

Dec. 29, 1942.

L. J. SAROSDY

2,306,503

FORM FOR MOLDING CONCRETE STRUCTURES

Filed Aug. 13, 1942

2 Sheets-Sheet 1

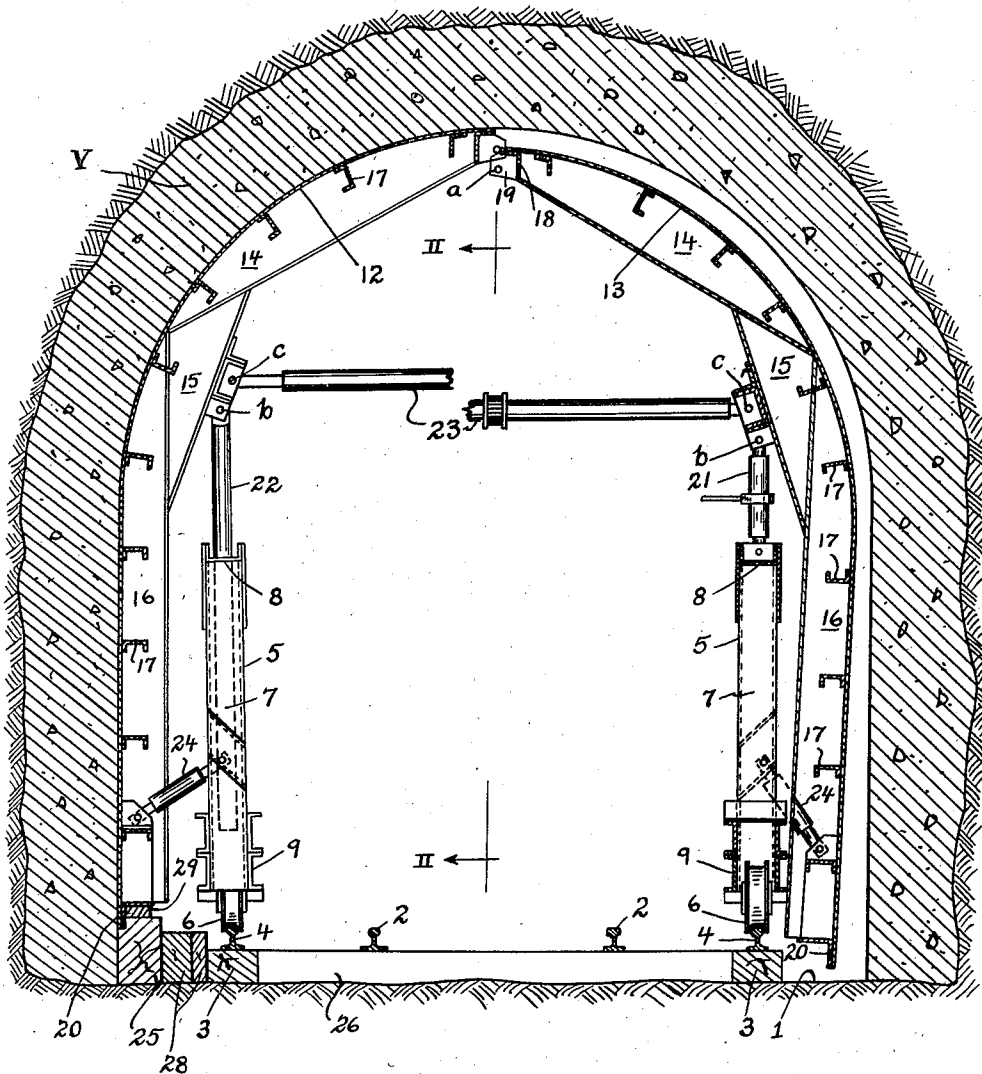


FIG. I.

INVENTOR

Louis J. Sarosdy
by *Christy, Parmelee & Strickland*
his attorneys

Dec. 29, 1942.

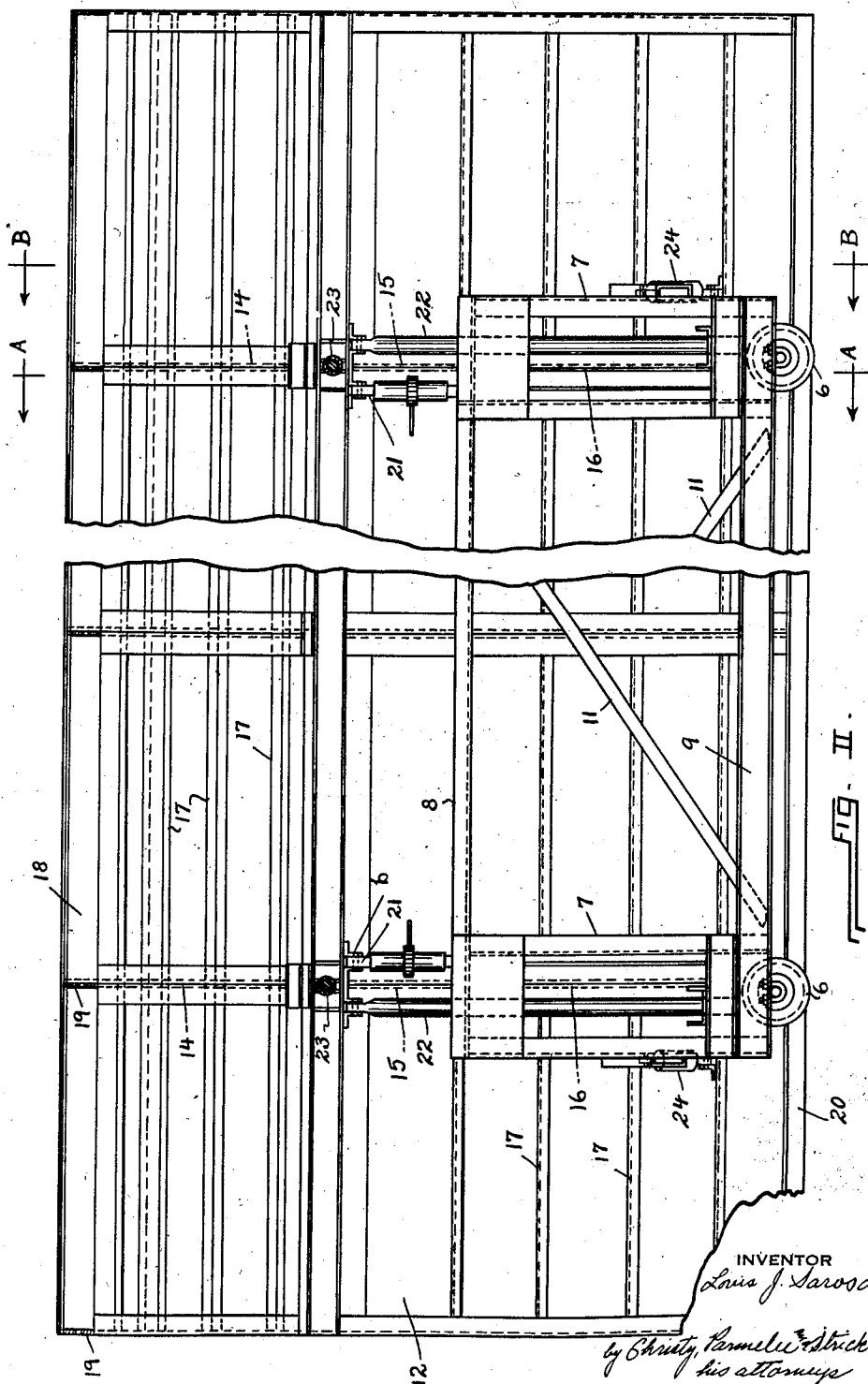
L. J. SAROSDY

2,306,503

FORM FOR MOLDING CONCRETE STRUCTURES

Filed Aug. 13, 1942

2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,306,503

FORM FOR MOLDING CONCRETE STRUCTURES

Louis J. Sarosdy, Pittsburgh, Pa., assignor to
Blaw-Knox Company, Blawnox, Pa., a corpora-
tion of New Jersey

Application August 13, 1942, Serial No. 454,646

6 Claims. (Cl. 25—131.6)

This invention relates to forms for concrete structures. It finds practical application in the lining of tunnels with concrete, and in such application I shall show and describe it.

In tunnel building it is common practice to line the excavation with concrete progressively as the operation of excavation goes forward; and, accordingly, the structure required for the support of and shaping of the inner face of the concrete lining must be so constructed as to permit of the passage of cars for the removal of excavated material and for the bringing in of concrete for placement. It is customary in operations of this sort to provide a carriage and expansible and collapsible mold sections. A mold section in collapsed condition is mounted upon the carriage; the carriage with its load is advanced through the excavation until the point of placement is reached; the mold section is then expanded and secured in place in the excavation, and the concrete is placed. In some cases the carriage remains, with the mold sections attached to it, while the concrete sets; in other cases the mold sections being freed from it, the carriage is withdrawn, that it may similarly receive and carry another mold section. When the concrete has set, the mold section may be separated from it and may then be borne by a carriage to a more advanced position of service.

The equipment of my invention is simpler. There is no separate carriage which may be detached from the mold and retain self-sustaining properties. In place of a separate self-sustaining carriage, I employ parts which, attached to the mold, form with it a unitary collapsible mold structure, capable when collapsed of being moved through the completed arch of the tunnel lining, but affording a greater amount of clearance beneath or within it than the previously used self-sustaining carriage structures. In addition to possessing the advantage of affording greater clearance, the combined carriage and form is somewhat simpler and more economical to construct and to operate than devices in which the carriage of itself is a self-sustaining, independent unit.

In the accompanying drawings Fig. I is a view in cross section through a tunnel excavation, in a portion where the concrete lining has already been placed; and in this figure the mold equipment of my invention is shown in cross section. It is shown on two planes of section. The plane of section of the right half of Fig. I is indicated in Fig. II by the broken line A—A,

and the plane of section of the left half is indicated by the broken line B—B. The mold section on the right is shown in collapsed position; the section on the left, in expanded position. Fig. II is a view in vertical and longitudinal section, of the equipment of my invention, on the plane indicated at II—II, Fig. I. The mold section that is shown in Fig. II is shown in its expanded position.

On the floor 1 of the tunnel excavation shown in Fig. I tracks 2, 2 are laid, adapted to sustain and carry cars for the removal of excavated material and for the carrying into the excavation concrete to be placed, tools, etc.

Between the tracks 2, 2 and the walls of the excavation stringers 3, 3 are laid, and upon the stringers tracks 4, 4 are secured, and these are the tracks that carry the equipment of the invention.

Two horizontally elongate frames 5, 5, equipped along their lower edges with wheels 6, rest upon and travel upon the tracks 4, 4. The frames are duplicates. Each conveniently consists of a succession of vertically standing hollow and box-like legs 7 (cf. Fig. II) formed of suitable steel shapes cut and fitted and welded or bolted together (at the lower ends of which legs the wheels 6 are journaled in the frame), of chord members 8 and 9 connecting the legs, and of braces 11 that give to the frame the character of a truss.

Two mold parts 12, 13, upon whose outer surfaces the concrete is actually shaped, are unitedly of arch shape, symmetrical with respect to a vertical mid-plane. They are pivotally united adjacent the crown of the arch that they unitedly form; and conveniently, and as here shown, they are duplicates (in reverse) and are united precisely at the crown of the arch. Each mold part may be formed of a skeleton frame, consisting of transverse bracing plates 14, 15, 16, with flanged and re-enforced inner edges, and longitudinal members 17, and of plates borne by the frame, to which plates the numerals 12 and 13 are immediately applied. At the upper edges of the mold parts extend suitably shaped beams 18 that carry plates 19 in which the pivots are set that unite the mold parts, and at the free lower edges of the mold extend suitably shaped beams 20. The pivotal union of the mold parts is upon an axis (indicated at a, Fig. I) that extends longitudinally of the structure.

The frames 5, 5 are equipped, each with a succession of vertically up-standing jack-screws 21, and upon the upper ends of the jack-screws of the two frames the two mold parts are severally

pivotally borne. The pivotal bearings of each mold part are aligned in a common axis that extends longitudinally of the structure, and that axis (indicated at the point *b*, Fig. 1) is, it will be seen, remote from the axis *a* of union of the two mold parts, and intermediate in position in the extent of the mold part from the axis *a* to the lower edge. Adjacent to each jack-screw 21 and in the plane of the succession of jack-screws is arranged a vertically extending stem 22. This stem is guided through and by orifices formed for it in the transverse webs of the structure of leg 7. To the two lines of stems 22 at their upper ends the mold parts 12 and 13 are severally pivoted, and the pivoting is in the same axis *b* of pivotal union to the jack-screws. As the jack-screws are extended and retracted the mold parts are raised and lowered upon the frames 5, 5; and in such raising and lowering the stems 22 constitute guides, limiting movement to direction in the substantially vertical plane of the extent of the frames 5, 5. The jack-screw 21 is shown to be pivoted to leg 7 as well as to the mold part. This is both convenient and affords allowance in the matter of alignment in assembly.

The frames 5, 5 and the mold parts 12, 13, assembled in the manner described, constitute a structure that is vertically extensible and laterally expandable; and it is a double structure whose duplicate components are pivotally united at *a*. Between the two components and pivotally united at its ends to the two components extends a succession of extensible and contractible chord members. The chord member is here shown in the form of a jack-screw 23. It is preferably pivoted at its ends to the mold parts 12, 13, rather than to the frames 5, 5; and the axis of pivoting *c* lies intermediate in the extent of the mold parts, between the axis *a* and the lower edges. It will be understood that there is a succession of jack-screws 23 arranged in parallelism longitudinally of the structure.

Turnbuckles 24 are provided, pivotally connected each at one end to one of the mold parts 12, 13, near the otherwise free lower edge thereof, and extending thence upwardly and inwardly, and at the inner end pivotally connected to the frames 5, 5.

The jack-screws 21 and 23 and the turnbuckles may be of conventional form, and are so shown in the drawings. By means of jack-screws 21 the mold parts may be raised and lowered within the excavation; by means of the jack-screws 23 the mold parts may be spread fully to the required shape and collapsed; by means of the turnbuckles 24 the raised and spread mold forms may be adjusted in minutely accurate erect position.

In the spreading of the mold forms and in the adjustment by means of the turnbuckles, it will be seen that there is a slight pivotal movement of the wheel-mounted frames 5, 5 upon the tracks 4, 4. The wheels 6 are advantageously doubly flanged.

In operation the equipment described, when in collapsed position (the position shown on the right, Fig. 1), is advanced upon the rails 4 until it comes to proper position within the excavation. The jack-screws 21 and 23 are then extended and the mold parts brought to the expanded position (the position shown on the left, Fig. 1). Any inaccuracy that may be found in the vertical standing of the structure is corrected by adjustment of the turnbuckles 24. Beneath

the lower edges of the mold parts 12, 13 timbers 25 are then placed. Downward extending flanges of beams 20 are engaged from the inside by vertical faces upon the beams 25, as is clearly shown in Fig. 1. The track structure includes cross-ties 26 that extend between the stringers 3. When the timbers 25 have been laid they are secured against lateral displacement and the mold parts secured against inward movement by wedge blocks 28 set between the timbers 25 and the track structure. The expanded mold parts may be adjusted vertically by means of wedges 29 interposed between their lower edges and timbers 25. When the form has been made ready, concrete is in known manner introduced into and caused to fill the space above the form and within the excavation, as indicated at V. The setting of the concrete follows.

After the concrete has been placed and has hardened sufficiently to permit the form to be removed, the timbers 25 are first taken away. The jack-screws 21 and 23 are then retracted, with the effect that the mold parts 12 and 13 are lowered and drawn away from the concrete and are collapsed. The parts thus come again to the position indicated on the right, Fig. 1. The collapsed form may then be moved along the rails 4, 4 to a position for continuance of the work, and, when the form has so been brought to a new position, the operation described is repeated. It will be perceived that the upward and inward inclination of the turnbuckles 24 in their positions permits the collapse of the two-part form. The turnbuckles swing on their pivots and the lower edges of the mold parts move inward and downward.

The jack-screws 23 (as will readily be seen in Fig. 1) are placed at such height as to allow free passage beneath of cars traveling on tracks 2, 2. The clearance here (and the drawing is to scale) is of a space six feet in vertical extent and six feet in lateral extent above a track of 36-inch gauge.

Ordinarily, the bottom lining of the tunnel will be spread after the arch has been placed and the forms removed. It may, however, be spread first, and the forms erected upon it.

The tunnel may be of the simple barrel type shown, or it may be of horseshoe shape or of other specific cross-sectional outline.

I claim as my invention:

1. An expansible and collapsible two-section form for concrete work, consisting of two horizontally elongate and vertically extensible frames, and two complementary mold parts, each pivotally borne by one of the said frames, the mold parts of the two form sections being pivotally united together, and an extensible and contractible chord connection arranged between and at the ends pivotally united to the two form sections.

2. A form for building a concrete tunnel consisting of two horizontally elongate and vertically extensible frames, two complementary mold parts unitedly of arch-shaped contour pivoted together at the crown of the arch, and severally pivotally mounted upon the two frames, and extensible and contractible chord connection between the two mold parts pivotally united to the two mold parts, whereby in response to extension of the frames and of the chord connection the mold parts may be raised and spread to operative position and in response to lowering of the frames and contraction of the chord connection the mold parts may be moved downwardly and inwardly away from the work.

3. A form for building a concrete tunnel consisting of two horizontally elongate and vertically extensible frames, two mold parts presenting upper and outer surfaces upon which concrete may be spread, the two mold parts being pivotally united to one another and being unitedly of arch shape, the two form parts being pivotally mounted, each upon one of the two vertically extensible frames, a plurality of extensible chord members arranged between and at their ends pivotally united to the two mold parts at longitudinally successive and opposite points intermediate between the axis of pivotal union of the mold parts to one another and the lower edges of the mold parts, and a plurality of extensible braces arranged between and pivotally united to one of the mold parts and the frame upon which it is pivotally mounted, the points of pivotal union between the braces and the mold part being situated between the axis of pivotal mounting of the mold part upon the frame and the lower edge of the mold part.

4. A form for building a concrete tunnel including two horizontally elongate frames composed each of a plurality of substantially vertically standing legs and interconnecting braces, a jack-screw borne by each leg, two mold parts unitedly of arched contour pivoted together at the crown of the arch and severally mounted pivotally upon the jack-screws of the two frames, and a plurality of extensible and contractible chord members arranged between the two mold parts and pivotally connected at their ends to the two mold parts at points remote from the crown of the arch, whereby in response to the extension of jack-screws and chord members the mold parts may be raised and spread to operative positions, and in response to the lowering of the jack-screws and the contraction of the chord members the mold parts may be moved downward and inward away from the work.

5. An expansible and collapsible two-section form for shaping a concrete arch, such form consisting of two horizontally elongate and vertically extensible frames, two complementary mold parts unitedly of arch shape and pivotally united ad-

jacent the crown of the arch, each of said mold parts being united pivotally to one of the said frames on a longitudinally extending axis intermediate in the extent of the mold part between the axis of union of the two mold parts and the lower edge of the mold part, a plurality of extensible and contractible chord members extending between and pivotally united at their ends to the two mold parts at points remote from the crown of the arch, and an extensible and contractible brace pivoted at one end to one of the mold parts at a point between the axis of pivotal mounting of the mold part upon the frame and the lower edge of the mold part and extending thence upwardly and inwardly and at its upper and inner end pivoted to the frame.

6. A form for building a concrete tunnel consisting of two horizontally elongate frames, two mold parts presenting surfaces upon which concrete may be spread, the two mold parts being severally elongate and of half-tunnel shape and unitedly of complete tunnel shape, the two mold parts being pivotally united to one another at the crown of the tunnel that they unitedly form, a plurality of extensible chord members arranged between and at their ends pivotally united to the two mold parts at longitudinally successive and opposite points remote from the common axis of pivotal union of the mold parts and intermediate between such axis of pivotal union and the lower edges of the mold parts, a plurality of jacks mounted upon each of the two said frames, the two mold parts being pivotally mounted each upon one of the two sets of jacks at longitudinally successive points intermediate in the extent of the mold part between the axis of mold-part union and the lower edge of the mold part, and a plurality of extensible braces arranged between and pivotally united to one of the mold parts and to the frame upon which the mold part is borne, the braces being united with the mold part at points situated between the axis of pivotal support of the mold part upon the jacks and the lower edge of the mold part.

LOUIS J. SAROSDY.