July 15, 1952 E. O'SULLIVAN 2,602,982

CONCRETE WALL MOLD

Filed Feb. 17, 1951 2 SHEETS—SHEET 1

FIG. 1.

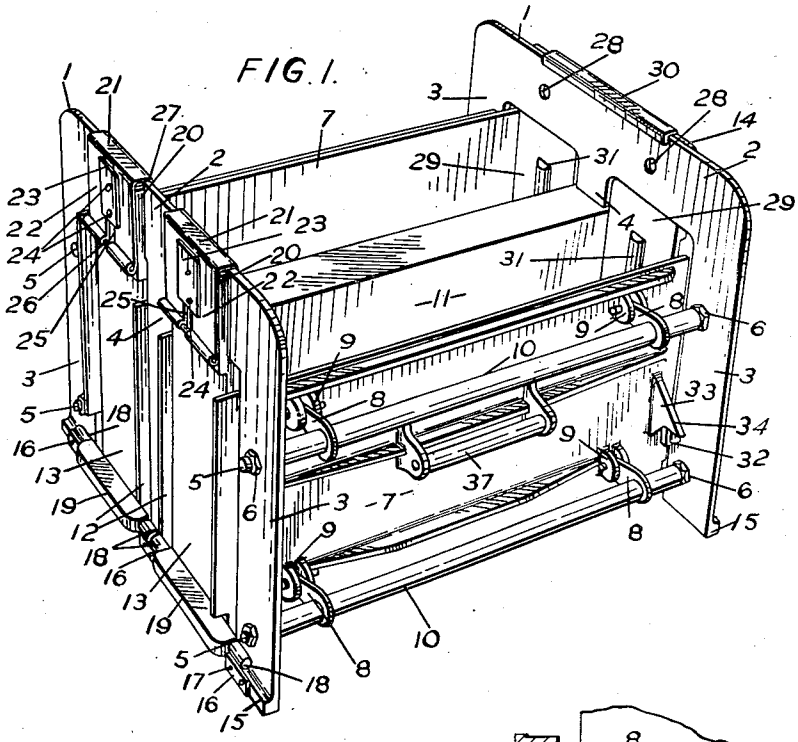
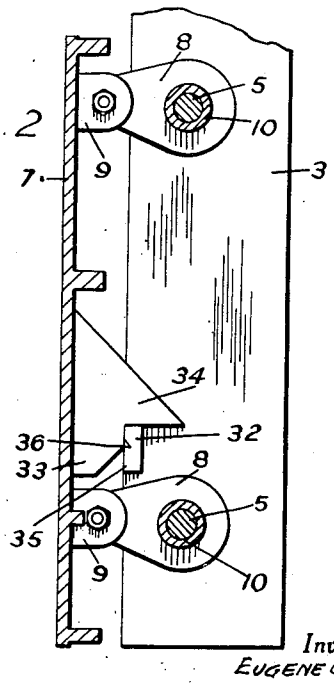


FIG. 2



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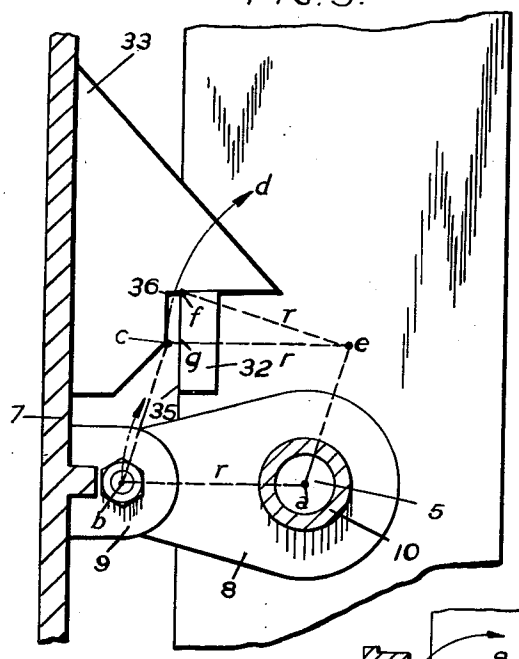
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July 15, 1952 E. O'SULLIVAN 2,602,982

CONCRETE WALL MOLD

Filed Feb. 17, 1951 2 SHEETS—SHEET 2

FIG. 3.



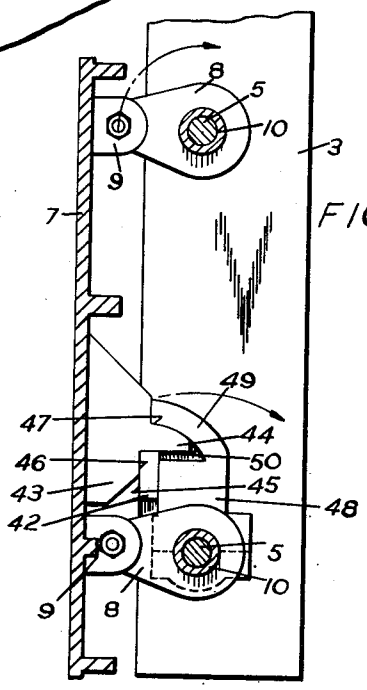


FIG. 4.

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Patented July 15, 1952

2,602,982

UNITED STATES PATENT OFFICE

2,602,982

CONCRETE WALL MOLD

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Application February 17, 1951, Serial No. 211,468
In Great Britain March 6, 1950

19 Claims. (Cl. 25—131)

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This invention relates to moulds and is more particularly concerned with the types of mould which are employed in the construction of buildings in situ or for making building blocks using concrete or other material which is capable of being cast in a mould. All such materials are to be considered as being comprised within the term "concrete" which will be used hereinafter for the sake of convenience.

For such purposes moulds are known which comprise a frame structure and a pair of side mould plates which are movably carried by the frame structure for movement between an inner moulding position and an outer position to permit of the mould being readily removed from a moulded block or section of wall without damaging it while the concrete is still soft. In one known form of such mould each mould plate is supported by two pairs of links which are pivotally connected at their inner ends with the mould plate and at their outer ends with the frame of the mould so that the mould plate can be moved between an inner and lower moulding position and an upper and outer position in which it is clear of the moulded block or section. In such a mould, one form of which is described in the specification of British Patent No. 594,897, stops are provided to define the inner moulding positions of the mould plates, which stops are so arranged that when the plates are in their moulding positions the supporting links are substantially horizontal.

As a result of this arrangement an internal pressure acting normally against the inner faces of the mould plates acts along the length of the links without producing any turning moment on the latter which would tend to cause the mould plates to move upwardly away from their moulding positions. To open the mould a direct upward or lifting force must be applied to the mould plates.

It has, however, been found in practice that, in spite of the above theoretical considerations, there is a tendency for the mould plates to work upwardly away from their moulding positions during the filling of the mould and more particularly while the concrete is being tamped to compact it in the mould. This is apparently due to the fact that the downward forces caused by the tamping are concentrated away from the side walls of the mould and tend to produce an upward creep or flow of the concrete in contact with the mould plates.

With a view to overcoming the above difficulty releasable locks or catches have been provided

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between the frame of the mould and the mould plates. Such catches, however, suffer from the disadvantage that they have to be operated manually to engage or release them, which necessitates an additional expenditure of time and effort. Furthermore, such catches involve the use of small moving parts which are liable to become blocked with concrete or dirt.

It is one of the objects of the present invention to provide a mould having at least one mould plate which is movable between an inner moulding position and an outer position and which is provided with novel and improved means for retaining the mould plate in its moulding position.

A further object of the invention is the provision of such a mould having means for retaining the or each mould plate in its moulding position, which means are automatic in their operation so that it is not necessary for the workman to carry out any additional operations to engage or release the retaining means when opening or closing the mould.

Yet another object of the invention is the provision of such a mould in which the retaining means comprise a pair of cooperating members one of which is mounted on and is operated by the movement of the mould plate and the other of which is fixedly mounted in the frame of the mould.

Generally speaking, a mould which is designed for forming walls or for making building blocks will include two side plates which are arranged substantially parallel to each other and each of which is movable between an inner moulding position and outer position.

It is accordingly a further object of this invention to provide such a mould in which both the said mould plates are provided with means for retaining them in their moulding positions, each of which means comprises a pair of cooperating members, one mounted on the mould plate and one mounted on the frame of the mould.

The mould plate, or each of the mould plates, may be provided with one, two or more pairs of cooperating members. According to a convenient form of construction each plate may be provided with two such pairs of members located adjacent its opposite ends.

It will be appreciated that in any mould construction in which a mould plate is movably connected with the frame of the mould the necessary working clearances which must be provided at the joints result in the mould plate having a little play or freedom of movement in the inward and outward directions when it is in its moulding posi-

tion. Furthermore, the plate and the members supporting it possess at least a small amount of flexibility or resiliency. As a result of these two factors, when the mould is full the pressure of the concrete in it will tend to force the mould plate outwardly as far as is permitted by its connection with the frame and will also tend to flex the plate itself in an outward direction where it is not directly supported. On the other hand, when the mould is empty the mould plate will be unflexed, while it will also be free to move inwardly by the small amount allowed by the working clearances. It is primarily these small movements which are utilised in carrying out the present invention, it being understood, however, that if necessary the construction of the mould may be modified in order to increase the amount of movement permitted.

For the better understanding of the invention two embodiments thereof will now be more fully described, by way of example. Reference will be had to the accompanying drawings, in which:

Figure 1 is a perspective view of a mould embodying the invention;

Figure 2 is a detail sectional view, to a larger scale, showing one of the retaining means provided in the mould of Figure 1;

Figure 3 is a diagram illustrating the operation of the retaining means;

Figure 4 is a view similar to Figure 2 but showing a modified form of retaining means.

Referring first to Figures 1 and 2, the drawings show a mould which is perticularly designed and intended for use in building hollow or cavity walls in situ. This mould comprises a frame structure which consists of two end frame members 1 each of which includes an upper cross part 2, a pair of outer depending legs 3 and a depending central leg 4. The end frames 1 are connected together to form a rigid frame structure by means of two pairs of longitudinal rods 5 the ends of which are secured to the legs 3 by means of nuts 6.

The mould includes a pair of side mould plates 7 which are mounted on the longitudinal rods 5 by means of links 8, the inner ends of which are pivotally connected to lugs 9 on the plates 7 and the outer ends of which are rigidly secured to tubes 10 which are rotatably mounted on the rods 5. As a result of this arrangement each mould plate 7 is movable between an inner moulding position as shown, in which the links 8 are substantially horizontal and perpendicular to the plane of the mould plate, and an upper and outer position.

In order to form a central cavity in the wall the mould is provided with a core 11 the ends of which are attached to and supported by the legs 4. The ends 12 of the sides of this core project through the end frame members 1 on either side of the legs 4, while the ends of the side plates 7 also project beyond the end frames as shown, sufficient clearance being left to permit of the necessary upward and outward movement of the mould plates 7 away from their moulding positions.

In the drawing one end of the mould is shown as being closed by means of two small end plates 13, while the other end is shown as being closed by means of a full-sized end plate 14. For attaching the lower ends of these plates to the end frames 1 the lower ends of the legs 3 and 4 of the latter are formed with projecting lugs 15 to which small upwardly-projecting plates 16 are attached by means, for example, of screws 17.

These lugs 15 and plates 16 together form recesses in which laterally-projecting pins 18 provided on the lower ends of the end plates 13 can engage. The parts 19, which may be cast or otherwise formed integrally with the remainder of the end plates 13, serve to strengthen the latter and also to carry the pins 18.

The upper parts 20 of the plates 13 are offset outwardly with respect to the main portions of the plates so that when the parts 20 are fitted against the outsides of the end frames 1, as shown, the inner surfaces of the main portions of the plates 13 are substantially flush with the inner surfaces of the frames 1.

In order to secure its upper end each of the end plates 13 is provided with a U-shaped clip 21, the main portion 22 of which is slidably attached to the part 20 by means of a plate 23 which is fastened to the part 20 by means of screws or rivets 24 passing through a slot 25 formed in the clip. At its lower end the portion 22 of the clip is bent or rolled outwardly, preferably round a pin or rod 26, so as to form a handle by means of which the clip can easily be operated.

When the clip is in its lower position as shown its downwardly-turned upper lip 27 hooks over the cross part 2 of the end frame 1 and thus secures the top of the end plate to the frame. It also holds an inwardly-projecting stud (not shown) provided on the end plate engaged in a hole formed in the cross part 2 of the end frame 1. These holes are not visible in the left-hand end frame of the drawing, but they correspond in position to the holes 28 in the right-hand end frame. To remove one of the end plates 13 the appropriate clip 21 is moved upwardly to disengage its lip 27 from the end frame, after which the top of the end plate is swung outwardly so as to disengage the aforesaid stud from the hole in the cross part 2. The end plate can then be lifted so as to disengage the pins 18 from the recesses at the feet of the legs 3 and 4.

The double end plate 14 consists in effect of two plates 13 which are connected together at their upper and lower ends. Thus the plate 14 includes two main portions 29 which are connected together at their upper ends by means of a single top part corresponding to the parts 20. At their lower ends the portions 29, which are shaped similarly to the corresponding parts of the individual plates 13, are connected together by providing a single continuous pin instead of the two separate central pins 18. The plate 14 is provided with a single sliding clip 30 which takes the place of the two clips 21.

It will thus be seen that the single end plate 14 fulfills the same functions as the two separate plates 13. The use of a single end plate will generally be preferred for normal use. The provision of the two small plates 13 is, however an advantage in certain cases when it may be required to close only one side of the mould, for example, when forming a section of wall against the side of a window or door frame.

The portions 29 of the plate 14 are shown provided with internal ribs 31 which are intended to form grooves in the ends of the wall sections to improve the bonding between the different sections. Similar ribs may be provided on the plates 13 or, if desired, the ribs could be omitted entirely from all the plates or they might be replaced by grooves designed to form projecting ribs on the ends of the wall sections.

In the drawing the mould plates 7 are shown in their inner and lower moulding positions. In these positions the links 8 are horizontal and per-

pendicular to the planes of the plates 7 with the result that an outward force acting on the inner faces of the mould plates will act along the length of the links 8 without producing any turning moment on the latter which would tend to cause the mould plates to move upwardly away from their moulding positions.

As has been explained, however, it has been found that there is a tendency for the mould plates to work upwardly during the tamping of the concrete when the mould is being filled and retaining means are, therefore, provided for resisting this tendency.

These means comprise pairs of co-operating retaining members 32 and 33 which are provided at the opposite ends of each of the plates 7. The member 32 of each pair takes the form of a lug which projects from the inner face of the outer leg 3 of the appropriate end frame 1, while the other member 33 is mounted on the outer face of the mould plate 7 in a position to engage the member 32. These two members serve not only to resist the opening movement of the mould plate but also act as stops to define its moulding position. For this reason each member 33 is formed with a projecting tooth portion 34 which engages the top of the corresponding member 32 when the mould plate is in its moulding position and the links 8 are horizontal.

In the construction shown the retaining members 32 and 33 of each pair are formed with flat co-operating faces 35 and 36, respectively, which are vertical and parallel to the plane of the corresponding mould plate when the latter is in its moulding position. It is the co-operation of those two faces which is used to retain the mould plates in their moulding positions while the mould is being filled with concrete and while the latter is being tamped to consolidate it.

It will be appreciated that, owing to the parallel link mounting of each of the mould plates 7, when one of the mould plates is moved away from its moulding position all parts of it will move along parallel arcuate paths the radii of all of which will be equal to the length of the links. This is true of the member 33, and more particularly of the various portions of its vertical face 36, as is best shown in Figure 3.

In this figure, in which it is assumed that the mould is empty with the mould plate 7 in its innermost position, *a* indicates the axis of the rod 5 carrying the lower links 8, *b* is the axis of the connections of these links with the lugs 9 on the mould plate 7 and *r* is the effective length of the links 8. Thus, when the plate 7 is moved upwardly away from its moulding position the point *b* will follow an arcuate path having its centre of curvature at *a* and a radius *r*. Furthermore, since the upper links 8 (not shown in Figure 3) are equal and parallel to the lower links, all other parts of the plate 7 and of the member 33 will move along parallel arcuate paths having the same radii. In particular the point *c*, which is the lower edge of the face 36, will follow an arcuate path *cd* having a radius of curvature *r* and a centre of curvature at the point *e* (the line *ae* being equal and parallel to the line *bc*). Consequently, if the point *c* is just to pass the point *f*, which is the top edge of the face 35, the distance *ef*, must equal *r*. From this the necessary clearance or play *cg* can be calculated.

The amount of this clearance *cg* will depend of the length *r* of the links and on the length in the vertical direction of the co-operating portions of the vertical faces, 35 and 36, that is on the distance *fg*. Once these factors have been fixed the amount of clearance required can easily be calculated. For example, if $r = 1.5$ inches and $fg = 0.3$ inch the clearance (*cg*) required is approximately .03 inch. If *fg* is increased to 0.5 inch the clearance required is about .086 inch.

It will be apparent that, however rigid may be the construction of the mould plates and of the frame of the mould, these parts will possess some slight flexibility or resiliency, this applying particularly to the longitudinal rods 5 and also to the plates 7 themselves between the points of connection of the links 8. The effect of this flexibility, however small, is to cause the pressure of the concrete when the mould is full to press the side mould plate 7 with the member 33 outwardly, this movement being additional to the movement allowed by the play in the joints.

The construction of the various parts of the mould and the mounting of the mould plates is such that the required clearance *cg* is available when the mould is empty as shown in Figure 3, but when the mould is full the outward pressure of the concrete acting on the plate 7 serves to press the face 36 of the member 33 against the face 35 of the member 32. The required movement of the mould plates may be allowed for principally or wholly at the pivotal connections of the links. The normal working clearances here may be sufficient to provide the desired movement but, if necessary, the pivotal connections may be specially modified to give an increased movement, for example, by slightly elongating the holes for the pins or bolts used for connecting the links 8 to the lugs 9.

Thus it will be seen that when the mould is empty the mould plates can easily be moved from one position to the other, since the unstressed state of the plates and other parts and the play in the joints provide clearances between the faces 35 and 36 of the retaining members 32 and 33 which enable the corners *c* of the members 33 just to clear the corners *f* of the members 32.

When, however, the mould is full of concrete the outward pressure of the latter acting on the mould plates presses the faces 36 firmly against the faces 35. This engagement provides a resistance to the upward movement of the mould plates which is sufficient to prevent the latter from working upwardly when the concrete is being tamped in the mould. The mould plates can, however, be raised to free them from the moulded section or block by applying a firm upward pull on the plates, for which purpose the latter are provided with suitable handles 37 (Figure 1).

It will be seen that in the construction described, in which the faces 35 and 36 of the retaining members 32 and 33 are vertical and parallel to the mould plates, the latter are constrained to move vertically during the first portion of their movement away from their moulding positions. It will also be appreciated that the amount of the resistance to the opening movement will depend materially on the exact angles between the faces 35 and 36 and the direction of the normal initial movement of the mould plates. If the faces 35 and 36, instead of being vertical, were inclined inwardly the resistance to the movement of the mould plates would be very greatly increased, but the amount of any such inclination of the faces would have to be kept small if movement of the plates is to be possible, since the concrete or other material used for filling the mould is usually almost incompressible.

Figure 4 illustrates a modification in which additional retaining members are provided which

are adapted to engage the mould plates (or rather members carried by the latter), in order to resist the upward movement of the plates. These additional retaining members are provided in addition to the retaining members already described and are arranged to be operated automatically by the movement of the mould plates and to have a frictional or wedging engagement with the retaining members carried by the mould plates.

In this modification retaining members **42** and **43** having co-operating faces **45** and **46** corresponding to the members **32** and **33** and faces **35** and **36** of Figure 2 are provided, but the tooth portions **44** of the members **43** have their upper portions cut away to form curved surfaces **47**, while retaining arms **48** are provided mounted on the tubes **10** carrying the lower pairs of links **8**. Each of the retaining arms **48** is formed near its upper end with a curved tongue **49** having an under surface **50** which is adapted to engage the curved surface **47** of the member **43**. The arrangement is such that, as the mould plate **7** is moved downwardly the arms **48** are automatically moved inwardly until the surfaces **50** of the arms engage the surfaces **47** of the members **43**. When, however, the mould plate is moved upwardly the arms **48** are swung outwardly clear of the members **43**.

The cooperating surfaces **47** and **50** of the members **43** and **48** are so formed as to permit of the movement of the mould plates and to ensure that the engagement between the surfaces is of a frictional or wedging character. As a result of this, any tendency of the mould plates to work upwardly during the filling of the mould is resisted.

I claim:

1. A mould for use in forming concrete walls or blocks comprising a mould frame, a pair of mould plates carried by said frame, means movably connecting at least one of said plates with said frame for movement between an inner moulding position and an outer position, the path of the initial part of said movement away from said moulding position being generally parallel to the plane of said plate and said connecting means permitting limited free movement of said plate in a direction normal to the plane thereof under the pressure of the concrete in the mould when said plate is in its moulding position, and a pair of retaining members one mounted on said mould plate and the other mounted on said frame, said members being freely movable one past the other when said mould is empty but being adapted to be pressed towards each other by the pressure of the concrete when the mould is full, thereby to resist movement of said mould plate away from its moulding position.

2. A mould as claimed in claim 1, wherein the said retaining members are formed with co-operating faces the planes of which are parallel to the plane of said mould plate when the latter is in its moulding position.

3. A mould as claimed in claim 2, wherein the said retaining members are formed with stop faces which abut one against the other when said mould plate is in its moulding position to define said position and to allow movement of said plate away from this position in one direction only.

4. A mould for use in forming concrete structures comprising a mould frame, at least one mould plate, means movably connecting said mould plate with said frame for upward and outward movement away from its moulding position while permitting to at least part of said plate limited play under the pressure of the concrete in the mould when said plate is in its moulding position, and a pair of retaining members one mounted on said mould plate and the other mounted on said frame, said members being freely movable one past the other when said mould is empty, but being adapted to be pressed towards each other by the pressure of the concrete when the mould is full, thereby to resist movement of said mould plate away from its moulding position.

5. A mould as claimed in claim 4, wherein said retaining members are formed with stop portions the engagement between which when said mould plate is in its moulding position defines said position and prevents downward movement of said plate beyond said position.

6. A mould for use in forming concrete sections comprising a mould frame, a pair of side mould plates adapted to form the side faces of the sections, means movably connecting said plates with said frame for upward and outward movement from inner moulding positions, in which said plates are substantially vertical and parallel to each other, and outer positions, the direction of the initial movement of said plates away from said inner positions being substantially vertical and said connecting means permitting limited outward movement of said plates under the pressure of the concrete in the mould when said plates are in said inner positions, and for each of said plates a pair of retaining members, one mounted on said plate and the other mounted on said frame, said members having co-operating faces which can move freely one past the other when the mould is empty but which are pressed into engagement with each other by the pressure of the concrete when the mould is full to resist movement of the said mould plate away from its said inner position.

7. A mould as claimed in claim 6, wherein the said co-operating faces are parallel to the planes of said mould plates.

8. A mould for use in forming concrete sections comprising a pair of end frames of inverted U-shape having depending legs, means including longitudinal members rigidly connecting said end frames together, a pair of generally vertical side mould plates extending between said end frames inwardly of said longitudinal members, means including pivotal links connecting said mould plates with said longitudinal members for movement between inner moulding positions in which said links are substantially horizontal and upper and outer positions, stop means preventing downward movement of said plates past said inner positions, said connecting means allowing limited horizontal movement of said mould plates when in their inner positions under the pressure of the concrete on said plates, and means for retaining said mould plates in their said inner positions comprising for each mould plate at least one pair of retaining members, one of which members is mounted on said mould plate and the other of which is mounted on a leg of one of said frames, said members being freely movable one past the other when the mould is empty but being adapted to be pressed into engagement with each other by the pressure of the concrete when the mould is full thereby to resist movement of said mould plate away from its inner position.

9. Apparatus as claimed in claim 8, wherein tubular members are provided rotatably mounted

on said longitudinal members and wherein said links are rigidly secured to said tubular members.

10. A mould as claimed in claim 9, wherein an additional retaining means is provided for each mould plate comprising an arm mounted on one of said tubular members and a co-operating element mounted on said mould plate, said arm being operable into frictional engagement with said co-operating element by the rotation of said tubular member as the mould plate is moved to its inner position.

11. A mould for use in forming concrete sections comprising a mould frame, at least one mould plate, means including pairs of substantially parallel links connecting said mould plate with said frame for bodily movement along an arcuate path between an inner moulding position, in which said links are substantially normal to said plate, and an outer position and means retaining said mould plate in said inner position comprising at least one pair of retaining members having co-operating faces, one of said members being mounted on said mould plate and the other being mounted on said mould frame such that when said mould is full the pressure of the concrete on said mould plate produces limited outward movement of the retaining member mounted thereon to press it against the other retaining member to resist movement of said plate away from its inner position, whereas when said mould is empty said members can move freely one past the other to allow said plate to be moved easily from its outer to its inner position.

12. A mould as claimed in claim 11, wherein the co-operating faces of said retaining members are parallel to the plane of said mould plate.

13. A mould for forming concrete sections comprising a frame structure, at least one mould plate for forming a face of the section, means connecting said plate with said frame structure for movement between an inner moulding position and an outer position in which it is clear of said section, a first retaining member carried by said frame structure and a second retaining member actuated by and responsive to the pressure of the concrete in said mold for causing said second retaining member to be actuated by the pressure of said concrete into locking engagement with said first retaining member when the mold is filled to resist movement of said plate away from its molding position, said two retaining members being normally held in position which permits relatively free movement of said plate away from its molding position when said mold is substantially empty.

14. A mould comprising a frame structure, at least one mould plate, means connecting said plate with said frame structure for movement between an inner moulding position and an outer position, a first retaining member mounted on said plate, and a second retaining member mounted on said frame structure in a position to be engaged by the first retaining member so as to resist movement of said plate away from its inner position when the mould is full while permitting free movement of said plate between its said positions when the mould is empty.

15. A mould for use in forming concrete sections comprising a frame structure including a pair of end frames and longitudinal members connecting said frames together, a pair of side mould plates extending between said frames, tubular members rotatably mounted on said longitudinal members, a pair of links secured to each of said tubular members and pivotably connected with one of said mould plates, means limiting downward movement of said mould plates to define inner moulding positions thereof in which said links are substantially horizontal and perpendicular to the planes of said plates and retaining means for resisting upward and outward movement of said mould plates away from said moulding positions, said retaining means including for each mould plate a first retaining member mounted on said plate and a second retaining member mounted on said frame structure such that when the mould is full one retaining member engages the other retaining member to provide frictional resistance against upward movement of said mould plate away from its inner position.

16. A mould for use in forming concrete sections comprising a frame structure including a pair of end frames and longitudinal members connecting said frames together, a pair of side mould plates extending between said frames, tubular members rotatably mounted on said longitudinal members, a pair of links secured to each of said tubular members and pivotably connected with one of said mould plates, means limiting downward movement of said mould plates to define inner moulding positions thereof in which said links are substantially horizontal and perpendicular to the planes of said plates and retaining means for resisting upward and outward movement of said mould plates away from said moulding positions, said retaining means including for each mould plate a first retaining member mounted on said plate, a second retaining member mounted on one of said end frames such that when the mould is full the first retaining member is forced by the pressure of the concrete into engagement with the second retaining member to resist upward movement of the mould plate away from its inner position, and a retaining arm mounted on one of said tubular members so as to be moved by the rotation thereof into wedging engagement with the first retaining member when the mould plate is moved to its inner position so as to resist movement of said plate away from said position.

17. A mould for use in forming concrete sections comprising a frame structure including a pair of end frames and longitudinal members connecting said frames together, a pair of side mould plates extending between said frames, tubular members rotatably mounted on said longitudinal members, a pair of links secured to each of said tubular members and pivotably connected with one of said mould plates, means limiting downward movement of said mould plates to define inner moulding positions thereof in which said links are substantially horizontal and perpendicular to the planes of said plates and retaining means for resisting upward and outward movement of said mould plates away from said moulding positions, said retaining means including for each mould plate a retaining member mounted on said mould plate, and a retaining arm mounted on one of said tubular members so as to be moved by the rotation thereof into wedging engagement with said retaining member when the mould plate is moved to its inner position thereby to resist movement of said plate away from said position.

18. A mould for use in the construction of concrete walls or blocks, comprising a frame structure, at least one mould plate movably carried by said frame structure for movement between an inner moulding position and an outer

position and retaining means for holding said mould plate against movements away from its moulding position, said retaining means comprising a pair of members having co-operating faces which members are rigidly mounted one on said frame structure and one on said mould plate, the said face of one of said members being so oriented with respect to the plane of the mould plate and to the direction of the initial movement of said plate away from its moulding position that an internal pressure acting outwardly on said plate tends to force the two said members into engagement with each other to produce a resistance to the initial movement of said mould plate away from its moulding position, whereas when no internal pressure is acting on said mould plate

one of said members can move freely past the other said member.

19. In a mold as claimed in claim 13, said first retaining member being held fixed by said frame structure and said second retaining member being carried by said plate.

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