United States Patent

Andersson

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[54] ARRANGEMENTS IN SLIDING FORMS

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[30] **Foreign Application Priority Data**

Apr. 8, 1969 Sweden 4894/69

[52] **U.S. Cl.** **425/65**, 249/17, 264/33, 425/182, 425/213, 425/155

[51] **Int. Cl.** **B28b 7/04**

[58] **Field of Search** ..... 25/118 R, 124, 131 K, 131 EM, 25/131 SA, 131 SB, 131 RR, 131 SC, 131 R, 131 SD, 131 YA, 131 YF, 1 B, DIG. 26; 249/17, 20, 33; 264/33

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Primary Examiner—J. Spencer Overholser
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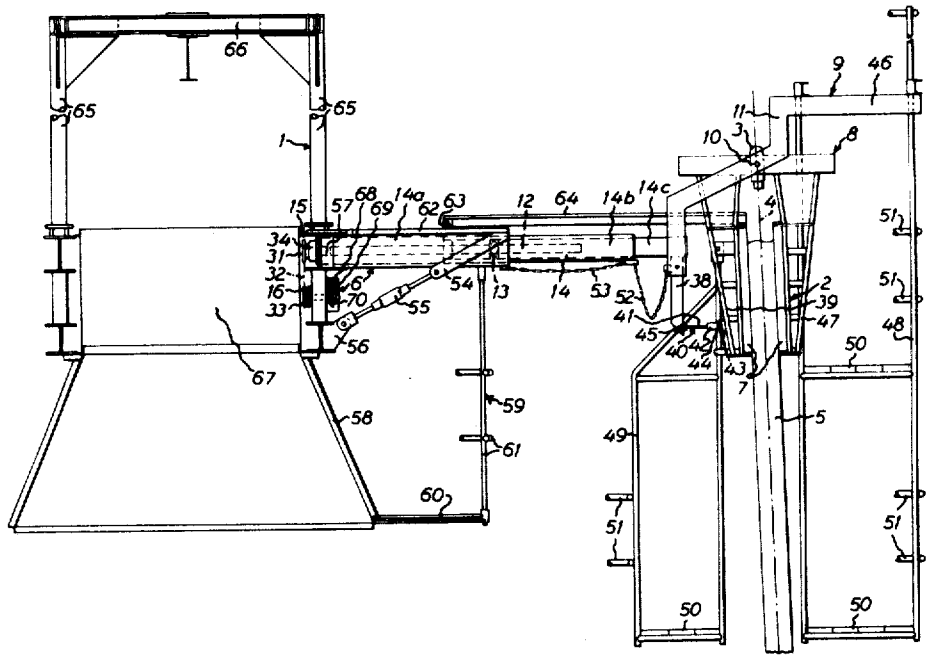
[57] **ABSTRACT**

An adjustable sliding form or shuttering for concrete casting of buildings comprises relatively movable form sections to permit contraction and/or enlargement of the sliding form by the action of width regulating means to vary the width of the building, yoke-shaped scaffolding members carrying the sliding form and the scaffolding thereof for vertical movement, and climbing means operating the sliding form and the scaffolding thereof. Each of the movable form sections operable by the width regulating means is freely pivotally mounted in the scaffolding at a point above the form section to permit said form section to freely adapt itself to the width adjustment initiated by the width regulating means at the single mounting point.

15 Claims, 12 Drawing Figures



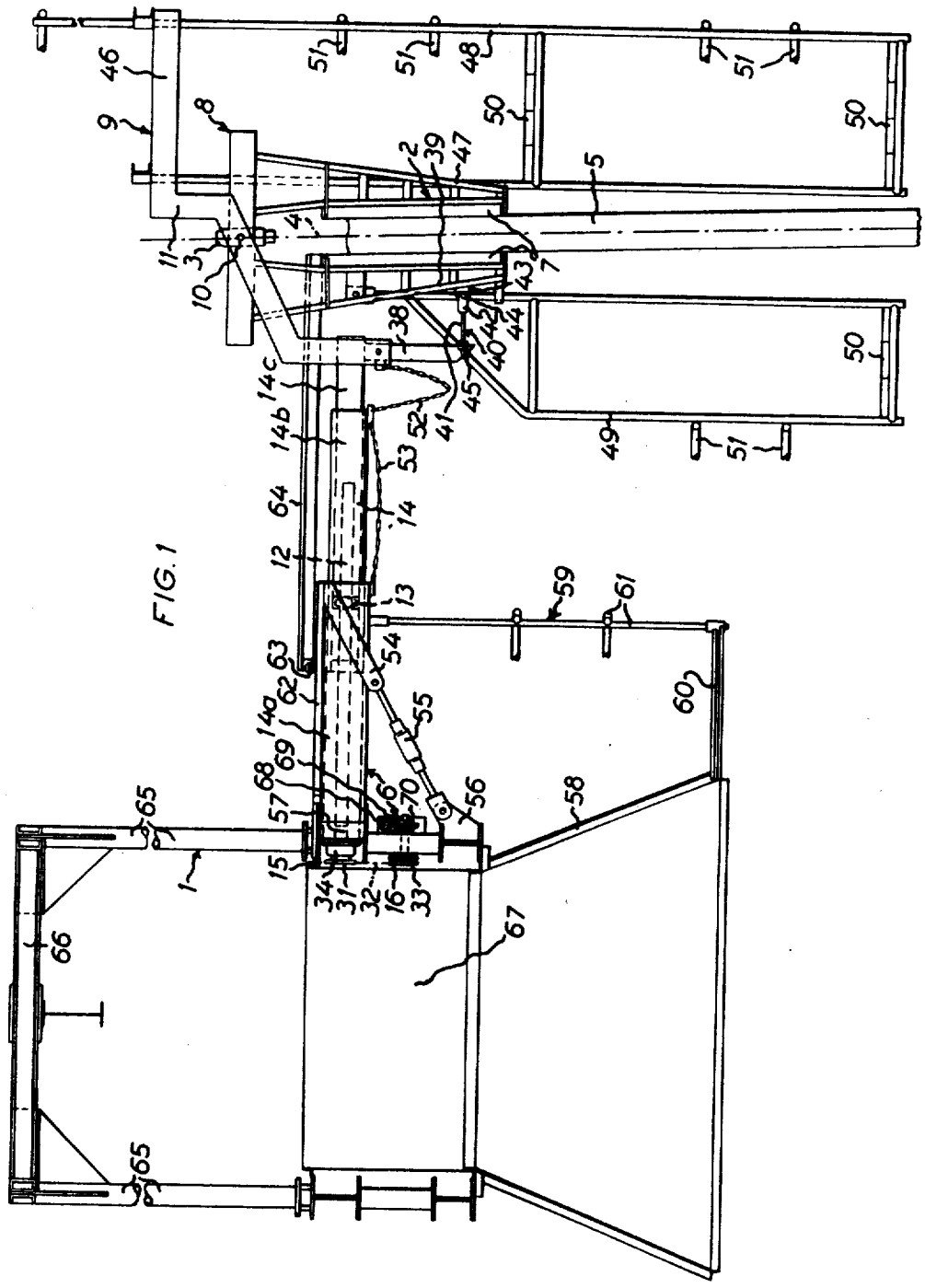


FIG. 1

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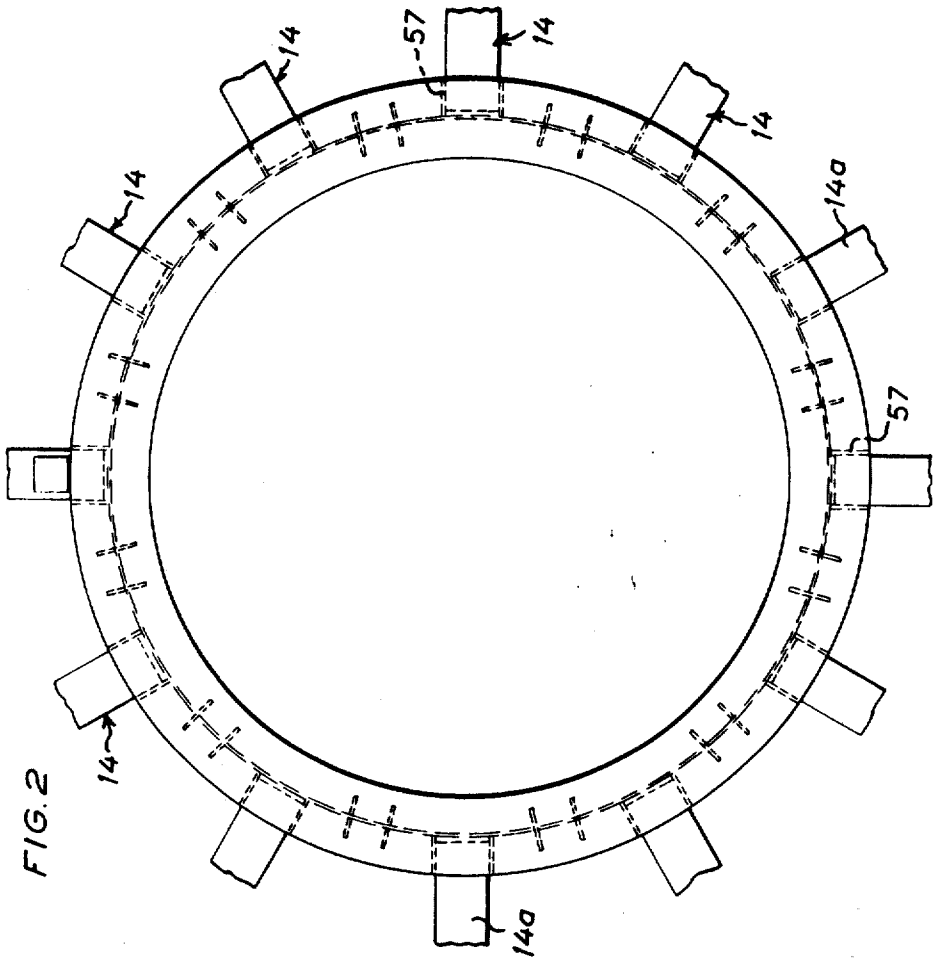

FIG. 2

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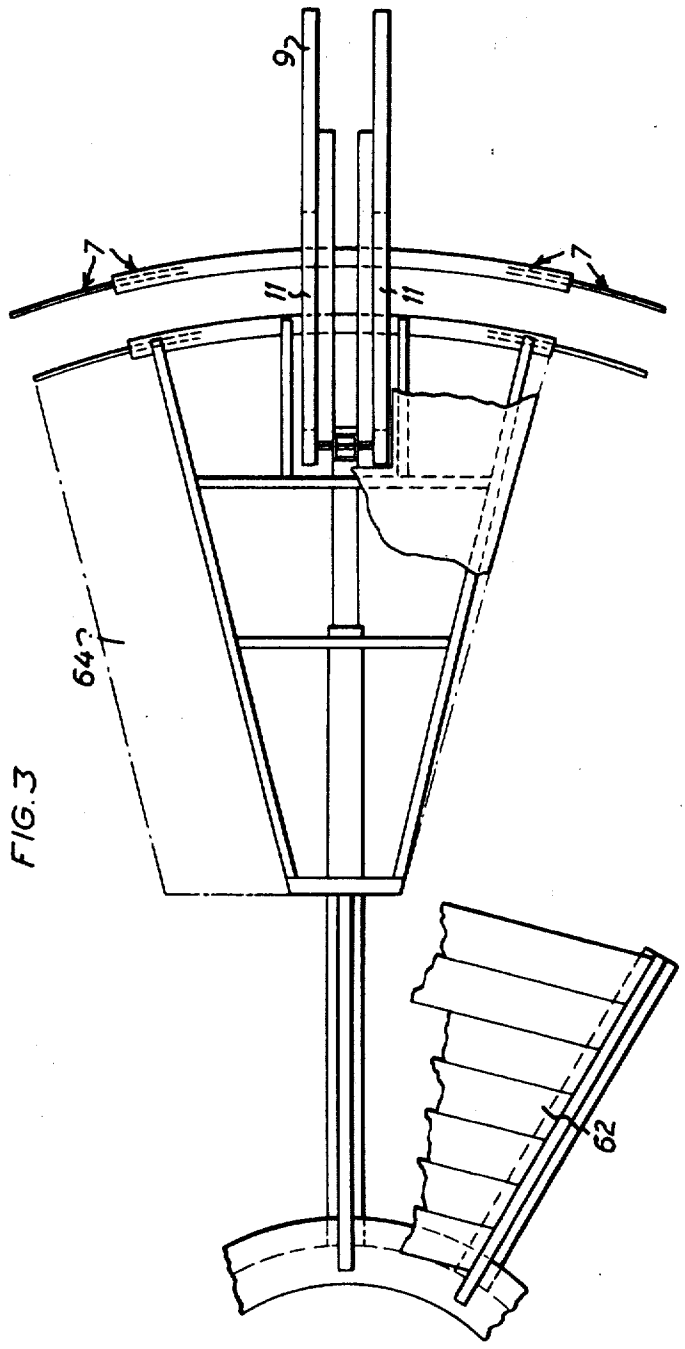

FIG. 3

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FIG. 4

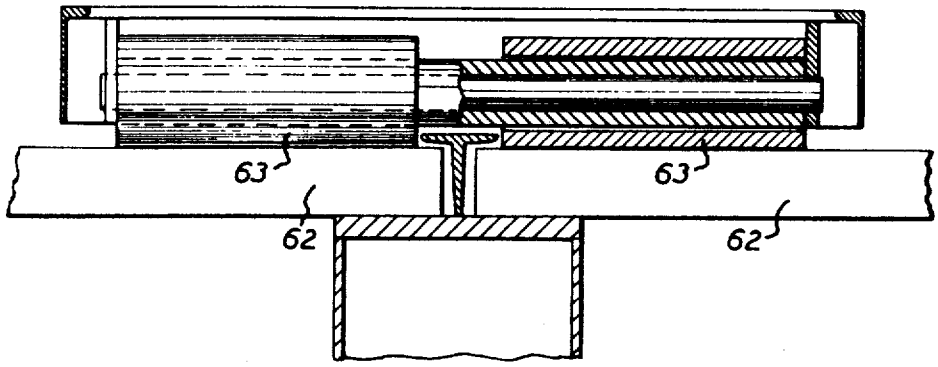
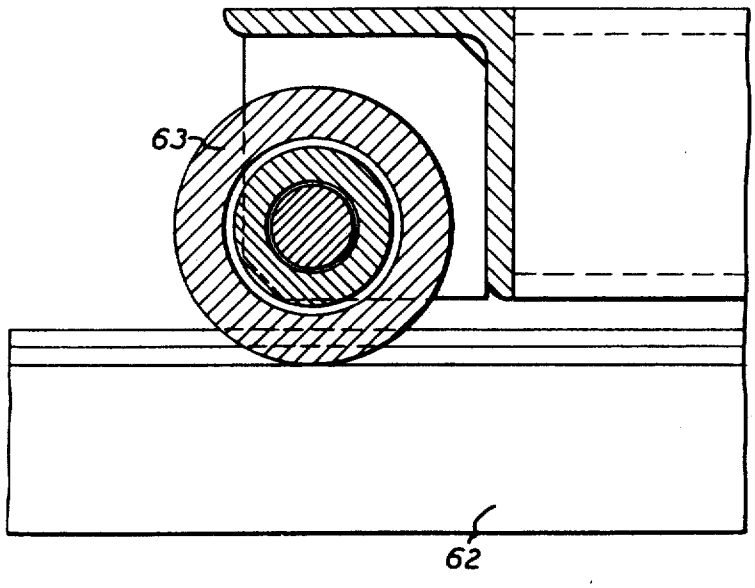


FIG. 5



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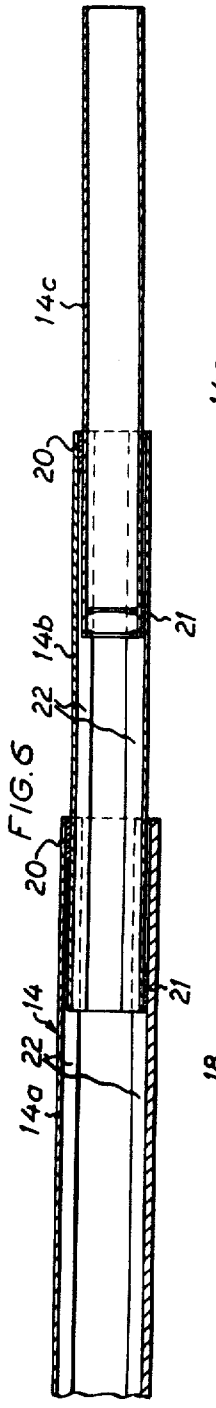

FIG. 5

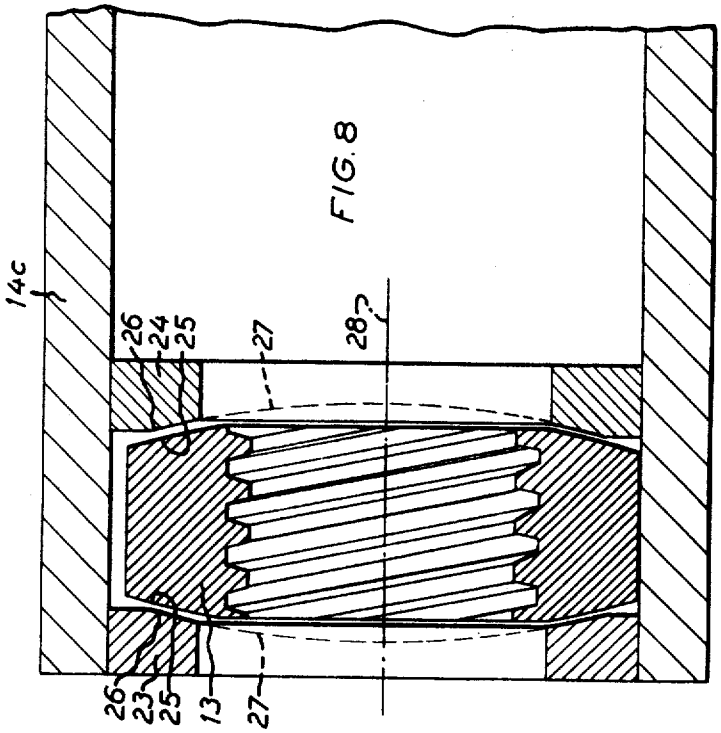

FIG. 8

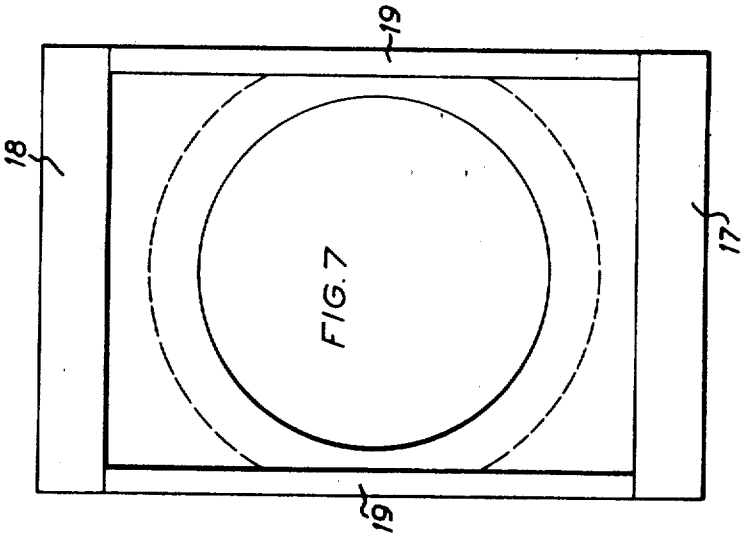

FIG. 7

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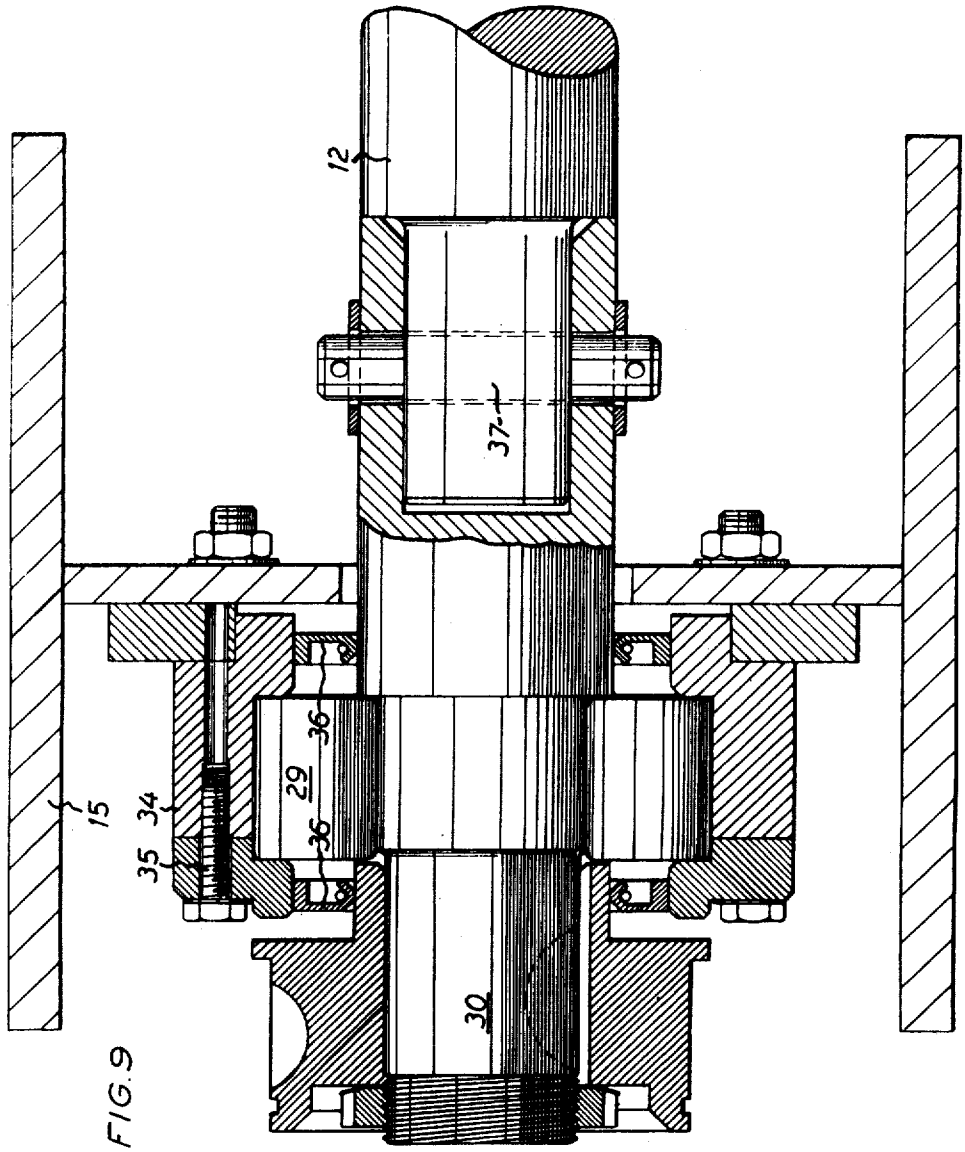

FIG. 9

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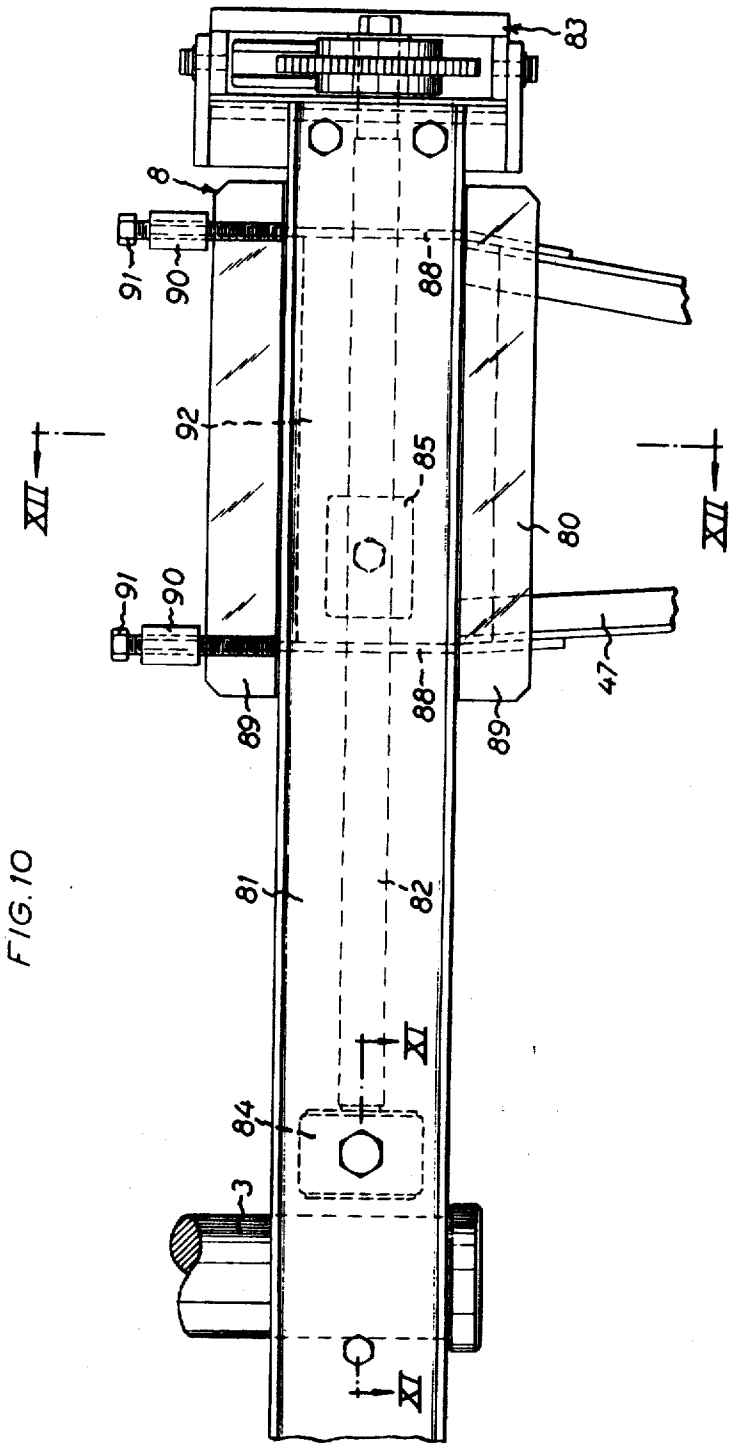

FIG. 10

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FIG. 12

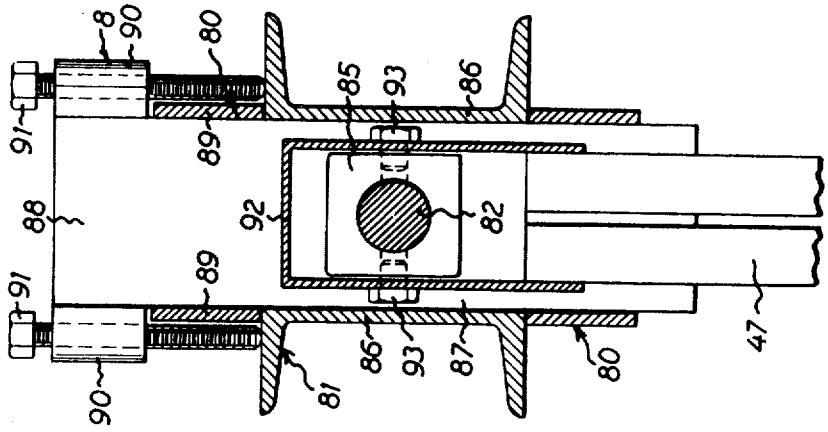
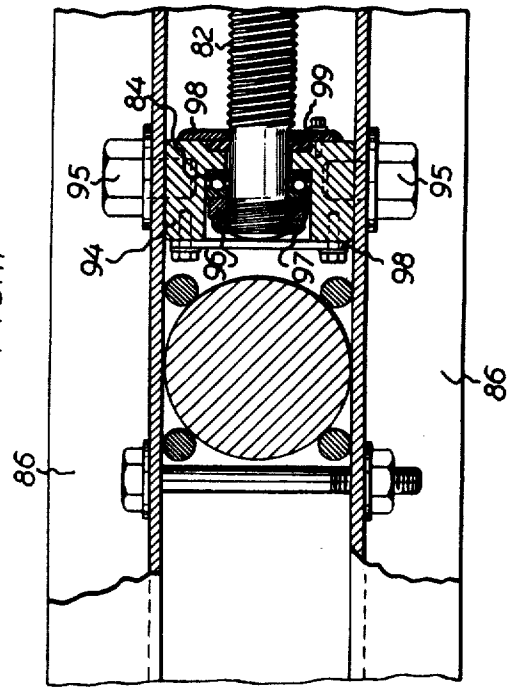


FIG. 11



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ARRANGEMENTS IN SLIDING FORMS

This invention relates to an arrangement in sliding forms or shuttering of the adjustable type for the erection of concrete buildings. For varying the width of the building by contraction and/or expansion of the sliding form the latter comprises relatively movable form sections some of which can be operated by width regulating means to realize the desired width adjustment, and the sliding form and the associated scaffolding are vertically movably carried by yoke-shaped scaffolding elements and operated by climbing means.

Prior-art scaffoldings for this type of sliding forms are of a very complicated construction and necessitate a great deal of work for their manipulation. The invention has for its object to simplify the scaffolding and also the manipulation thereof, making it fully automatic. To this end, each of the movable form sections which are operable by the width regulating means is freely pivotally mounted in the scaffolding at a point above the form section so that said form section can freely adapt itself to the width adjustment initiated by the width regulating means at the single mounting point.

These and further characteristic features of the invention and the advantages gained thereby will become more fully apparent from the following, reference being made to the accompanying drawings in which:

FIG. 1 is a vertical part section of a scaffolding provided with the arrangement according to the invention;

FIG. 2 is a plan view of a central scaffolding member;

FIG. 3 is a part plan view of the scaffolding;

FIGS. 4 and 5 are sections taken at right angles to one another and showing a detail;

FIG. 6 is a longitudinal section of one of a number of telescoping arms in the scaffolding;

FIG. 7 is an end view of a telescoping arm section;

FIG. 8 is a section of part of the telescoping arm;

FIG. 9 is a section of a further detail;

FIG. 10 is a side view of part of a yoke-shaped scaffolding member;

FIG. 11 is a section on line XI—XI in FIG. 10;

FIG. 12 is a section on line XII—XII in FIG. 10.

The scaffolding illustrated in the drawings and generally designated 1 is for use with an adjustable type sliding form 2 for the erection of buildings of concrete, such as chimneys, water towers, etc. For its vertical movement the sliding form is carried and operated by climbing means 3. The climbing means 3 shown in FIG. 1 engages a climbing rod 4 indicated by dash-and-dot lines and cast into a wall 5 produced in the sliding-form casting operation. To control the sliding form and to adjust the width of the building and, where chimneys are concerned, the contraction of the wall 5 towards the upper part of the chimneys, and thus to diminish the total cross sectional area of the building, the sliding form 2 is operated by means generally designated 6, which for regulating the width of the building act upon certain of relatively movable sections 7 of the sliding form. Every second form section 7 which is operatively connected with the width regulating means 6 is mounted in a yoke-shaped member 8 of the scaffolding 1, and a climbing means 3 is arranged in said yoke-shaped member 8.

The yoke-shaped scaffolding member 8 is pivotally mounted in a bracket 9 of the scaffolding 1 at a point through which extends an axis 10 intersecting the climbing means 3 and the longitudinal axis thereof, which coincides with the climbing rod 4. Each of the movable form sections 7 operable by the width regulating means 6 is thus freely pivotally mounted in the scaffolding 1 at a point above the form section so that said section is capable of freely adapting itself to the width adjustment initiated by the width regulating means at the single mounting point. The form sections 7 can thus readily adapt themselves to the inclination of the wall 5 determined prior to casting; this inclination can then be maintained or altered, if and when an alteration of the inclination is desired, without direct actuation of the form sections. It should be observed that the wall 5 can also be given an outward inclination, whereby an enlargement of the total cross sectional area of the building is realized. This will appear more fully from the following.

In the embodiment illustrated the scaffolding 1 has twelve brackets 9. Each bracket 9 has a pair of arms 11 between which the yoke-shaped scaffolding member 8 and the climbing means 3 are disposed. The preferred form of the arms 11 and the brackets 9 will become apparent from the following.

The width regulating means 6 are screw spindles 12 and nut means 13 cooperating therewith. Relative movement of the screw spindle 12 and the nut means 13 upon rotation of, in the present instance, the screw spindle 12 will result in the requisite adjustment of the relatively movable form sections 7. The screw spindle 12 is mounted within a telescoping arm 14 which in the embodiment illustrated includes an inner section 14*a*, an intermediary section 14*b* and an outer section 14*c*. The telescoping arms 14 connect the brackets 9 and thus the yoke-shaped scaffolding members 8 to a central scaffolding member 15. Said central scaffolding member 15 comprises means 16 being part of the width regulating means 6 for simultaneous rotation of all of the spindles 12, whereby setting of all form sections can be performed at one and the same time.

As will appear particularly from FIG. 7, the telescoping arms 14 are of rectangular cross section having a relatively thick lower wall 17 and a relatively thick upper wall 18, while the side walls 19 are thinner. At the outer free ends the inner section 14*a* and the intermediary section 14*b* have sliding means 20 provided at the top of the inner surfaces of said ends. The intermediary section 14*b* and the outer section 14*c* at their inner ends have sliding means 21 disposed on the outer surfaces of said ends. The inner section 14*a* and the intermediary section 14*b* at the inner surfaces have guides 22 at the upper and lower edges. The sliding means 20, 21 and the guides 22 shall be kept well lubricated to keep the friction between the relatively movable sections 14*a*, 14*b*, 14*c* at a minimum. At the end projecting into the intermediary section 14*b* the outer section 14*c* has two annular flanges 23 and 24 (FIG. 8), between which the nut means 13 is rotatably but axially fixedly mounted. The facing surfaces 25 and 26, respectively, of the nut means 13 and the flanges 23, 24 broadly coincide with arcs shown by broken lines 27, said arcs having their centers (not shown) on the axis of the arm 14 (said axis being indicated by a dash-and-dot line 28). As a result, the nut means 13 can adjust itself when the relative position between the telescoping arm 14 and the screw spindle 12 changes.

The screw spindles 12 are axially immovable but rotatably mounted in the central scaffolding member 15 by means of a spherical roller bearing 29. At the end 30 projecting from said bearing 29 the screw spindle 12 has a sprocket wheel 31 which is connected by means of a chain 32 to a sprocket wheel 33 of the means 16. The spherical roller bearing 29 is mounted in a housing 34 which is secured to the central scaffolding member 15 by means of screws 35. Gaskets 36 prevent dirt from penetrating into the bearing 29. The end of the screw spindle 12 projecting into the bearing 29 is in the form of a particular journal which is connected to the remaining screw spindle by a cotter pin 37. The inner ends 38 of the bracket arms 11, which ends are connected to the telescoping arms 14, are directed downwardly. Between each of these downwardly directed arms 38 and the end of one downwardly directed limb 39 of the yoke-shaped scaffolding member 8, which limb is spaced from the pivot axis 10 of said member 8, there extends a connection 40 permitting the yoke-shaped scaffolding member 8 to be adjusted with respect to the bracket 9 by a swinging movement about the pivot axis 10. The connection 40 in the embodiment illustrated simply consists of a threaded rod 41, the wide fork-shaped end 42 of which engages a lug 43 over a shaft 44. The lug 43 is secured to the outer side of the limb 39. Disposed on the threaded rod 40 are two nuts 45, and the downwardly directed end 38 of the bracket arm is inserted between said nuts. The rod 41 passes through a hole or groove (not shown) in said downwardly directed end 38 so as to be easily detachable from said end. The bracket 9 has an extension 46 which projects outside the outer limb 47 of the yoke-

shaped scaffolding member 8 and carries an outer scaffolding member 48. The inner limb 39 of the yoke-shaped scaffolding member 8 carries an inner scaffolding member 49. Said scaffolding members 48, 49 extend around the building and are provided with conventional platforms 50 and protective railings 51 for the workers occupied with the erection of the wall 5.

One end of a chain 52 is secured to the downwardly directed end 38 of the bracket 9. The other end of the chain 52 is secured to the front end of the intermediary section 14*b* of the telescoping arm 14. From the front end of the intermediary section 14*b* there extends a further chain 53 which has its other end attached to the inner section 14*a*. A lug 54 extends obliquely downwardly and inwardly from the outer end of the inner section 14*a*, and to the free end of the lug 54 there is secured a brace in the form of a shroud screw 55 with one end while the other end thereof is connected to a lug 56 of the central scaffolding member 15. The shroud screws 55 keep the telescoping arms 14 securely inserted in fastenings 57 which are in the shape of open cups and arranged for the telescoping arms in the central scaffolding member 15. The shroud screws also permit easy dismounting of the scaffolding for transportation. The central scaffolding member 15 substantially has the form of a sleeve, the telescoping arms 14 extending from one upper edge of said sleeve in the position of use of the scaffolding. From the lower edge of the central scaffolding member 15 there further extends a downwardly widening hopper 58 for a purpose to be described in the following. A further scaffolding member 59 is disposed beneath the inner stationary section 14*a* of the telescoping arms 14 and secured adjacent the outer free arms of the inner sections 14*b* and at the lower edge of the hopper 58. Said scaffolding member 59 has a platform 60 and a railing 61. It is intended primarily for workers supervising the operation of the width regulating means 6.

The inner stationary sections 14*a* of the telescoping arms carry a stationary platform 62. Laterally overlapping platform portions 64 secured in the brackets 11, the yoke-shaped scaffolding members 8, and certain of the form sections 7 slidably engage the upper surface of said platform 62 by the intermediary of rollers 63. The central scaffolding member 15 carries columns 65 upstanding therefrom, the upper ends of which carry a beam structure 66 with the necessary means for an elevator (not shown) by which material and persons can be transported to the work platform. At such a transportation the downwardly widening hopper 58 is adapted to guide the cage into the through shaft 67 of the central scaffolding member 15.

All the climbing means 3 of the scaffolding 1, in the present instance twelve, are connected by conduits (not shown) to a power source (not shown), such as a hydraulic pump by means of which hydraulic pressure medium is supplied under pressure to the climbing means 3 at predetermined intervals whereby the scaffolding 1 and the form sections 7 are raised in step with the casting of the wall 5 and the setting of the concrete. The means 16 are connected to the conduit system leading to the hydraulic pump. Each such means 16 comprises a hydraulic cylinder and piston unit 68 the reciprocable piston of which is connected to a toothed element 69 with which a ratchet wheel 70 is engaged. Said ratchet wheel 70 is disposed on the same shaft 71 as the sprocket wheel 33. The hydraulic pump (not shown) can be connected to a timing device starting and stopping the pump at suitable intervals. When the pump is started and urges pressure medium to the climbing means 3 the scaffolding 1 and as a consequence the form sections 7 are raised an extremely small distance simultaneously as the pressure medium via the unit 68 and the toothed element 69 rotates the ratchet wheel 70 through a small angle. The ratchet wheel rotates the sprocket wheel 33 which via the chain 32 rotates the sprocket wheel 31 and thus the screw spindle 12. Rotation of the screw spindle will contract the telescoping arm 14. This will first pull the section 14*c* into the section 14*b* and then carry along the latter section so that both sections 14*b* and 14*c* are pulled into the section 14*a*. By the contraction of all telescoping arms the relatively movable form sections 7 will be operated in such a way that the total cross sectional area of the wall 5 is reduced. The operation of the form sections 7 both for lifting and setting thus takes place automatically without any manual measures. A certain supervision of the operation of the width regulating means 6 is of course necessary and further a normal supervision of the climbing means 3 will have to be effected. If it is desired at a certain height of the wall 5 being cast to enlarge or widen it, all means 16 are turned through 180° without necessitating uncoupling and renewed coupling of the conduits connected to the cylinder and piston units 68 of said means, whereupon at renewed operation of the climbing means 3 and the means 16 a widening of the total cross sectional area of the wall 5 will be attained.

After the lower part of the wall 5 has been cast, the position of the yoke-shaped scaffolding member 8, and thus the inclination of the form sections 7, is fixed by means of the adjustable connection 40 which determines said inclination with respect to the scaffolding 1. In the continued casting operation with the aid of the sliding form the connection 40 is released so that the form sections 7 are free to swing about the axis 10 but follow the inclination imparted to the wall 5 in the initial phase. The chains 52 and 53 prevent the telescoping arm sections from being extended.

As appears from FIGS. 10–12, one (47) of the limbs 39, 47 of the yoke-shaped scaffolding member 8 is reciprocable with respect to the other limb 39. To this end the reciprocable limb 47 engages the main portion 81 of the scaffolding member 8 over a guide 80. A screw spindle 82 centrally arranged with respect to the guide 80 is disposed in the main portion 81 of the yoke-shaped scaffolding member 8. Said screw spindle 82 projects from said main portion 81 and has its projecting end connected with means 83 for stepwise rotation of the spindle 82 in one or the other sense. Said means 83 is only diagrammatically shown but is of the same type as the earlier described means 16. The end of the spindle 82 projecting into the main portion 81 is rotatably but longitudinally non-displaceably mounted in a bearing 84. Intermediate its ends the spindle 82 engages nut means 85 secured in the limb 47 which is reciprocable longitudinally of the spindle.

The main portion 81 of the scaffolding member 8 comprises two parallel U-beams 86 with facing and slightly spaced apart webs to form a clearance 87 between them. End pieces 88 on the movable limb 47 project into said clearance and carry bars 89 interconnecting the end pieces 88 and bearing against said beams with the edges facing the beams. At the upper free ends the end pieces 88 carry lugs 90 for screws 91 engaging the beams 86. Means 92 of inverted U-shape extend between and are fixed to the end pieces 88 in the clearance 87, and the nut means 85 is disposed between the ends of said means 92 and secured with screws 93 thereto.

The bearing 84 is arranged in the main portion 81 near the climbing means 3. The bearing is an axial thrust bearing mounted in a fastening piece 94 which is retained by screws 95 between the U-beams 86. At the end of the spindle 82 projecting from the axial thrust bearing there are disposed a nut 96 and a locking nut 97 to keep the bearing in the proper position on the spindle 82 in the fastening piece 94. Screwed-fast washers 98 and a gasket 99 ensure a dust-free sealing of the bearing 84.

The means 83 is to be connected to an operator (not shown) which is common to all of the means 83, climbing means 3, means 16 for rotating the spindles in the telescoping arms 14 so that a uniform raising of the sliding form and contraction of the form sections and the form walls in each section can be performed. This automatic operation of the sliding form, which is controlled from an operator's stand, provides a very smooth and uniform erection of buildings without complications and faulty operation of the sliding form.

What I claim and desire to secure by Letters Patent is:

1. An arrangement in adjustable sliding forms for the erection of concrete buildings, such sliding form being of the type that for varying the width of the building by contraction and/or expansion of the sliding form comprises relatively movable form sections some of which can be operated by width regulating means to realize the desired width adjustment, and the sliding form and the associated scaffolding are vertically movable carried by yoke-shaped scaffolding members and operated by climbing means, wherein each of the movable form sections which are operable by the width regulating means is freely pivotally mounted in the scaffolding but a single point above the form section in order that said form section can freely adapt itself to the width adjustment initiated by the width regulating means at the single mounting point.

2. An arrangement as claimed in claim 1, wherein the single mounting point of the respective pivotally mounted form section is provided in a known manner in the yoke-shaped scaffolding member and a bracket of the scaffolding at a point through which extends an axis intersecting the climbing means and the longitudinal axis thereof.

3. An arrangement as claimed in claim 2, in which the width regulating means are screw spindles and nut means cooperating therewith, wherein the screw spindles are disposed within telescoping arms connecting the yoke-shaped scaffolding member to a central scaffolding member which has means for simultaneously rotating all spindles, thereby permitting simultaneous adjustment of all form sections.

4. An arrangement as claimed in claim 3, wherein the inner end of each bracket arm which is connected to a telescoping arm is directed downwardly, and between said downwardly directed end and the yoke-shaped scaffolding member and spaced from the pivot axis of said scaffolding member there extends a connection which permits adjustment of the yoke-shaped scaffolding member in relation to the bracket by a swinging movement about the pivot axis.

5. An arrangement as claimed in claim 4, wherein the bracket has an extension which projects outside the outer limb of the yoke-shaped scaffolding member and carries an outer scaffolding member, the inner limb of the yoke-shaped scaffolding member carrying an inner scaffolding member.

6. An arrangement as claimed in claim 2, wherein the central scaffolding member substantially is in the form of a sleeve, and the telescoping arms extend from one edge of said sleeve which is the upper one in the position of use of the scaffolding, while bracing means extend from the lower edge of said sleeve, said bracing means being connected to the outer free edge of the inner stationary section of the respective telescoping arm.

7. An arrangement as claimed in claim 6, wherein the bracing means is a tension means.

8. An arrangement as claimed in claim 7, wherein a downwardly widening hopper extends from the lower edge of the central scaffolding member.

9. An arrangement as claimed in claim 8, wherein a scaffolding member is arranged below the inner stationary section of the telescoping arms and is secured near the outer free ends of said sections and to the lower edge of the hopper.

10. An arrangement as claimed in claim 9, wherein the inner stationary section of the telescoping arms carries a stationary platform, laterally overlapping platform portions slidably engaging the upper surface of said platform.

11. An arrangement as claimed in claim 3, wherein nut means is rotatably but axially non-displaceably mounted in the outer movable section of the respective telescoping arm and to this end is freely rotatably mounted between a pair of flanges in the hollow space of the arm, the facing surfaces of the nut means and the flanges substantially coinciding with arcs having their centres in the longitudinal axis of the telescoping arm, thereby permitting self-adjustment of the nut means at varied relative position between the telescoping arm and the screw spindle.

12. An arrangement as claimed in claim 11, wherein the respective screw spindle is axially non-displaceably but rotatably mounted in the central scaffolding member by means of a spherical roller bearing and is provided at its end projecting from said bearing with a sprocket wheel connected to the means for rotating the screw spindle.

13. An arrangement as claimed in claim 2, wherein one of the two limbs of the yoke-shaped scaffolding member is reciprocable with respect to the other limb.

14. An arrangement as claimed in claim 13, wherein the reciprocable limb engages the main portion of the yoke-shaped scaffolding member by the intermediary of a guide.

15. An arrangement as claimed in claim 14, wherein a screw spindle disposed centrally in the main portion of the yoke-shaped scaffolding member with respect to the guide has its end projecting from said main portion connected to means for stepwise rotation of the spindle while it has its end projecting into the main portion of the yoke-shaped scaffolding member rotatably but longitudinally non-displaceably mounted, the spindle engaging intermediate its ends with nut means secured in the limb reciprocable longitudinally of the spindle.

* * * * *