosed my invention, I claim:

1. Means for raising concrete tip-up wall slabs, comprising: a framework formed of demountable tube-shaped scaffolding and wheel means supporting said framework whereby said framework can be moved as a unit from one section of a wall structure to another, said framework having at its front side an overhanging upper portion and having in its rear portion weight means for counterbalancing the weight of objects suspended from said overhanging portion, and means secured to said overhanging upper portion adapted to be secured to such a wall slab and operative to lift the same, said wheel means comprises a four wheel dolly positioned under each forward corner of said framework and a single wheel under each rear corner of said framework, some of said wheels being of a caster type rotatable about a vertical axis so as to permit turning of said framework.

2. The method of raising a concrete, tip-up wall slab to its position in the plane of the wall at the edge of a floor of a building, comprising: casting a concrete slab outside-face-down on said floor near said floor edge; lifting the edge of the slab nearest to said floor edge and slowly raising and moving said nearest edge to a position near the position it is to occupy in the wall and trailing the edge of the slab farthest from said floor edge along said floor toward said floor edge until the slab is suspended above the floor completely in the plane of the wall with the face of the slab previously abutting the floor forming the outside face of the wall slab and with said nearest edge uppermost, and adjusting the position of the slab longitudinally of said wall and lowering it into final position.

3. The method of raising a concrete, tip-up wall slab to its position in the plane of the wall at the edge of a floor of a building, comprising: positioning a concrete slab face-down on said floor near said floor edge; lifting the edge of the slab nearest to said floor edge and slowly raising and moving said nearest edge to the position it is to occupy in the wall and trailing the edge of the slab farthest from said floor edge along said floor toward said floor edge until the slab lies completely in the plane of the wall with the face of the slab previously abutting the floor forming the outside face of the wall slab and with said nearest edge uppermost.

4. The method of raising a concrete, tip-up wall slab to its position in the plane of a wall, comprising: casting a concrete slab face-down on the floor; lifting the edge of the slab nearest to the wall plane and slowly raising and moving said nearest edge to a position near the level of the top of the wall in the plane of the wall and trailing the edge of the slab farthest from said wall plane along the floor toward said wall plane until the slab lies completely in the plane of the wall with said nearest edge uppermost.

5. The method of claim 4 including the step of removably securing a strongback to the upper face of said slab and applying the lifting force to a portion of the strongback at said nearest edge of said slab and securing wheel means to said strong-back adjacent the farthest edge of said concrete slab in position to engage the floor when said nearest edge is raised for supporting said slab as it is trailed.

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