United States Patent

Johansson

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[54] **APPARATUS FOR SLIP-FORMING**

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[52] **U.S. Cl.** **425/65,** 249/20, 249/48, 264/33

[51] **Int. Cl.** **B28b 1/14**

[58] **Field of Search**.....25/131 SA, 131 SB, 131 R, 131 K 25/131 P, 131 YA, 131 YF, 131 IA, 131 B, 131 EM, 131 EY; 249/17, 20, 33, 34, 48; 264/33; 425/65

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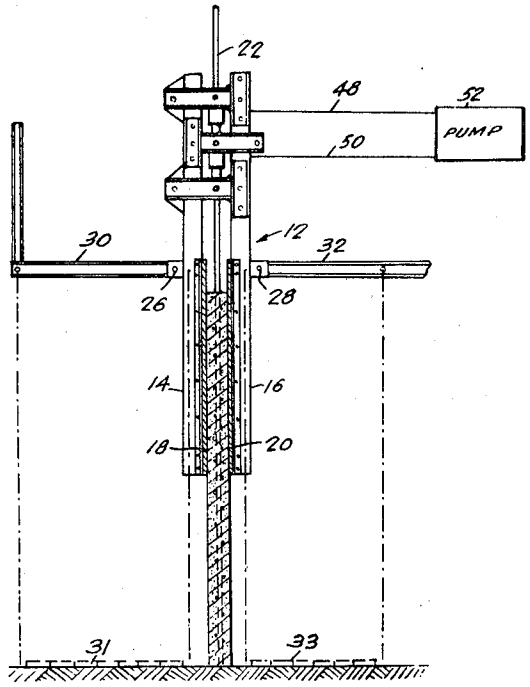
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[57] **ABSTRACT**

A mold assembly used in the construction of concrete walls and including two leg members carrying opposing spaced form panels within which concrete is poured. Thinner walls may now be erected by alternately (instead of synchronously) raising the form panels. Jacks operating on transversely extending cross-members secured to the leg members cooperate with gripping members climbing along the vertical rod extending in the concrete to alternately raise the two form panels.

5 Claims, 7 Drawing Figures



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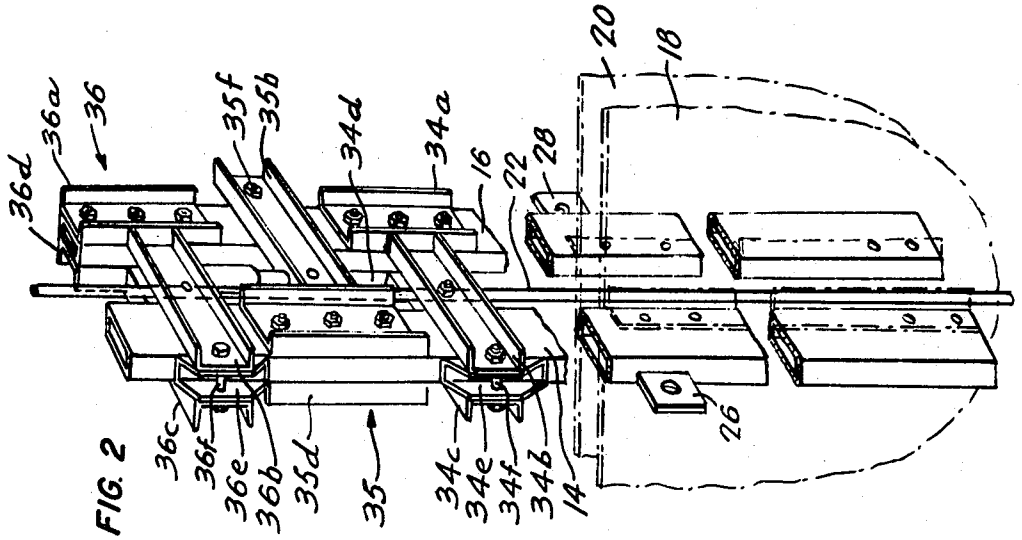


FIG. 2

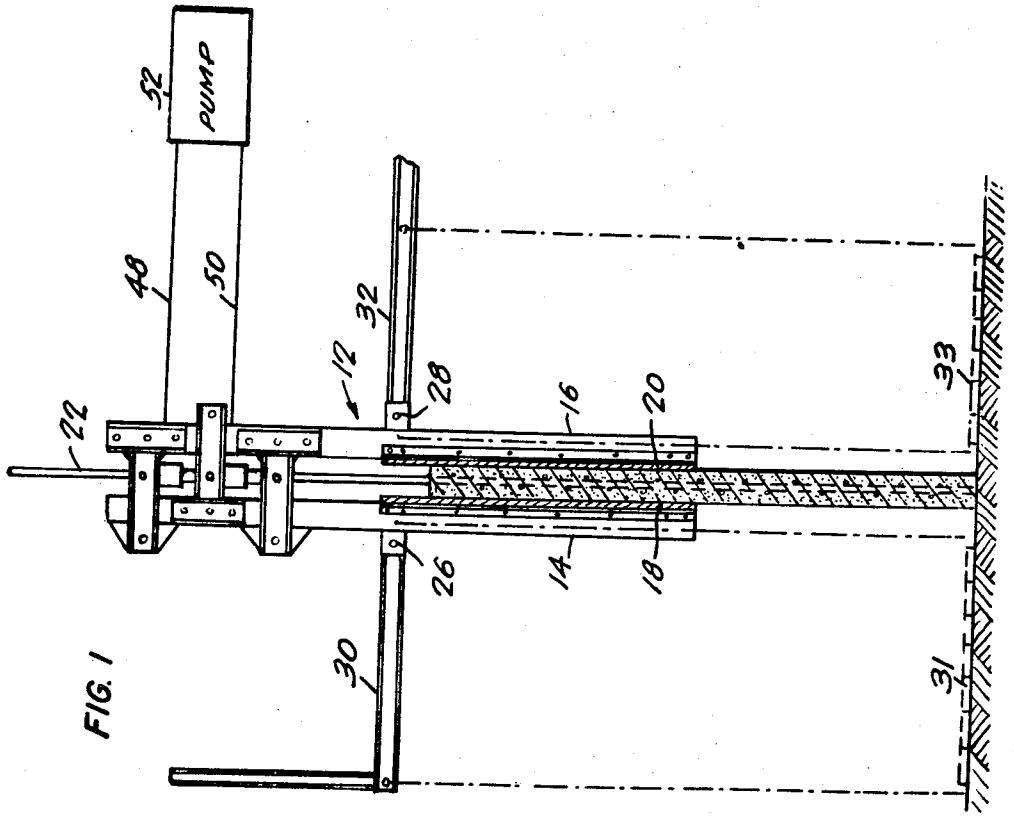


FIG. 1

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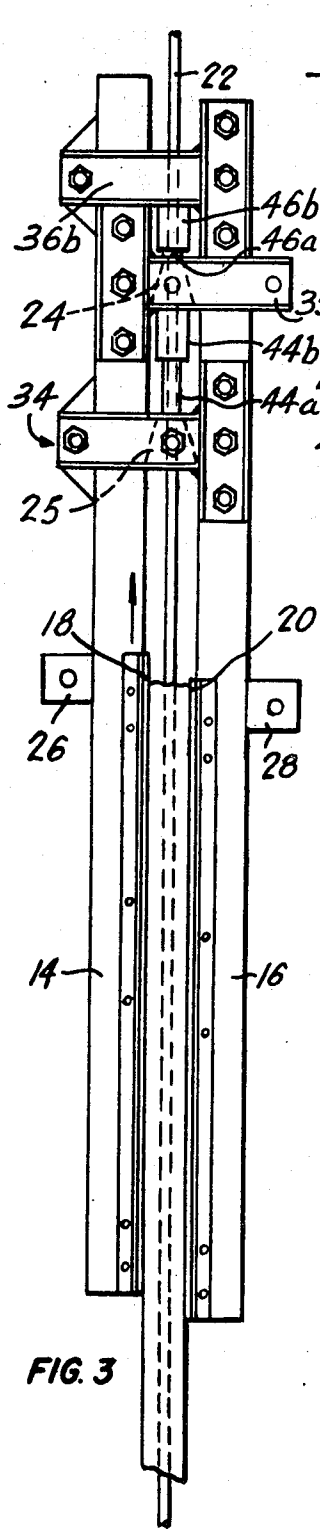


FIG. 3

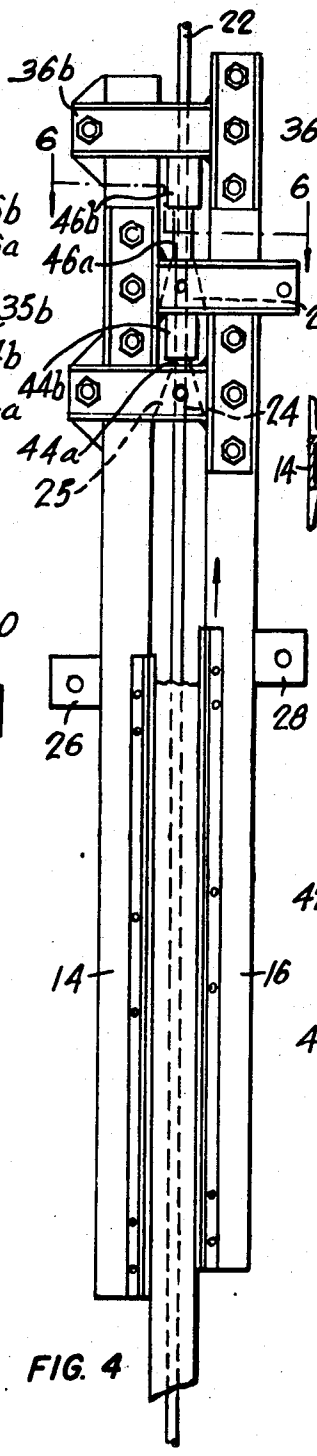


FIG. 4

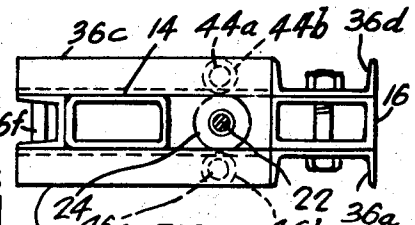


FIG. 5

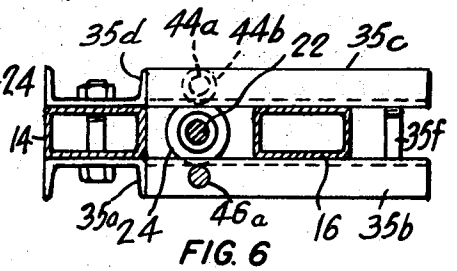


FIG. 6

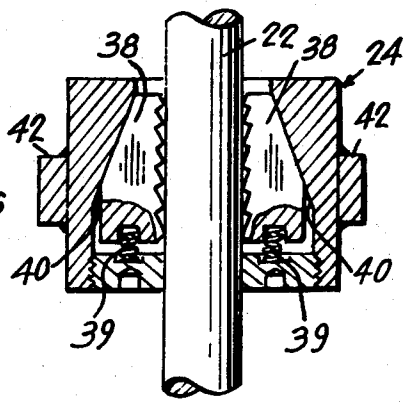


FIG. 7

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APPARATUS FOR SLIP-FORMING

This invention relates to a method and apparatus for concrete wall construction. More particularly, this invention pertains to a method and a sliding mold assembly used in the casting of concrete wall structures with the use of slipforms.

The slipform technique uses form panels constituting the mold surfaces between which the concrete is poured and shaped in the building up of a wall; the forms are synchronously slided upwards at a rate slow enough to allow the placing of the reinforcement, the pouring and the vibrating of the concrete and also slow enough to ensure that the concrete has hardened sufficiently. However, the rate of slide must be fast enough to prevent the hardened concrete from sticking to the form panels and smooth enough so as not to disturbed the concrete which is already compacted but which is not yet hardened.

It is generally known by those versed in the technique of slipforming that certain limitations exist with regard to this method; for instance it is generally admitted that there is a limit with respect to the minimum thickness which may be alloted to a wall structure casted with present forming methods, in order to avoid the occurrence of horizontal cracking of the concrete. On the other hand, there is a need for thin concrete walls, in some cases, for practical reasons, and, in other cases, for cost reduction.

The present invention has for its object to provide a method which makes it possible to slipform a much thinner wall than that successfully achieved so far with the synchronous lifting of the two form panels while still providing a smooth lifting that will prevent shrinkage and distortion of the concrete. It has been found that the limitations of the previous methods may be exceeded by alternating the upward slide of the form panels. The nature of this invention is based on the realization that by successively ascending each form panel the frictional resistance between panel and concrete for that panel being lifted does not exceed the counter-acting frictional resistance between the panel not being lifted and concrete at the time of lifting thereby providing the beneficial result that the concrete between the form panels is not lifted through sticking and the occurence of horizontal cracking and distortion of the concrete is greatly diminished.

It is also an object of this invention to provide an apparatus which will perform the alternate lifting of each form panel of a mold assembly thereby enabling the casting of thinner concrete wall structures than that obtained up to now with presently known methods.

The present invention relates to a mold assembly for use in the casting of a concrete wall structure which comprises in its broadest aspect, a frame consisting of two leg members; first and second opposing spaced form panels carried respectively by each of the leg members for containing concrete therewithin; a plurality of vertically-spaced cross-members mounted on these legs, each cross-member alternately having one end thereof rigidly secured to one of the leg member and having the other end slidably receiving the other leg member; a pair of climb members mounted on respective cross-members and each provided with grip means for gripping a vertical rod fixed in the concrete so as to climb thereon; and at least two vertically

disposed jacking members, the opposite ends of each jacking member resting against successive vertically-spaced cross-members whereby the alternate actuation of the jacking members will cause the alternate raising of the form panels along the set concrete.

The present invention also relates to a method of casting a concrete wall structure which comprises, in its broadest aspect, the steps of securing vertically two opposing spaced form panels, pouring concrete within the form panels, letting the concrete set to a desired firmness and alternately raising the form panels by successively operating jacking members acting on cross-members transversely mounted on the frame structure.

Examples of a preferred embodiment of the invention are illustrated in the accompanying drawings in which:

FIG. 1 is a diagrammatic sectional elevational view of one embodiment of the present invention with attached working decks and pump means for operating jacks used in the present invention;

FIG. 2 is a perspective cut-in-section view of the mold assembly in accordance with present invention with the form panels in dotted lines;

FIGS. 3 and 4 respectively illustrate the steps in alternately ascending the form panels used in the present invention;

FIG. 5 is a top view of FIG. 4;

FIG. 6 is a cross-section taken along lines 6—6 of FIG. 4; and

FIG. 7 is cross-sectional view of the rod gripping members used in the present invention.

Referring specifically to FIG. 1, there is shown the lower section **10** of a concrete wall which has been previously poured and which is now hardened. The wall is surmounted by a mold assembly **12** which comprises a frame structure consisting of two leg members **14** and **16**. These leg members respectively carry steel or wooden form panels **18** and **20** arranged in an opposing relationship and between which concrete has been poured and is in its first hardening process. Embedded in and extending above the concrete wall is a rod **22**, and climbing along this rod is the mold assembly **12** by means of two climb members **24** and **25** shown in dotted lines in FIGS. 3 and 4.

Leg members **14** and **16** are respectively provided with extension plates **26** and **28** for mounting working decks **30** and **32** to facilitate the pouring of concrete between the form panels and to secure scaffolds **31** and **33** respectively.

FIG. 2 illustrates the construction of the lifting section of the mold assembly **12** along the vertical rod **22**; three T-shaped cross-members **34**, **35** and **36** are each made up of a pair of two U-shaped channel iron members **34***a*, **34***b*, **34***c*, **34***d*; **35***a*, **35***b*, **35***c* (not shown), **35***d*; and **36***a*, **36***b*, **36***c*, **36***d*; the pairs of T-shaped cross-members are connected at their ends in an opposing spaced relationship. Members **34***a* and **34***b* are welded together, or otherwise secured, so are members **34***c* and **34***d*, **35***a* and **35***b*, **35***c* and **35***d*, **36***a* and **36***b*, **36***c* and **36***d*. Members **34***a* and **34***d*, **36***a* and **36***d* are bolted, or otherwise secured, to leg member **16** while members **35***a* and **35***d* are bolted to leg member **14**. Members **34***b* and **34***c* slidably receive leg member **14** and are joined together through sliding member **34***e* and bolt **34***f*. Members **36***b* and **36***c* slidably receive leg

member 14 and are joined together through sliding member 36*e* and bolt 36*f*. Members 35*b* and 35*c* (FIG. 6) slidably receive leg member 16 and are joined together through bolt 35*f*.

Secured to opposing spaced members 34*b* and 34*c*, 35*b* and 35*c*, in the area between the leg members 14 and 16, are the two climb members 24 and 25 respectively, one of which is illustrated in cross-section in FIG. 7. These devices which are well known and used in the construction field consist of a series of toothed climb jaws 38 gripping the rod 22; the jaws are upwardly resiliently biased by spring 39 and are adapted to slide along sliding surfaces 40 rendering the grip on climb rod firm and secure and preventing the climb member from slipping down with its load. The climb devices 24 and 25 is provided with stud bolts or the like 42 which extend through opposing members 34*b* and 34*c*, 35*b* and 35*c*, respectively. The jaws permit the climb devices 24 and 25 to slide upwards on climb rod 22 but prevent them from sliding down by gripping the climb rod.

The climb devices 24 and 25 operate when lifting jacks 44 and 46 are operated; these jack may be hydraulically or otherwise powered as indicated diagrammatically by connecting lines 48 and 50 and pump 52 in FIG. 1. As illustrated in FIGS. 2–6, one jack is disposed between the upper edge of member 35*b* and the lower edge of member 36*b*; the other jack 44 (hidden in FIG. 2) is disposed between the upper edge of 34*c* and the lower edge of 35*c*. Each jack consists of a piston 44*a* (or 46*a*) which slides into a cylinder 44*b* (or 46*b*).

The mold assembly described above may be used singly or in combination with similar assemblies to form a definite shaped structure. The form panels of the mold may have different shape and be provided with concrete abutting surfaces of different textures. All these variations are well known in the art and will not be described.

The crux of the present invention is that an apparatus has been devised wherein the form panels used in building concrete walls may be lifted alternately. The operation of such a lifting operation will now be described by referring to FIGS. 3 and 4 more particularly. In FIG. 3, jack 44 is shown with its piston 44*a* extended outside cylinder 44*b* while the piston 46*a* of jack 46 is received in cylinder 46*b*. In this fixed position, it will be assumed that form panel 18 has just been lifted and it is therefore wished to now lift form panel 20 (or to arrive at the illustration of FIG. 4). Jack 46 is hydraulically powered so that piston 46*a* is forced out of cylinder 46*b*. This causes the cylinder 46*b* to move upward, pushing the lower edge of 36*b* to ascend, piston 46*a* being unable to force member 35*b* down since the gripping of climb device 24, which is connected to the member 35*b*, will prevent through the action of its jaws 38 any downward movement of the cross-member 35. Therefore, cross-member 36 will slide upward along leg member 14 and, being connected to leg member 16, will lift leg member 16 a distance equal to the stroke of the piston 46*a*, as is illustrated in FIG. 4.

Similarly, the lifting of leg member 14 will be caused by the actuation of hydraulically powered piston 44*a* (now in cylinder 44*b*) whereby it will lift cross-member 35 and, simultaneously, leg 14, gripping of climb device 25 preventing member 34 from being lowered down along climb rod 22.

This method of alternating the lifting of the form panels greatly reduces the total friction between the hardened concrete and the form panels. Whereas before, with the synchronous lifting of the panels, the frictional resistance is at least half diminished with one form panel acting as a holding panel while the other panel slides up.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A mold assembly for use in casting a concrete wall structure comprising

a frame consisting of two leg members;

first and second opposing spaced form panels carried respectively by each leg member for containing concrete therewithin;

a plurality of vertically-spaced cross-members mounted on said legs, each cross-member alternately having one end thereof rigidly secured to one of said leg member and having the other end slidably receiving the other leg member;

a pair of climb members mounted on respective cross-members and each provided with grip means for gripping a vertical rod fixed in the concrete; and

at least two vertically disposed jacking members, the opposite ends of each jacking member resting against successive vertically-spaced cross-members whereby the alternate actuation of the jacking member will cause the alternate raising of the form panels along the set concrete.

2. A mold assembly as defined in claim 1 wherein said plurality of cross-members consists of three T-shaped members, each being made up of a pair of two U-shaped channel irons, the pair of T-shaped cross-members being connected at their ends in an opposing spaced relationship.

3. A mold assembly as defined in claim 2 wherein one jacking member has its opposite ends resting between a channel iron of a first pair of cross-members and a channel iron of a second pair of cross-members and wherein the other jacking member has its opposite ends resting between a channel iron of the second pair of cross-members and a channel iron of a third pair of cross-members.

4. A mold assembly as defined in claim 3 further comprising pumping means for alternately actuating said jacking members.

5. A mold assembly as defined in claim 4 wherein said leg members include means for fixedly attaching a working deck to facilitate the pouring of the concrete.

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