Sept. 3, 1968 G. ROHLF 3,399,438

GUIDING MEANS FOR SLIDING SHUTTERING FOR BUILDING STRUCTURES WITH SLIGHTLY INCLINED AND VERTICAL CONCRETE WALLS

Filed July 14, 1965 4 Sheets-Sheet 1

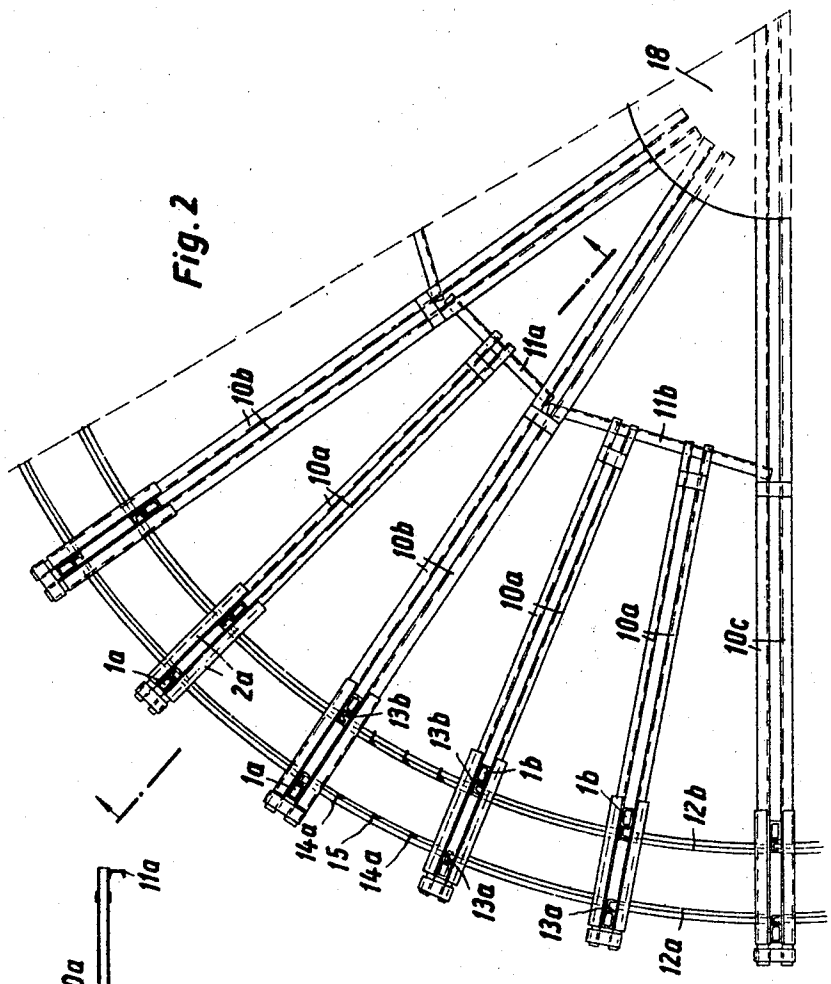

Fig. 2

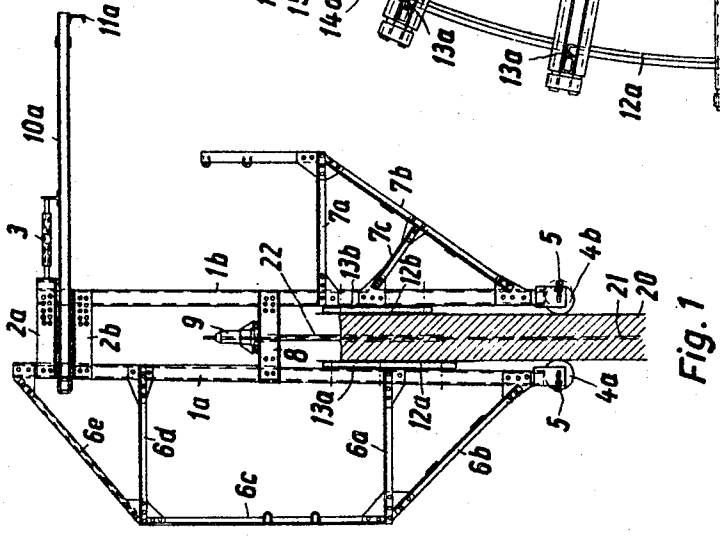

Fig. 1

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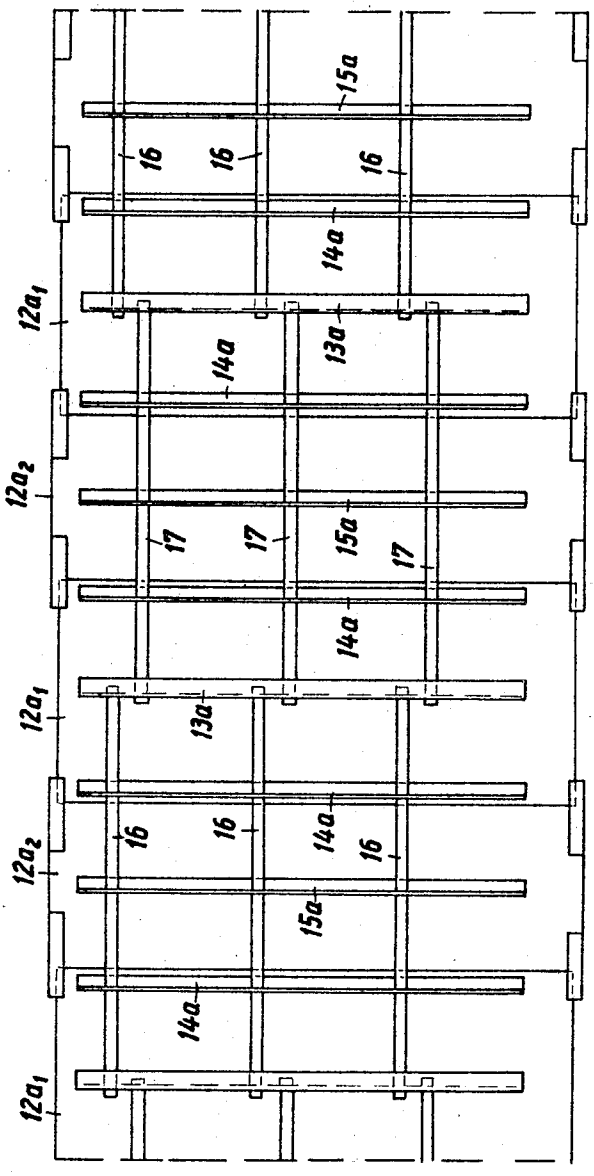
Fig. 3



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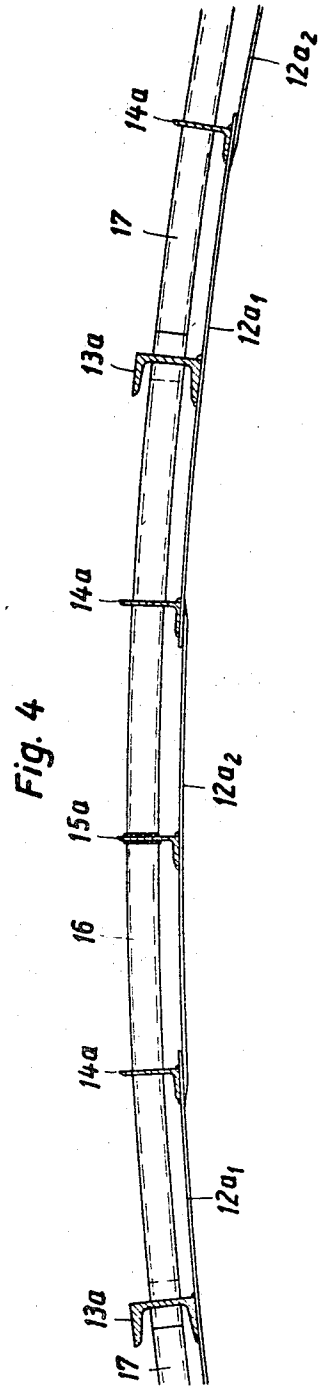

Fig. 4

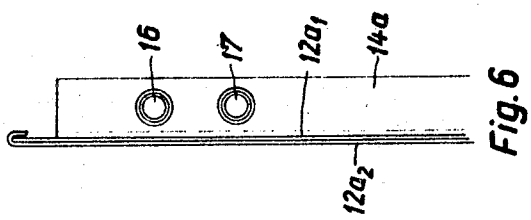

Fig. 6

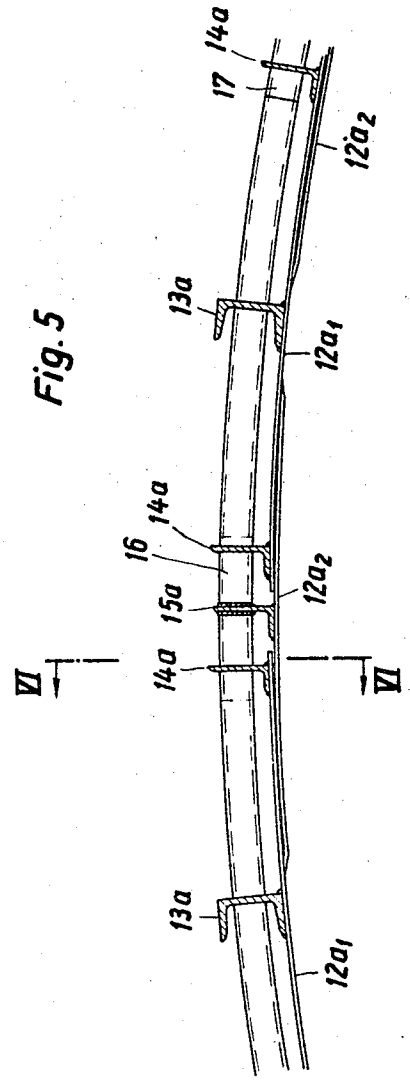

Fig. 5

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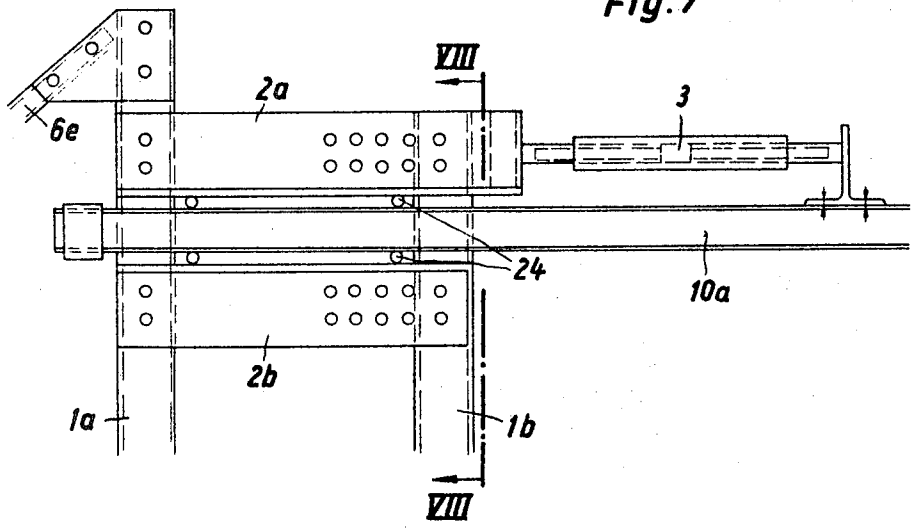
Fig. 7



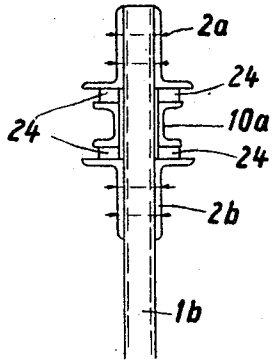


Fig. 8

United States Patent Office 3,399,438 Patented Sept. 3, 1968

3,399,438

GUIDING MEANS FOR SLIDING SHUTTERING FOR BUILDING STRUCTURES WITH SLIGHTLY INCLINED AND VERTICAL CONCRETE WALLS

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5 Claims. (Cl. 25—131)

ABSTRACT OF THE DISCLOSURE

Sliding framework for building concrete structures wherein a plurality of horizontally adjustable shuttering plate guides are mounted from a support with a plurality of shuttering plates being suspended from the guides, and means for lifting the plates.

Each guide has two parallel limbs to the inner side of which facing one another the plates are secured with the limbs being interconnected via a girder to which the lifting means is affixed. The limbs have downward extensions of sufficient length to reach a hardened concrete wall portion and with which movably mounted members on the extensions would be engageable to guide the plate guides.

This invention relates to sliding formwork for building molded concrete structures with slightly inclined walls, such as chimneys for example. With the systems of slidable formwork hitherto known it has usually only been possible to produce walls with vertical surfaces. Insofar as attempts have been made to build structures with slightly inclined wall surfaces, this has been done with inadequate means and there was no assurance that the inclination would be maintained constant. By use of the guiding formwork according to this invention it is possible to produce structures with slightly inclined wall surfaces with the assurance that a definite inclination will be reliably maintained. Such a possibility is particularly advantageous when concrete chimneys of great height are to be built, and in which the slightest error in the adjustment of the inclination would be noticeable.

The invention consists essentially in the feature that the members for guiding the shuttering plates are adjustably arranged at the margin of a horizontally supported disc or plate, that the guiding members consist of two stiffened parallel limbs, to the inner sides of which (facing one another) the shuttering plates are secured, these limbs being connected with one another by a transverse girder, to which the lifting appliances are attached, and that underneath the shuttering plates gliders or rollers guided by the concrete wall are provided at the lower ends of the limbs.

In a preferred form of construction of the invention, for the building of chimneys, the horizontally supported plate is a circular disc, and the guiding members are radially adjustable relatively to the edge of this disc. The horizontally arranged disc, as regards its lateral position, is guided by the already hardened concrete beneath the shuttering skin.

It is particularly advantageous to construct the disc as a grating, wherein radially extending girders are provided which pass between the limbs of the guiding device. To enable the guiding devices to be radially adjusted relatively to the grating, there may be provided, between the grating and the limbs, an adjusting member in the nature of a turnbuckle, while on the other side, between the transverse girders of the limbs and the radially extending girders, guiding devices are provided.

The guiding device is preferably adjustable for a definite wall thickness. In order to provide this adjustability, for the purpose of changing the distance between the limbs,

the transverse girders are provided at their ends with a number of bores, which can be selected according to the desired distance between the two limbs. In view of the stresses to which the guiding device is subjected, it is advantageous to stiffen the outer limb, for instance wholly or partly with latticework or a solid wall construction. The lower part of the inner limb may also have a stiffening structure, the upper girders of which then form a supporting grating for a working platform. The shuttering plates are preferably stiffened on the outside by vertically extending girder sections. Through the webs of these girder sections tubes are passed in a horizontal direction, these tubes being uniformly adapted to the curvature of the shuttering plates and acting as a supplementary annular stiffening.

One embodiment of the invention is illustrated by way of example, in connection with the building of a concrete chimney, in the accompanying drawings, in which:

FIGURE 1 shows a guiding device in side elevation;

FIGURE 2 shows in plan a sector-shaped portion of a horizontally arranged grating;

FIGURE 3 shows a front view of the shuttering plate, with an indication of the position of the vertically extending stiffening girders and the horizontally extending tubular girders;

FIGURE 4 and 5 show horizontal sections through the shuttering plates, which indicate the arrangement of the vertical stiffening girders and the position of the horizontal tubular girders;

FIGURE 6 is a sectional view corresponding to the section line VI—VI in FIGURE 5;

FIGURE 7 is a view on an enlarged scale of part of the device illustrated in FIGURE 1 for the production of the limbs; and

FIGURE 8 is a view corresponding to the section line VIII—VIII in FIGURE 7.

In the device illustrated in FIGURE 1, for the guidance of a slidable mold, use is made of hydraulic lifting appliances. The hydraulic lifting appliances illustrated may, however, be replaced by mechanical means. The apparatus as a whole is supported upon a ferro-concrete post **20**, shown in cross-section and cast in local shuttering.

This post should be about 1.50 meters high. As a lifting appliance there is employed, in a known manner, a jack rod **21**. At the upper part of the jack rod is shown a recovery tube **22**. All these parts, however, are not directly connected with the invention, and may be replaced by other lifting devices. At the upper end of the pack rod there is a lifting device **9**, which may be a hydraulically operated jack.

The actual guiding device consists of two parallel limbs **1***a* and **1***b*, which are connected with one another approximately centrally by a transverse girder **8**. The limbs are connected the top by two parallel transverse girders **2***a* and **2***b*. The distance between the limbs **1***a* and **1***b* is determined by the thickness of the concrete wall to be produced. In order that the appliance may be adjustable to different thicknesses, a plurality of holes are provided in all the transverse girders **8**, **2***a*, and **2***b*, so that the distance between the limbs **1***a* and **1***b* can be varied. The transverse girder **8**, in this constructional example, serves as a yoke which is fixedly connected with the lifter **9**.

In the upper part of the device there is a sector-shaped grating, comprising individual girders **10***a* which extend radially. Between each girder **10***a* and the associated transverse girder **2***a* is a sleeve **3**, with right-handed and left-handed screw threads, in the manner of a turnbuckle, one end of the bolt of which is secured upon a transverse flange of the girder **10***a*, while the other end is secured to the transverse girder **2***a*. By rotating the turnbuckle **3** the relative positions of the girder **10***a* and the limbs **1***a* and **1***b* can accordingly be altered.

For this purpose, between the flanges of the transverse girders **2***a* and **2***b* and the flanges of the girder **10***a*, rollers or similar devices (not shown) are mounted to facilitate sliding. In this constructional example the limb **1***a* is braced by a truss consisting of the girders **6***a*, **6***b*, **6***c*, **6***d* and **6***e*. Instead of this truss, a solid wall construction may of course in part be employed. On the other side, namely, at the lower part of the limb **1***b*, a truss **7***a*, **7***b*, **7***c* is likewise provided, which at the same time serves to support a working platform. At the lower ends of the limbs **1***a* and **1***b* there are rollers or gliders **4***a* and **4***b*, which are adjustable to a definite thickness of the wall **20** by means of set screws **5**.

These rollers or gliders, as seen in FIGURE 1 extend to at least the vertical extent of the shuttering plates below the lower edge of the shuttering plates **12***a* and **12***b* so that the rollers or gliders contact the surfaces of the concrete so far below the shuttering plates that the concrete against which they bear is substantially hardened or, in common parlance, has taken its permanent set.

The construction of the horizontal grating will be apparent from FIGURE 2. This illustration shows that girders **10***a*, **10***b* and **10***c* are arranged radially. These radial girders are stiffened by transverse girders **11***a* and **11***b*. Some of the radial girders **10***b* extend right to a centrally arranged plate or disc **18**.

The shuttering plates **12***a* and **12***b*, also shown in FIGURE 1, are stiffened by vertical girders **13***a*, **14***a* and **15***a*. This arrangement of the stiffening girders will be apparent from FIGURE 3. For radial stiffening, horizontal lengths of tubing **16** and **17** are used, the arrangement of which, as seen from the front, is shown in FIGURE 3. The relation between the individual stiffening girders with the shuttering plates $12a_1$ and $12a_2$ will be apparent from FIGURES 4 and 5. The skin of the shuttering consists of laminated high sheet-iron plates, in which shuttering plates $12a_1$ are fixedly arranged and the intervening shuttering plates $12a_2$ are displaceably arranged. The shuttering plates $12a_1$ are fixed to the yoke structure by bolts extending through channel bars **13***a* and **13***b*. The displaceable intervening shuttering plates have upper and lower bent-over edges, which are slipped on to the fixed plates $12a_1$. This arrangement will be apparent from FIGURE 6. As already mentioned, tubes **16** and **17** are provided, which are passed through bores in the angles and girders. These tubes are so dimensioned that due to their resilience they can assume any curvature, so that, since all these tubes are of the same dimensions, a circular shape formed by these tubes is obtained. In order that these tubes may not be hampered by the interlocking of the shuttering, they are staggered in height. This arrangement is also shown in FIGURE 6.

FIGURE 7 is a view on a larger scale of the upper portion of the apparatus shown in FIGURE 1 and shows how the girder **10***a* is guided between the girders **2***a* and **2***b* formed as slideways by means of rollers **24**.

FIGURE 8 shows a section through a girder **10***a* of the girder grating, which is guided upon the girders **2***a* and **2***b* which are constructed as slideways, and which are secured to the parallel limbs **1***a* and **1***b*. The taper, that is, the obliquity of the limbs, is obtained by actuating the turnbuckle **3**, while the rollers **4***a* and **4***b* are guided by the hardened concrete.

I claim:

1. A mold for making annular concrete walls of considerable height and of varying diameter comprising a plurality of pairs of limbs, each pair of limbs lying in a vertical plane, and parallel to the inner and the outer surface of the annular wall being molded, shuttering plates mounted on each of said limbs, the shuttering plate mounted on one of said limbs to face the shuttering plate mounted on the other said limb of said pairs, the shuttering plates supported by each said pair of limbs slidably overlapping the shuttering plates supported by adjacent pairs of limbs, means to raise all of said pairs of limbs simultaneously, said limbs each extending downwardly from the lower edge of said shuttering plates a distance equal to at least the vertical extent of said shuttering plates and glider means at the extreme lower ends of each said limb contacting the already substantially hardened concrete structure.

2. The mold of claim **1** in which said glider means are rollers.

3. The mold of claim **1** in which said limbs are in the form of trusses.

4. The mold of claim **1** in which the limbs of each pair of limbs are adjustable in the vertical plane in which they lie to adjust the slope of the concrete wall being molded.

5. The mold of claim **1** in which means is provided to assemble the said limbs at different distances from each other so that walls of a selected thickness can be molded.

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