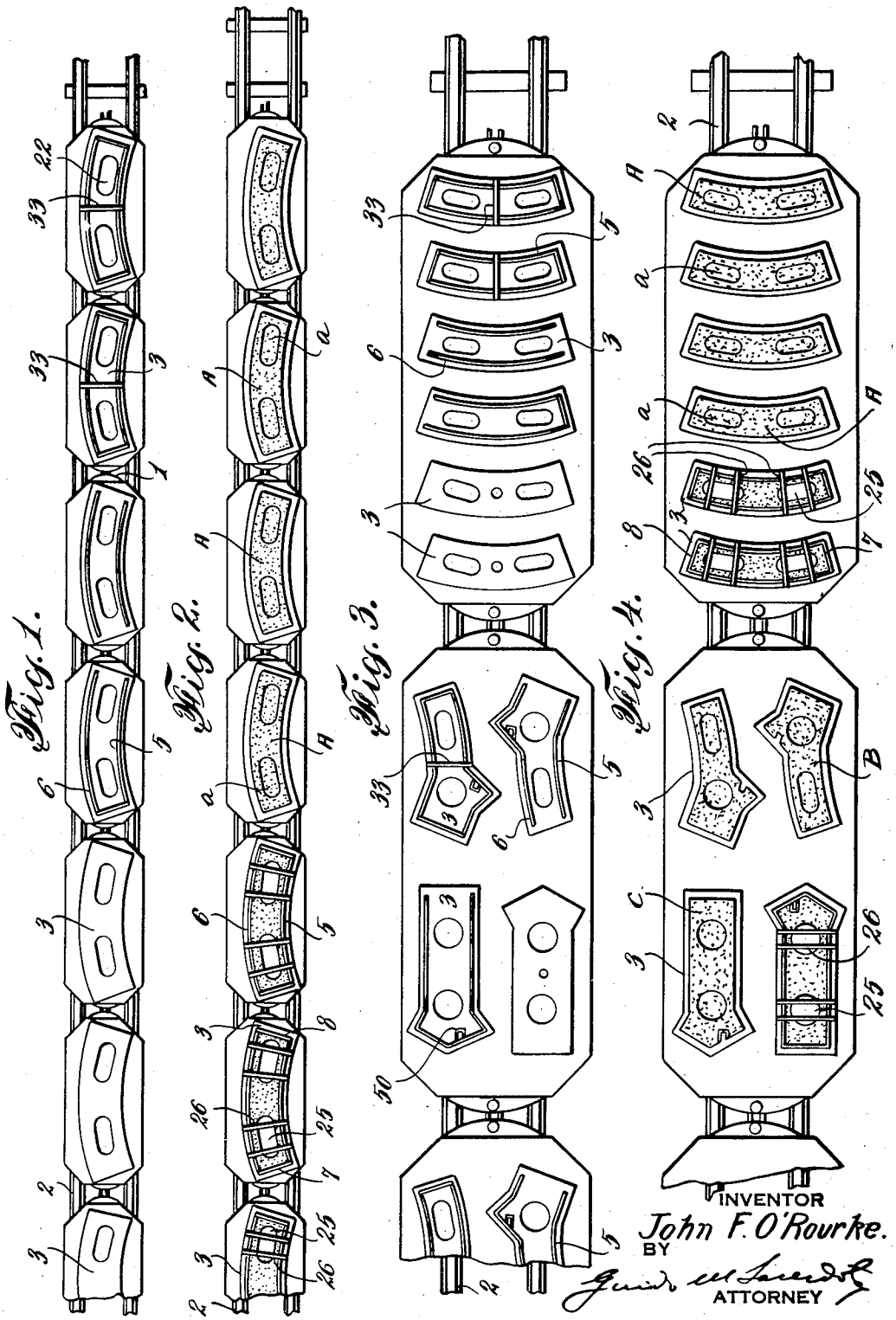
Oct. 9, 1934. J. F. O'ROURKE 1,976,627

MOLD FOR THE MANUFACTURE OF CONCRETE BLOCKS

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MOLD FOR THE MANUFACTURE OF CONCRETE BLOCKS

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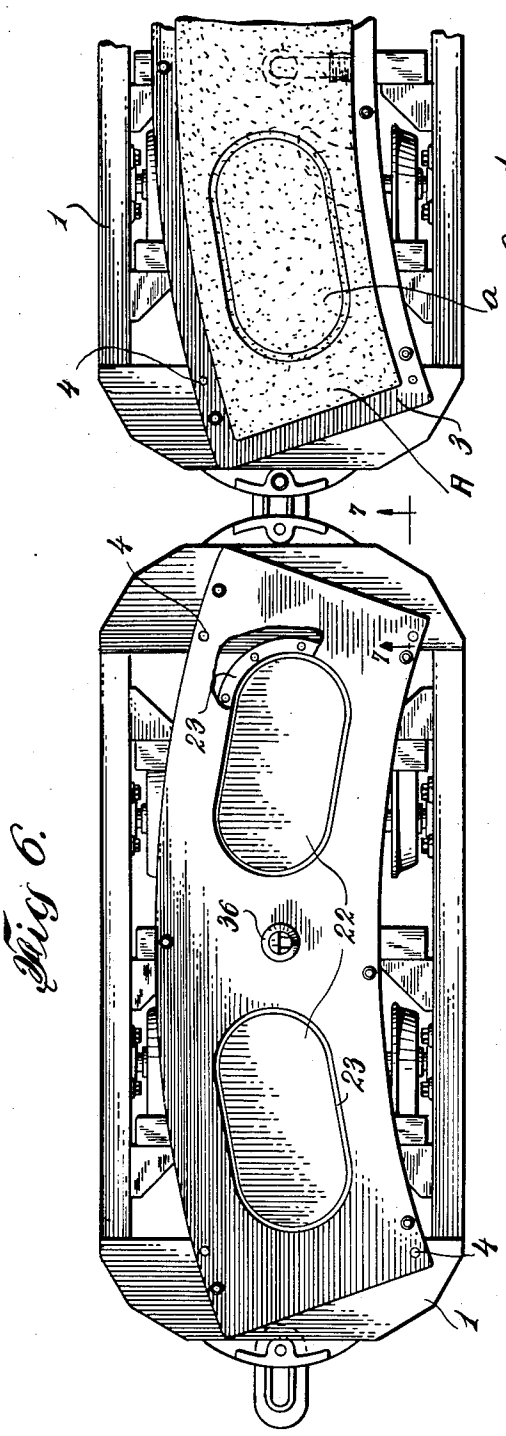


Fig. 6.

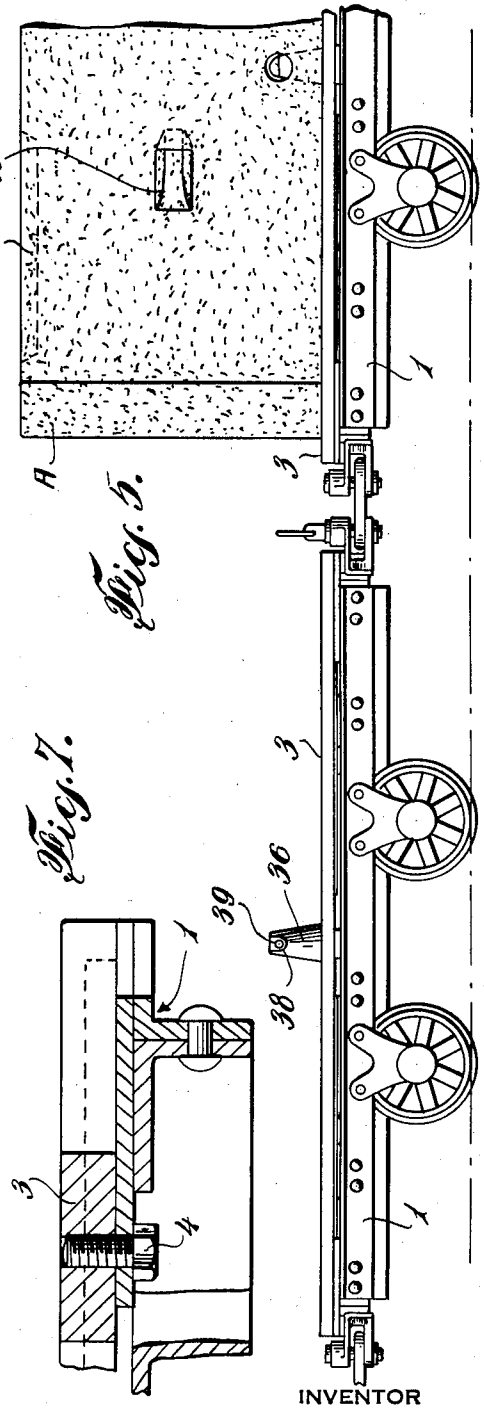


Fig. 5.

Fig. 7.

INVENTOR
John F. O'Rourke.
BY
Geo. W. Lacey
ATTORNEY

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Fig. 12.

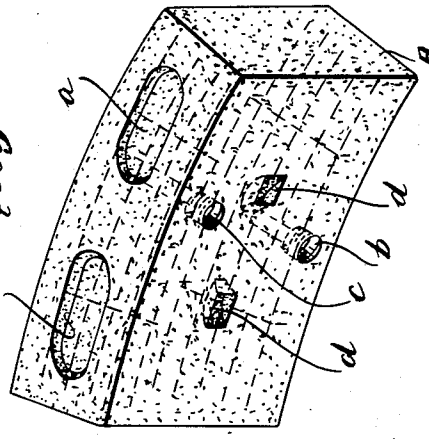


Fig. 13.

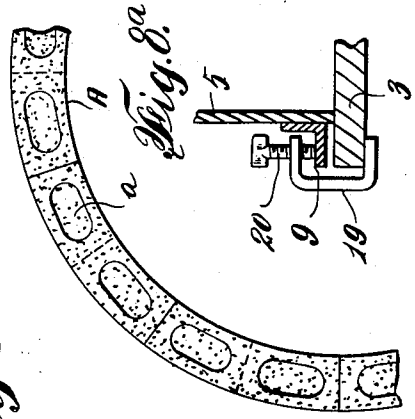


Fig. 8a.

Fig. 9.

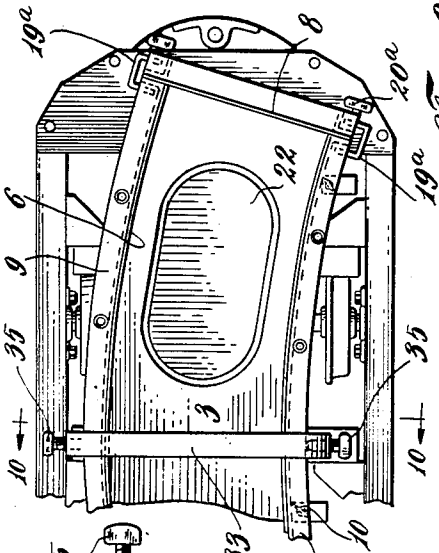


Fig. 8.

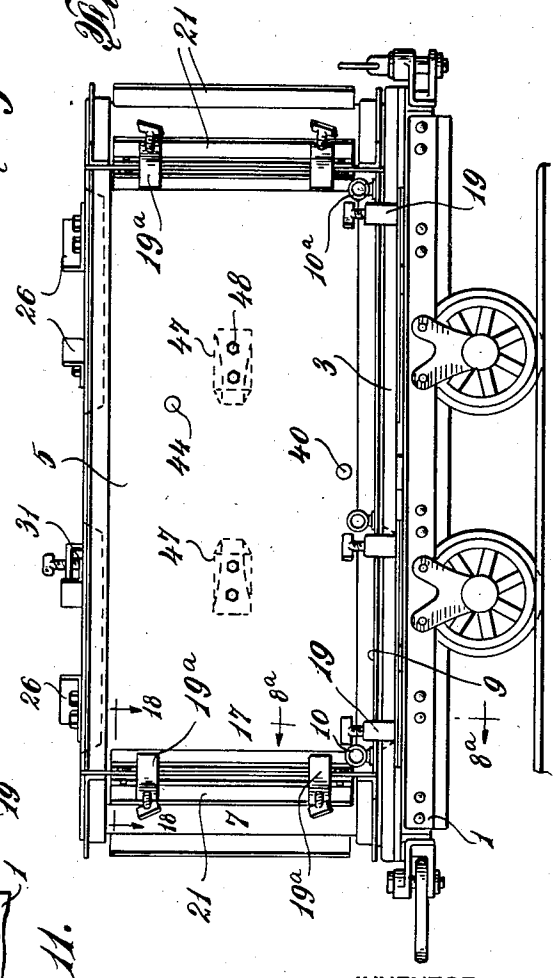


Fig. 10.

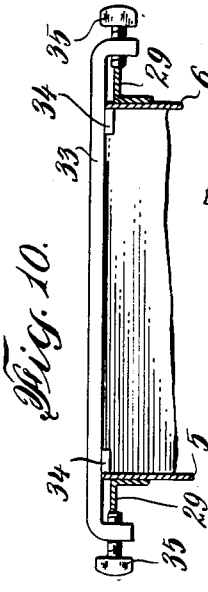
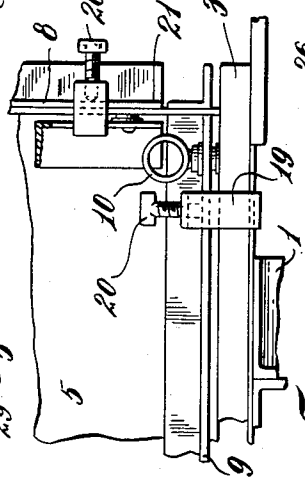


Fig. 11.

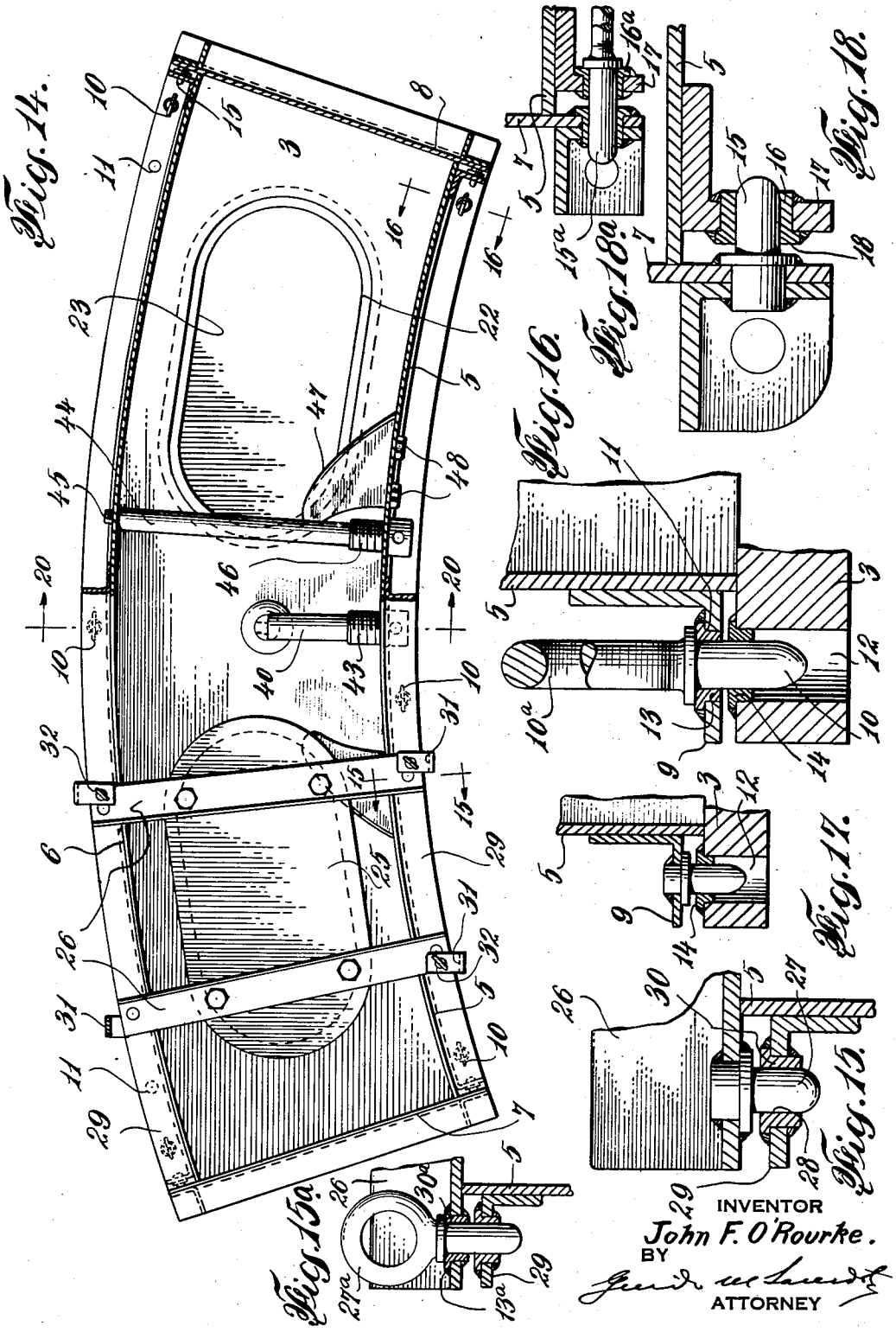


INVENTOR
John F. O'Rourke.
BY
ATTORNEY

Oct. 9, 1934. J. F. O'ROURKE 1,976,627

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INVENTOR
John F. O'Rourke.
BY
ATTORNEY

Oct. 9, 1934. J. F. O'ROURKE 1,976,627

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Fig. 20.

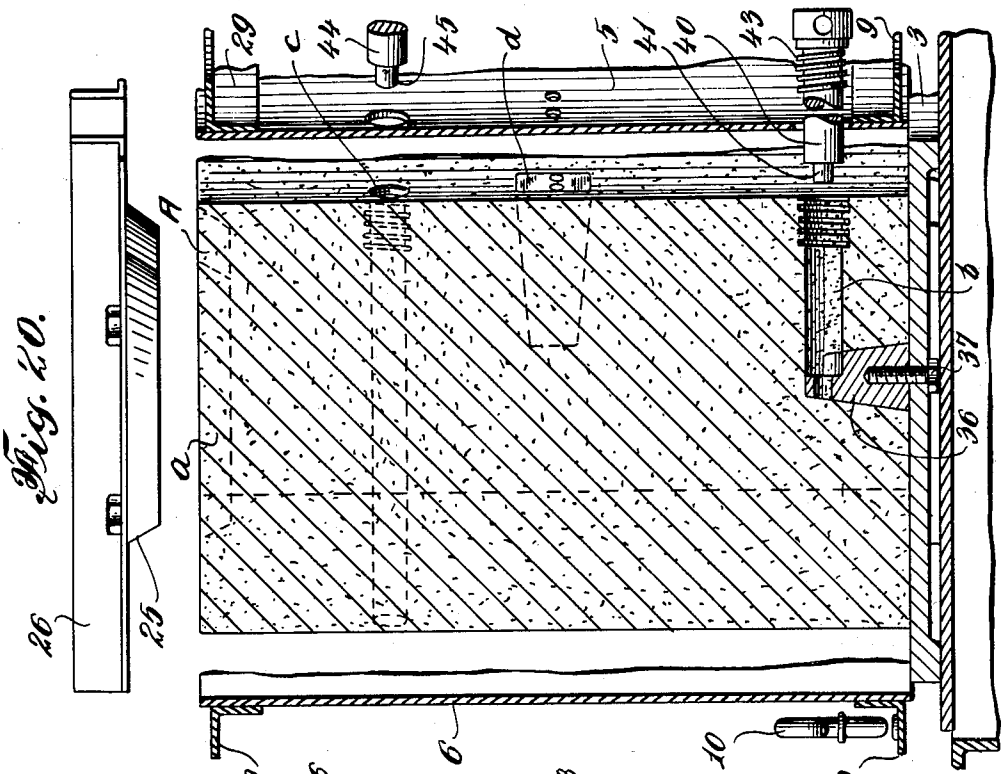
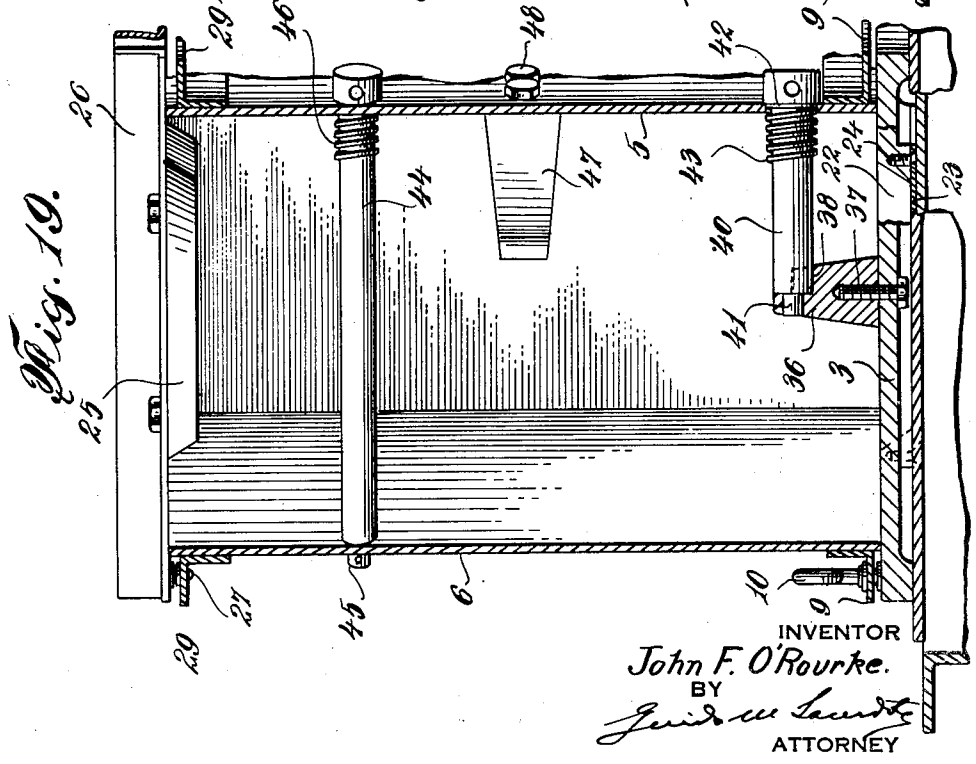


Fig. 19.



INVENTOR
John F. O'Rourke.
BY
Fred W. Lamb & Co.
ATTORNEY

Oct. 9, 1934. J. F. O'ROURKE 1,976,627

MOLD FOR THE MANUFACTURE OF CONCRETE BLOCKS

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Fig. 22.

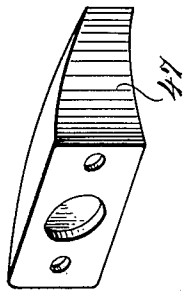


Fig. 23.

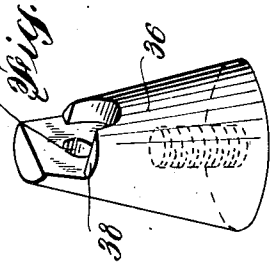


Fig. 24.

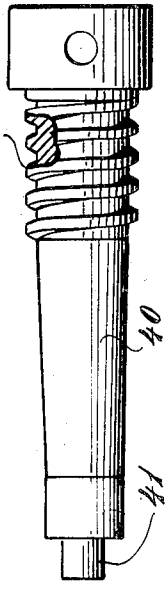
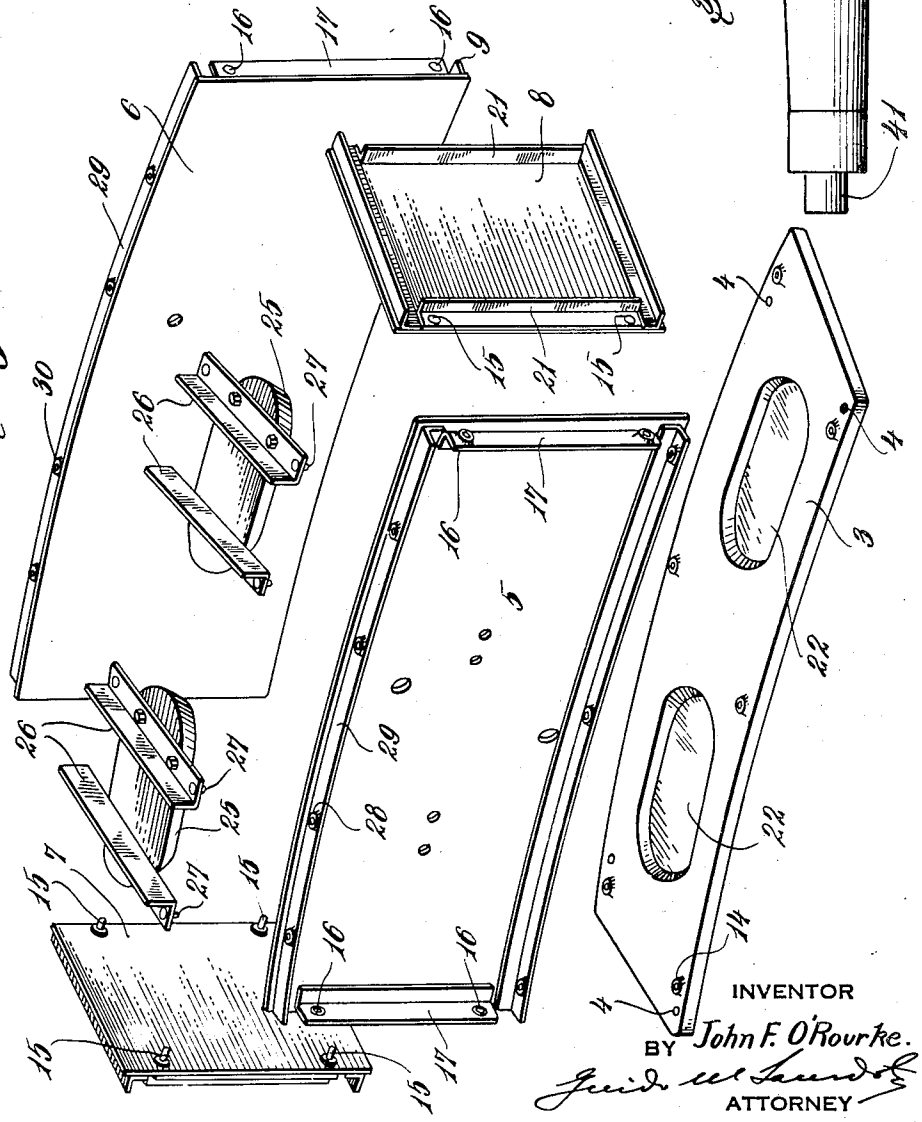


Fig. 21.



INVENTOR
BY John F. O'Rourke.
Guido M. Saunders
ATTORNEY

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MOLD FOR THE MANUFACTURE OF CONCRETE BLOCKS

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Fig. 31.

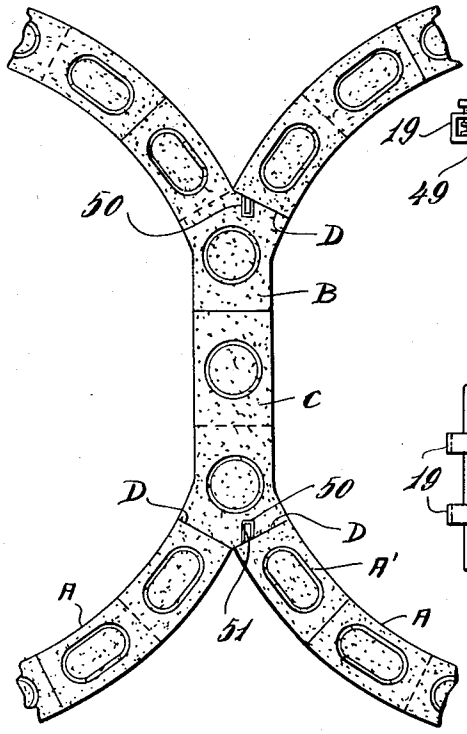


Fig. 25.

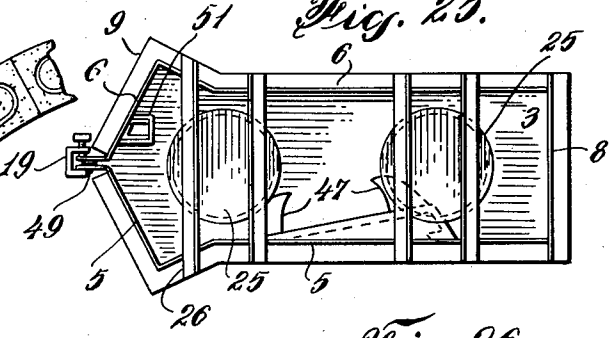


Fig. 26.

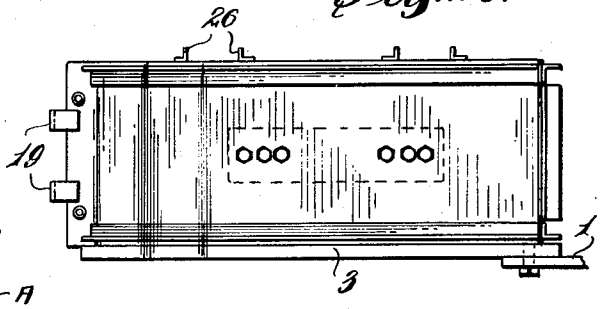


Fig. 29.

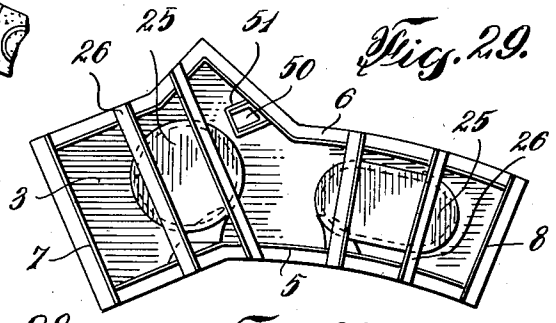


Fig. 28.

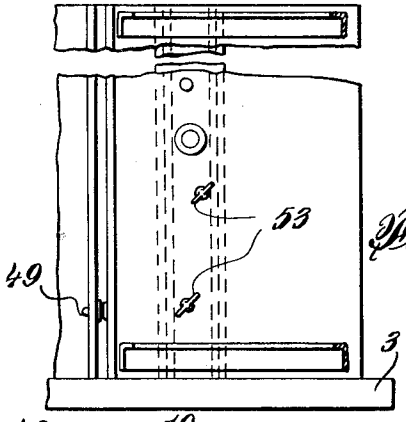


Fig. 30.

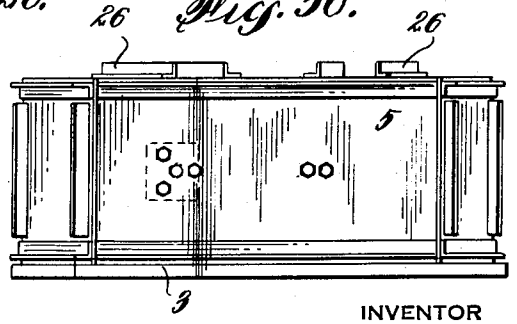
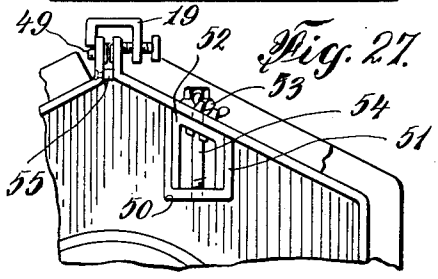


Fig. 27.



INVENTOR
John F. O'Rourke.
BY
ATTORNEY

Oct. 9, 1934. J. F. O'ROURKE 1,976,627

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Fig. 32.

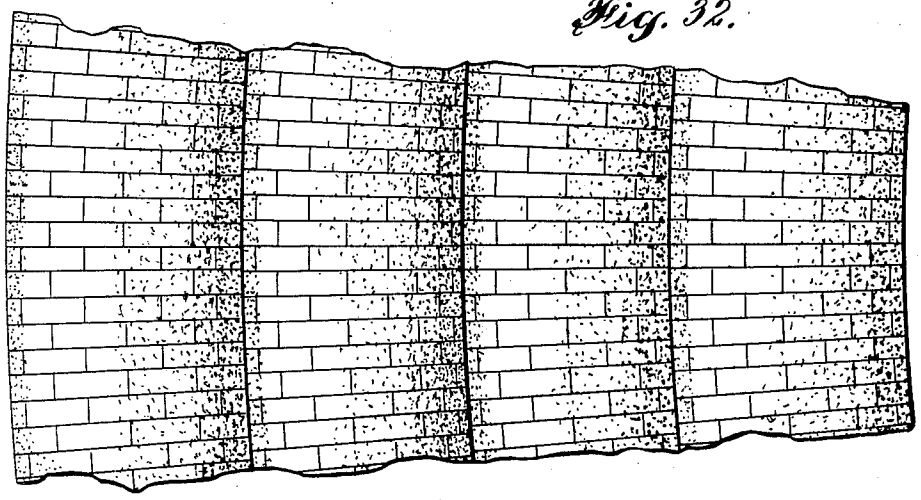


Fig. 33.

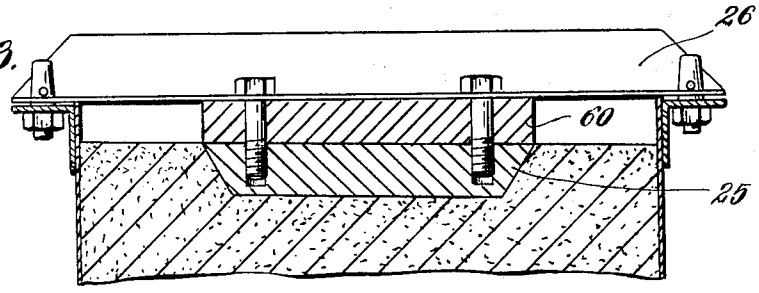
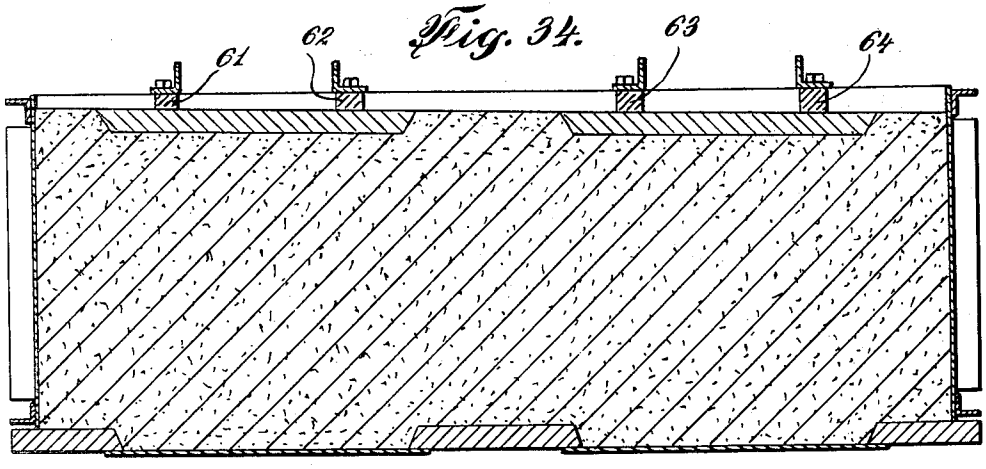


Fig. 34.



INVENTOR
John F. O'Rourke.
BY
ATTORNEY

Patented Oct. 9, 1934 1,976,627

UNITED STATES PATENT OFFICE

1,976,627

MOLD FOR THE MANUFACTURE OF CONCRETE BLOCKS

John F. O'Rourke, New York, N. Y.,

Application October 16, 1929, Serial No. 400,107

4 Claims. (Cl. 25—121)

This invention relates to the art of manufacturing concrete blocks and the like and more particularly refers to improvements in the construction of molds used for the production of such blocks.

Such is the case, for instance, where blocks to be used for constructing a circular tunnel, subway, conduit or an analogous underground structure, where such blocks are set in ring-like form, are concerned. In these types of constructions the blocks composing each elementary ring must exactly complete the ring when the adjoining ends of adjoining blocks are spaced a certain predetermined distance. The width of a ring thus obtained, that is, its longitudinal dimension must be uniform throughout and furthermore the blocks of each ring must interlock in a longitudinal sense with the blocks of the adjoining rings.

Blocks of this type have been described and claimed by me in another patent entitled Tunnel or conduit lining, #1,043,348.

In another patent application entitled Methods of manufacture of concrete blocks, filed simultaneously herewith, I have described and claimed a novel and improved method for rapidly producing concrete and like blocks by means of an especially designed plant, entailing the use of molds easily movable throughout the various stages of the manufacturing process. In said application I have also described the type of mold which I prefer to use in carrying out my method of manufacture, said mold embodying various features to which the present invention more particularly refers.

The primary object of this invention is to provide a demountable mold of a novel and improved construction, whereby concrete and like blocks can be produced with the greatest degree of accuracy.

A further object of the invention is to provide in demountable molds of the character specified, novel and improved means for positioning its component parts with respect to one another, and means for connecting adjoining parts insuring a perfectly tight fit and the accurate measurements of the completed structure.

A still further object is to provide in a mold intended for the manufacture of concrete blocks to be used in underground constructions of the character above mentioned, means for varying the inclination of one of the surfaces directed transversely of the axis of the tunnel or conduit when the blocks are set in position, in order to take care of the variations in the size of said blocks required by changes in the direction of the tunnel or conduit.

In the annexed drawings a preferred embodiment of my invention is illustrated such as is preferably employed in carrying out the process described and claimed in my other patent application for Methods of manufacture of concrete blocks, above referred to.

Referring to said drawings:

Fig. 1 is a plan view illustrating part of a train of single bottom mold bodies, upon some of which the sides and ends of molds from an adjoining train of concrete blocks (Fig. 2) are remounted, ready for concrete, others show same in different stages of remounting, the remaining mold bottoms awaiting removable parts;

Fig. 2 is a plan view of part of a train of single bottom mold bodies carrying concrete blocks, illustrating some blocks inside complete molds and some blocks stripped of the movable parts of the molds;

Fig. 3 is a plan view illustrating part of a train of multiple bottom mold bodies, upon some of which the sides and ends of molds from an adjoining train of concrete blocks (Fig. 4) are remounted, ready for concrete, others show same in different stages of remounting, the remaining mold bottoms awaiting removable parts;

Fig. 4 is a plan view of part of a train of multiple bottom mold bodies carrying concrete blocks, illustrating some blocks inside complete molds and other blocks stripped of the movable parts of the molds;

Fig. 5 is a side view illustrating a mold body, coupled to a portion of another mold body carrying a concrete block on its mold bottom;

Fig. 6 is a plan view illustrating a mold body with a partly broken mold bottom, coupled to a portion of another mold body carrying a concrete block on its mold bottom;

Fig. 7 is an enlarged detail section on line 7, 7, in Fig. 6;

Fig. 8 is a side view of a railroad track carrying a mold body, upon which are mounted the removable parts of a concrete block mold;

Fig. 8a is a section on line 8a, 8a, in Fig. 8, showing a side view of the screw clamp;

Fig. 9 is a detail plan view of part of a mold body, with sides and ends mounted on its bottom and a cross clamp holding tops of side plates at middle;

Fig. 10 is a section on line 10, 10 in Fig. 9, illustrating a cross clamp and its means for holding the tops of side plates from moving inward or outward;

Fig. 11 is an enlarged detail of Fig. 8, illustrating bottom corner fastenings of the side and end plates to one another and to the mold bottom;

Fig. 12 is a perspective view of one of the molded blocks;

Fig. 13 illustrates a series of blocks in circular ring form, as for a tunnel lining;

Fig. 14 is an enlarged partly broken plan view of one of the molds, with recess, grout, gravel and grip hole cores in position;

Fig. 15 is an enlarged detail section on line 15, 15, in Fig. 14, illustrating the connection of cross angles of recess cores to the top angles of the side plates;

Fig. 15*a* is a sectional detail of Fig. 15 illustrating a removable pin substituted for the fixed dowel;

Fig. 16 is an enlarged detail section on line 16, 16, in Fig. 14, illustrating the connection between the bottom angles of side plates and the bottom of the mold;

Fig. 17 is a sectional detail of Fig. 16, illustrating a fixed dowel substituted for the removable pin;

Fig. 18 is an enlarged detail section on line 18, 18, in Fig. 8, illustrating connection between the end plates and the side plates;

Fig. 18*a* is a sectional detail of Fig. 18, illustrating a removable pin substituted for the fixed dowel;

Fig. 19 is a cross section of part of the mold body and sides of mold substantially on line 20, 20, in Fig. 14, together with a side view of the recess core and its supporting angles and of the grout, gravel and grip hole cores.

Fig. 20 is a middle cross section of a concrete block, illustrating the detachability of demountable parts of the mold;

Fig. 21 is an exploded view of the mold parts;

Fig. 22 is a grip hold core;

Fig. 23 is the part of the grout core which is permanently attached to the bottom of the mold;

Fig. 24 is the detachable part of the grout core;

Fig. 25 is a plan view of a twin tube tunnel wall block mold;

Fig. 26 is a side view of Fig. 25;

Fig. 27 is an enlarged detail plan view of part of Fig. 25;

Fig. 28 is a side view of Fig. 27;

Fig. 29 is a plan view of a twin-tube tunnel wall-arch block mold;

Fig. 30 is a side view of Fig. 29;

Fig. 31 illustrates a portion of a twin-tube tunnel lining constructed of concrete block cast in molds Fig. 25 and Fig. 29;

Fig. 32 is a fragmentary plan view of a four-tube tunnel section going around a curve;

Fig. 33 is a fragmentary cross section of a mold equipped with packing bars for the production of tapering blocks required in the curved sections of a tunnel; and

Fig. 34 is a longitudinal section of a similar mold.

Similar numerals of references indicate corresponding parts in the several views. As stated, I have illustrated my improved mold as adaptable for making concrete blocks for use as linings for tunnels, tubes and analogous underground structures of a well known character, in which the blocks are provided with projections on one side and recesses on the opposite side, whereby the projections of blocks of one ring will enter the recesses in the blocks of an adjacent ring of blocks in the making of a tunnel or tube under ground.

The number 1 indicates a car or analogous wheeled structure adapted to run in trains on rails 2. The bottom 3 of a concrete mold is permanently connected to this wheeled part in any desired way, such as by means of screws 4, (Figs. 6 and 7), their combination thus being a mold body upon which may be mounted the remaining parts of a concrete block mold. 5 and 6, (Figs. 6, 8 and 9) indicate the sides of the molds, which are shown curved to correspond to the curvature of circular tunnel-ring blocks, which are adapted to be attached to the mold bottoms 3 and to one another, and at 7 and 8, (Fig. 8) are the ends of the molds, which sides and ends are adapted to be demounted or separated from the mold bottom when the concrete in the mold has hardened sufficiently, leaving the stripped concrete block on the mold bottom. The lower edge portions of the sides are provided with extended flanges 9, which overlie the bottoms, leaving a space between the flanges and the mold bottoms so that the machined edges of the side plates may bear directly on the machined surfaces of the bottoms when the sides are placed edgewise thereagainst (Fig. 16).

Guiding means for accurate positioning of the sides upon bottoms 3 include pins 10, adapted to pass through holes 11 in the flanges 9 and into holes 12 in bottoms 3 (Fig. 16).

The holes 11 and 12 are shown provided with apertured pin holders 13 and 14 respectively, which pin holders are welded to the flanges and mold bottom (Fig. 16). The pin holders, dowels and pins are made of a very hard tempered steel alloy to prevent the enlargement of the holes that receive the dowels or pins and wear and tear of the latter, so that the molds will preserve their original accuracy of form and dimensions unaffected by the forcing or driving of pins or dowels into the holes of the pin holders or their removal therefrom in mounting and demounting the movable parts. In fact in practice the pins and pin holders have been tempered to such a degree of hardness that they cannot be cut by ordinary filing processes.

Thus the molds will retain their accuracy of form and dimensions unchanged by wear and tear, assuring the same accuracy and uniformity in the concrete blocks. The pins 10 may have eyes 10*a* for ready handling. Instead of using pins 10 that are removable from the flanges 9, dowels 15 may be permanently secured to said flanges and will enter the pin holders 14 when the sides are applied, as illustrated in the modification shown in Fig. 17.

To assure accurate location of the ends 7 and 8 with respect to the sides 5 and 6, I provide dowels 15 shown attached to the ends (Fig. 18), adapted to enter holes 16 in vertical flanges 17 at the end portions of the sides, the holes 16 preferably being provided with hardened steel pin holders 18 to resist wear and to preserve the original accuracy of form and dimension before referred to. To retain the sides on bottoms 3 I provide U-shaped clamps 19 adapted to receive the bottoms 3 and the flanges 9, which clamps have screws 20 for securing the parts together (Figs. 8, 8*a* and 11). To detachably secure the ends and sides together I provide clamps 19*a*, having screws 20*a*, similar to the clamps 19, adapted to secure together the vertical flanges 17 of the sides 5 and 6 and the adjacent edge portion of the ends 7 and 8, which latter portions

are shown provided with flanges 21 engaged by the clamps 19a (Figs. 8 and 9).

The blocks A (Fig. 12), illustrated, are of the variety having recesses *a* in one side to receive projections on the opposite side of an adjacent block, when the blocks are arranged in the form of rings adjacent one to another. To form the projections on the molded block, recesses 22, (Fig. 6), are provided in the bottom 3 of the mold.

Such recesses are shown formed in the nature of openings through the bottoms 3, and plates 23 are secured by screws 24 to the outside of the bottoms, (Fig. 19), so that the concrete poured into the molds will enter the recesses 22 and stop against the plates 23, and thereby form the desired projections on the blocks. To provide the recesses *a* in the blocks A, (Fig. 12), I provide cores 25, (Figs. 14 and 21), which are detachably supported over the molds by means of cross bars 26 that are attached to the cores and extend from the opposite sides of the cores, and are adapted to rest on the machined top edges of sides 5 and 6. To accurately position the bars 26 upon the sides, said bars are provided with dowels 27 that are adapted to pass through holes 28 in flanges 29, secured approximately along the upper edges of said sides, (Figs. 15 and 21). The holes 28 are shown provided with hardened pin holders 30 welded to sides of holes to receive the dowels 27 and resist wear, as before described. Pins like those shown in Fig. 15*a* could be used instead of the dowels. Clamps 31 having screws 32 (similar to the clamps before described) secure the bars 26 and flanges 29 detachably together (Figs. 8 and 14). In order to brace the upper portion of the sides 5 and 6 to keep them properly spaced apart with respect to the exact thickness of the concrete blocks, I provide cross clamps 33 (Fig. 10) having projections 34 extending downwardly to engage the inner faces of the sides 5 and 6 adjacent to their upper edges, and said bars are bent at the outer ends to receive screws 35 that preferably bear against flanges 29.

When the projections 34 are against the sides 5 and 6 and the screws 35 are set tight against the flanges 29, the sides will be held rigidly against the projections 34 to keep them the exact distance apart, at the same time preventing outward movement of the sides by pressure from the soft heavy concrete while the mold is being filled and subsequently hauled away from the concrete mixer, (Figs. 1 and 10).

The blocks illustrated are provided with cored passages *b* and *c* and with recesses *d* to receive prongs from an erector. To provide the passages *b* a core like projection 36 is secured to bottom 3, as by screws 37 (Figs. 5 and 19), said projection being shown provided with recesses 38 and the hole at 39 to receive a transversely disposed core 40 having a reduced end 41 to enter said hole. The core 40 extends from the mold through a hole 42 in the side 5, and said core is shown provided with screw threads at 43, so that the core can be rotated to be drawn out of the cast concrete block and the screw threads in the concrete can be subsequently used to engage similar threads in a steel nipple attached to a grout hose. In the block the passage *b* will open through two sides of the block when the latter is lifted from the bottom 3. A core at 44 extends across between the sides 5 and 6, having a reduced end 45 entering a hole in the side 6.

The larger end of the core passes through the side 5, said core being shown provided with screw threads at 46 so that the core can be unscrewed out of the block cast in the mold, providing the passage *c* (Figs. 14 and 19). The screw threads in the concrete can be subsequently used to engage similar screw threads in a steel nipple attached to a gravel shooting hose. Cores 47 are shown attached to sides 5 by means of screws 48, whereby recesses *d* are formed in the block A.

Blocks so far described may be used for constructing a circular tunnel, subway, conduit, or analogous underground structures, where such blocks are set in ring-like form. Where a twin-tube underground structure is to be installed having a common wall between the two tubes, the aforesaid blocks may be used for the circular portions of each ring, but at the common or party wall blocks of different form are shown in Fig. 31, where the blocks B and C are provided, which blocks have skewbacks D against which some of the blocks A abut. The molds shown in Figs. 25 to 30 are adapted to produce the blocks B and C, the bottoms of the corresponding molds being shaped in accordance with the shape of the blocks, the sides and ends of the molds also being properly shaped according to the shape of the blocks to be produced. The sides and ends are to be connected together and to the bottoms 3 in the manner before described, and the cores 25 correspondingly shaped and supported on the sides.

The bent ends of side plates 5 and 6 form flanges and have a separator plate 55, connected to side plate 5 to provide a tight end joint between the flanges of the side plates 5 and 6 in conjunction with dowels 49 and screw clamps 19 (Figs. 27 and 28). The skewbacks D of the blocks C are provided with channels 50 in which channel bars 51 are located for guiding a shield having projections which slide loosely in the channel bars as it is driven along the common wall when one of the tubes is built. Said channel bar 51 is placed within the mold, approximately against one of the sides, and a guiding inset 52 located within said channel bar, which is detachably secured to the adjacent side by screw means 53 (Figs. 27 and 28). A screw 54 passes through the mold side and is screwed into the channel bar 51 to draw it tightly against the inset 52 to retain the bar 51 in exact position in the mold. After the block has been cast, the parts 53 and 54 are removed to enable the adjacent sides to be detached and the inset is subsequently removed, leaving the channel bar 51 embedded in the concrete.

When a tunnel goes around a curve as shown in Fig. 32, each ring should be tapered according to the rings of the curve and according to the thickness of the ring, the thickness of the ring corresponding to the height of the block. Furthermore, each lock composing a ring will be different from the others in this that its surfaces abutting against adjoining rings will be inclined at a different angle with respect to its end surfaces and with respect to its curved surfaces according to the position occupied by each block in the ring.

In order to produce these tapering or special blocks, I interpose between each core 25 and each of its cross bars 26, a packing bar such as shown at 60 in Fig. 33, having its top and bottom surfaces tapered at an angle corresponding to the inclination required in the bottom surface of the recess produced by each core 25.

These packing bars are obtained by securing

flat bars in circumferential series upon the face of a cast iron ring at spaced intervals corresponding to the positions occupied by the cross bars with respect to the blocks produced by each mold, if the blocks were assembled in ring formation and the cross bars were attached thereto. The structure thus obtained is placed on a boring mill, and the upper surface of the packing bars for the time being constituting an integral part of the cast iron ring are planed to correspond with the taper to be produced in each ring, this operation being carried out with the same accuracy used in producing the usual cast iron taper tunnel rings.

Each cross bar is numbered and each group of four contiguous cross bars along the circumference of the ring is employed in a mold used to produce the corresponding block.

The packing bar illustrated in Fig. 33 has its surface tapering in a direction from the outer to the inner curved surface of the block and therefore the drawing illustrates the molding of the block placed on the outer side of the tunnel curve about midway of the height of the tunnel.

In Fig. 34 I illustrate a mold equipped with a set of four packing bars 61, 62, 63, 64, causing the bottom surfaces of the recesses of the block to be inclined in a longitudinal direction from left to right; therefore, the resulting block is typical of those used at the top and bottom of a ring, the end of the block which is lower being the one nearest the center of the tunnel curve.

While I have described my invention as particularly adapted for manufacturing concrete blocks for tunnels, subways, and the like, and the mold parts arranged for the particular purpose set forth, it will be understood that other articles may be molded in the manner set forth with mold parts adapted for production of articles, varying in shape and detail from the molds I have set forth, and that changes may be made in the details of the construction described without departing from the spirit of the appended claims.

I claim:

1. A mold comprising a bottom, sides and ends, means to detachably connect said parts together, a channel guide within the mold, and means operated externally of the mold to detachably connect said guide with one of said sides.

2. A mold as set forth in claim 1 provided with an inset within the mold adapted to enter said channel, and means for detachably connecting said inset with the adjacent side.

3. A mold comprising a base and detachable sides, a core extending into a side of the mold having screw threads to form screw threaded apertures in the material molded, a core-like projection secured on the bottom of the mold and supporting the inner end of the first mentioned core.

4. A mold comprising a base and detachable sides, a core transversely disposed in said mold and extending into one of its sides and having its end anchored in the opposite side, said core having a threaded portion lying within the mold and adapted to produce a threaded aperture in the material molded, a second core extending into the mold through the wall thereof and having a threaded portion operative to form a threaded seat in the wall of the material molded, a core-like projection secured to the bottom of the mold and coacting with the inner end of the last mentioned core.

JOHN F. O'ROURKE.