H. O. DAVIDSON.

CONCRETE FORM.

APPLICATION FILED APR. 23, 1915.

1,304,945.

Patented May 27, 1919.

3 SHEETS—SHEET 1.

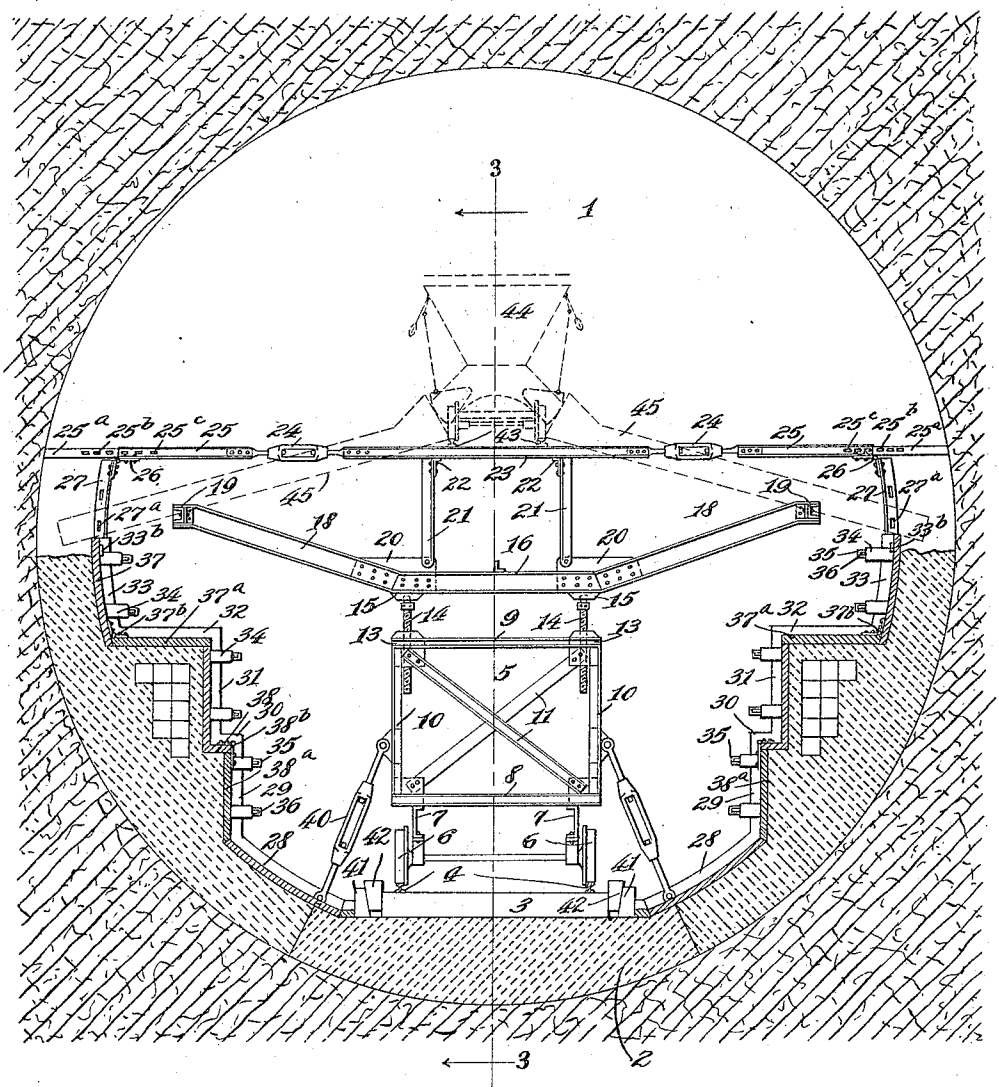

FIG. 1.

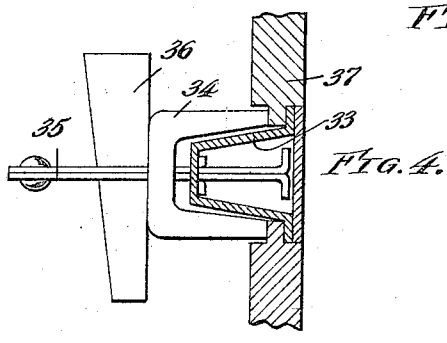

FIG. 4.

INVENTOR,

Harry O. Davidson,

By Hull & Smith,

ATTYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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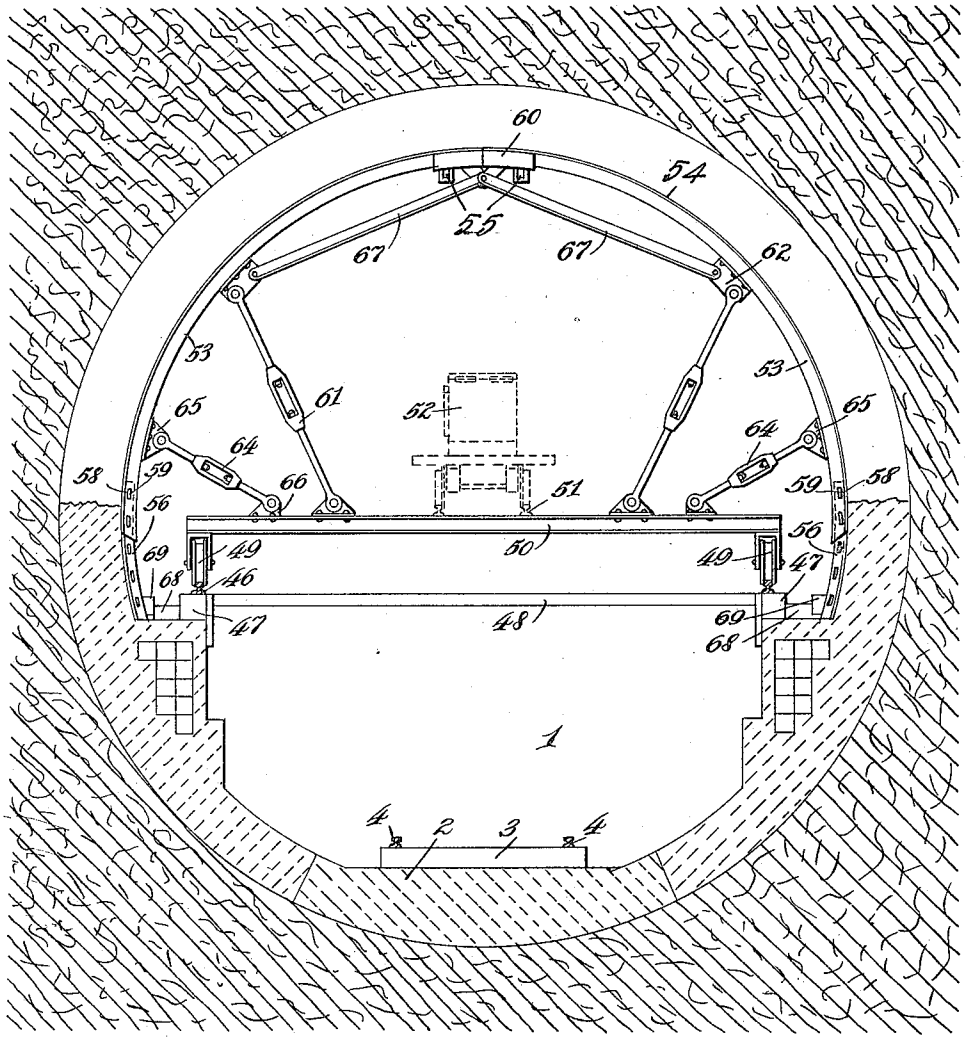

FIG. 2.

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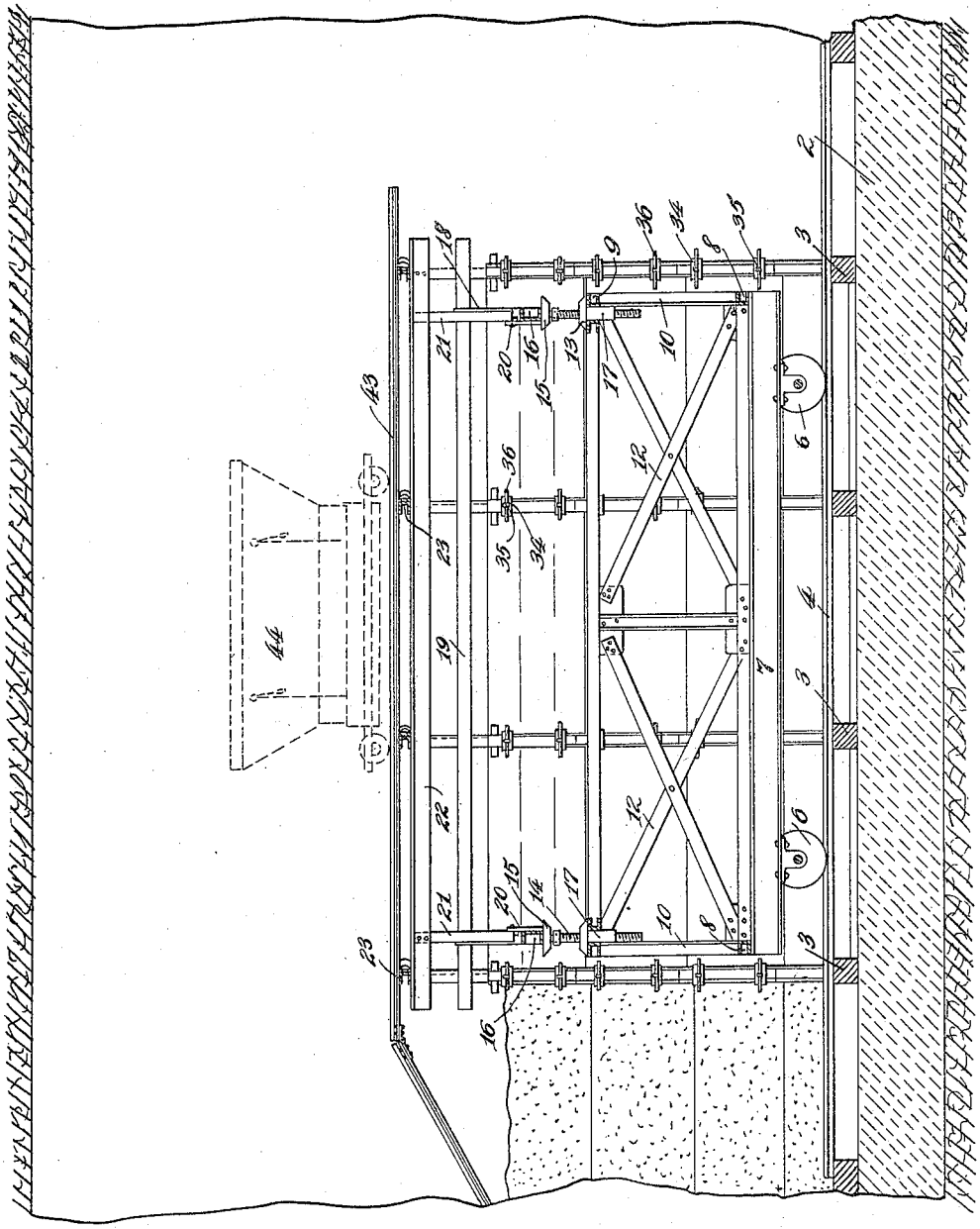

FIG. 3.

INVENTOR,

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UNITED STATES PATENT OFFICE.

HARRY O. DAVIDSON, OF CLEVELAND, OHIO, ASSIGNOR TO THE HYDRAULIC PRESSED STEEL COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

CONCRETE-FORM.

1,304,945. Specification of Letters Patent. Patented May 27, 1919.

Application filed April 23, 1915. Serial No. 23,499.

To all whom it may concern:

Be it known that I, HARRY O. DAVIDSON, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Concrete-Forms, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to concrete forms, and more particularly to forms which are used in tunnel construction, including circular work, such as sewers. It is the general object of the invention to provide a form which may be conveniently set up within the tunnel and, after the grouting has been applied and has set, which may be collapsed and transported on its carrier to another section. The form disclosed herein is particularly adapted to be detachably associated with a carrier while capable of being conveniently collapsed, whereby it may be withdrawn from the grouting and may be transported through other mold sections to the place where it is to be again set up. The invention comprises means whereby the foregoing desiderata may be attained, and may be defined further and more generally as consisting of the combinations of elements embodied in the claims hereto annexed and illustrated in the drawings forming part hereof, wherein Figure 1 represents a transverse sectional view through a tunnel and showing the carrier and the side forms for the lower section or "invert," the form sections being expanded and showing the major portion of the grouting in place; Fig. 2 is a similar view showing the form for the upper section and its carrier, the form being in its expanded position and part of the grouting being shown in place; Fig. 3 shows a longitudinal sectional view through the form and tunnel of Fig. 1; and Fig. 4 a sectional detail of one of the posts or ribs.

Describing by reference characters the various parts illustrated herein, 1 represents the tunnel generally. It is shown as having formed or molded therein a base portion 2 the upper surface whereof is flattened or plane and of sufficient extent to form a support for a platform 3 which carries the tracks 4 for the carrier truck. 5 denotes generally the truck or carrier for the form, said truck or carrier comprising the wheels 6 and a structural metal framework or body comprising longitudinal sills 7, cross sills 8 and 9, vertical sills 10, end diagonal braces 11 and side diagonal braces 12. At each corner of the carrier body there is provided a socket 13 in which there is mounted a screw jack 14 the upper end or saddle 15 whereof supports the bottom cross sill 16 of a cradle. The sockets 13 are provided each with a reduced lower end 17 (as shown in Fig. 3) which may fit between the ends sills 9 with the enlarged head thereof supported on top of said sills.

From each end of each of the cross sills 16 there projects an outwardly and upwardly extending arm 18, and the upper ends of the two arms on each side are connected by a suitable longitudinal sill 19. The arms 18 may be connected to their sills 16 by means of gussets 20, and to each gusset there is pivotally connected an arm 21 which may be of angle-iron section, the arms having their upper ends connected to longitudinally extending angle iron sills 22. Two pairs of arms 21 are provided, there being one pair at each end of the carrier, and the sills 22 carried by these arms are adapted to support transversely extending channel members 23.

The transverse sills 23 form a collapsible and expansible support for the upper portions of the invert mold sections and also serve to support the car by means of which the grouting is applied to the mold. To each outer end of the sills 23 there is connected a turnbuckle 24, the outer end of the turnbuckle being connected in turn to a channel member 25 the outer end whereof is pivotally connected, as by a hinge 26, to the upper end of a post or rib extension 27. Four such members 25 and four such post extensions 27 are shown on each side of the mold.

25[a] denotes an extension for each channel member 25, which is adapted to fit within the flanges thereof and to be projected outwardly against the wall of the tunnel, thereby to center and support the mold parts. The parts 25 and 25[a] may be conveniently connected through openings 25[b] which are adapted to be brought into register, the parts being retained in connected and adjusted position by means of suitable wedge keys 25[c].

Each side of the invert frame consists of

a plurality of posts or ribs with mold plates or boards extending between and detachably connected thereto. In the drawings herein, each rib or post is shown as consisting of a plurality of angularly disposed sections, namely; an inclined bottom section 28, a vertical section 29 thereabove, a horizontal section 30, a vertical section 31, a horizontal section 32, and a substantially vertical section 33 within which the member 27 telescopes. This shape of the ribs is imposed thereupon by the shape of the interior of the molded tunnel. The parts 27 and 33 may be conveniently connected through apertures 27^a and 33^a which are adapted to be brought into register, the wedge pins 33^b connecting such registering openings. The mold boards or plates extend between the posts and may be connected thereto by means of yokes 34 which are adapted to straddle the ribs or posts and bear with their opposite ends against the mold plates, the yokes being held by means of bars 35 which are connected to the posts and by wedge keys 36 driven through said bars and engaging said yokes in the manner shown, described and claimed in the application of Stewart R. McKay No. 872,648, filed November 17, 1914. The posts are preferably provided with flanges forming seats for the mold plates 37, 37^a, 38, 38^a and 39 which plates are engaged by the ends of the clamping yokes 36. The plates 37, 37^a are connected by hinges 37^b and the plates 38, 38^a by hinges 38^b. The lower section 28 of the post or rib at each end of each mold side is connected by means of a turnbuckle 40 to one of the end sills 10 of the carrier. 41, 42 denote a pair of reversely arranged wedges located on each side of the track support 3 and against which the lower ends of each mold side are adapted to bear.

The transverse members 23 may, if desired, support rails 43 for the car 44 containing the grouting. This car is shown in dotted lines in Fig. 1, as are also the chutes 45 which serve to distribute the grouting to the spaces above the tops of the mold sides. The outer end portions of the chutes may rest upon the sills 19 carried by the outer ends of the arms 18.

With the parts arranged as described, the operation will be as follows:—Assume that the mold parts have been transported to the proper place, these parts will be set up in the position shown in Fig. 1, the transverse members 23 being elevated through the telescopic connection between the posts or ribs 33 and the extensions 27 and being supported by folding upwardly the arms 21 and raising the members 16 by the jacks 14 until the said members are engaged by the sills 22. The turnbuckles 40 are unscrewed to bring the sections 28 in their proper place and the lower ends of these sections are braced by means of the wedges 41, 42. The members 23 being supported on top of the sills 22, the turnbuckles 24 are unscrewed the proper distance and the outer ends of the extensions 25^a are moved into engagement with the sides of the tunnel and then locked in bracing position by means of the wedges 25^c. The parts being in the positions shown in Fig. 1, the grouting may be applied, as by means of the car 44 and chutes 45. The carrier may then be removed, leaving the frame in position while the grouting is hardening, and the carrier be used with another mold section. This removal can be conveniently accomplished by removing the car 44 as by running it upon the platform of an adjoining section, or down the removable hinged track extensions 46. Then lower the jacks 14 slightly, enough to permit the arms 21 to be folded down on top of the sills 16, then disconnect the turnbuckles 40, and the carrier may be moved to another section and may have connected thereto another pair of side frames, which may be set up in a manner already described.

When it is desired to remove the frame which was left in place for the setting of the concrete or grouting, the carrier will be brought back and the turnbuckles 40 connected in the manner shown in Fig. 1 and the arms 21 will be folded up and the jacks elevated so as to lift the parts 23 and 25 sufficiently to take the weight off the wedges 33^b, which may then be driven out. The jacks may then be lowered, the parts 27 telescoping within the parts 33, until the members 25 rest upon the sills 19. The turnbuckles 24 and 40 may then be adjusted inwardly or shortened, whereby the mold frame sides will be moved bodily away from the molded sides of the tunnel, to clear the same; the carrier and the attached frame may then be moved to the next section in the tunnel and the operation repeated.

In Fig. 2 there is shown the carrier and frame which I use for making the top or arch of the tunnel or sewer, the bottom or invert section whereof has been molded by the frame and carrier connections hereinbefore described. In this figure, the tracks 46 are supported upon the lateral shoulders which were molded in the preceding operation. These tracks may be carried upon wooden beams or stringers 47 which may be conveniently held in position by transverse braces 48. The carrier comprises a truck having the wheels 49 and a suitable number of transverse beams 50. These beams in turn may support tracks 51 for a car 52 in which the grouting may be transported.

The form in this case comprises a pair of symmetrical side sections, each section comprising a plurality of curved posts or ribs 53 between which extend mold boards 54,

said mold boards being secured in place by means of clamps 55 similar to the clamps 36 on the lower frame sections. At the bottom of each rib or post 53 is a telescopic extension 56 having apertures 57 therein adapted to register with similar apertures 58 in the ribs or posts 53 and to receive the wedge keys 59. The posts or ribs on one side section are hinged to those on the other, one of the hinge joints being indicated at 60. Each side of the mold is supported from the carrier by means of turnbuckles, two turnbuckles being shown as connected to the carrier and to each rib 53. One of these turnbuckles is indicated at 61 and has one end connected to a plate 62 on the rib 53, located at substantially the spring line of the arch, while its other end is connected to a plate 63 on one of the cross sills 50. Another turnbuckle 64 is connected at one end to a plate 65 on the rib 53 and its other end to a plate 66 on the transverse sill 50. Braces 67 connect each hinge with the plates 62.

The form for the top of the arch may be collapsed on its carrier and transported through another form which is set up by operating the turnbuckles, the turnbuckle 61 approaching the vertical sufficiently to enable the form to be collapsed or moved vertically as well as laterally. When the carrier with the form thereon reaches the desired place, the turnbuckles are operated to expand the mold to the desired extent and the extensions 56 are dropped upon the shoulders provided therefor. Then the lower ends of these extensions may be held in place by means of blocks 68 and wedges 69.

Having thus described my invention, what I claim is:—

1. The combination, with a carrier, of a pair of side mold frames each consisting of a plurality of angular ribs and hinged mold plates, adjustable means for connecting the bottom portions of said frames to the carrier, and adjustable means for connecting the top portions of said side molds to the carrier.

2. The combination, with a carrier, of a pair of side mold frames, the upper section of each frame having a plurality of extensions adjustably connected thereto, means for adjustably connecting the lower portion of each frame to the carrier, means adjustably connecting opposed extensions, and means adjustably connecting the last mentioned means to the carrier.

3. The combination, with a pair of side mold frames each having an independent adjustable extension member at its upper end, and a longitudinally adjustable brace connected to said members.

4. The combination, with a pair of side mold frames each having an adjustable extension connected thereto, and a brace connecting said extensions, said brace having longitudinally adjustable extensions adapted to engage the sides of a tunnel.

5. The combination, with a pair of side mold frames the upper portions whereof have a member adjustably connected thereto, and lateral braces connecting said members, each brace consisting of a plurality of adjustably connected sections the outer ends whereof are provided with extensions adapted to engage the sides of a tunnel.

6. The combination, with a pair of side mold frames each having posts or ribs, posts or ribs telescopically connected to the posts or ribs of the frames and forming extensions thereof, and transverse braces connected to some of the opposed extensions, said braces being adjustable.

7. The combination, with a pair of side mold frames each having posts or ribs and adjustable extensions of said posts or ribs, transverse braces connected to some of the opposed extensions, said braces being adjustable and provided with adjustable extensions at opposite ends thereof adapted to engage the sides of a tunnel, and means for securing said extensions in adjusted position.

8. The combination, with a pair of side mold frames each comprising a plurality of ribs or posts with interposed mold boards or plates, of a plurality of posts or ribs telescopically connected to the first mentioned posts or ribs and forming adjustable extensions thereof, transverse braces pivotally connected to such extensions, said braces being adjustable in length, and extensions for the opposite ends of said braces, the last mentioned extensions being adjustably connected to said braces and adapted to engage the tunnel walls.

9. The combination, with a carrier, of a pair of side mold frames, means for detachably connecting the lower members of said mold frames to the carrier, adjustable transverse braces connected to the upper ends of said frames, means for supporting said braces from the carrier, and means detachably supporting said braces from the carrier whereby the carrier may be disconnected from the mold frames after the grouting has been applied and the upper ends of the frames be held by said braces and the frames may thereafter be connected to the carrier and be collapsed and transported to another section of the tunnel.

10. The combination, with a carrier, of a pair of side mold frames, means adjustably and detachably connecting the lower portions of the frames to the carrier, and means detachably connecting the upper portions of the frames to the carrier, the last mentioned means comprising adjustable transverse braces connected to the upper portions of the frames, supports for said braces

mounted on the carrier, and means whereby said supports may be moved into and out of operative relation to said braces.

11. The combination, with a carrier, of a pair of side mold frames, means adjustably and detachably connecting the lower portions of the frames to the carrier, and means detachably connecting the upper portions of the frames to the carrier, the last mentioned means comprising an adjustable member connected to the upper portions of the frames, a support for said member mounted on the carrier, and means whereby said support may be moved into and out of operative relation to said member.

12. The combination, with a carrier, of a pair of side mold frames, adjustable and detachable connections between the lower portions of said frames and said carrier, a vertically adjustable cradle connected to said carrier, an adjustable extension for the upper portion of each side frame, adjustable transverse braces connecting the upper ends of said extensions, and supports for said braces carried by said cradle and movable into and out of operative relation to said braces.

13. The combination, with a carrier, of a pair of side mold frames, adjustable connections between the lower portions of said frames and said carrier, a vertically adjustable cradle connected to said carrier, an adjustable transverse member connecting the upper portions of said frames, and a support for said member carried by said cradle and movable into and out of operative relation to said member.

14. The combination, with a carrier, of a pair of side mold frames, an adjustable and detachable connection between the lower portion of each frame and the carrier, adjustable extensions connected to the upper ends of said frames, transverse braces pivoted to the upper ends of said extensions, said braces being adjustable in length, a vertically adjustable cradle on the carrier, arms pivotally connected to said cradle and adapted to support said braces, and additional supporting means carried by the cradle and adapted to engage said braces by the adjustment of the cradle when said arms are folded down.

15. The combination, with a carrier, of a pair of side mold frames, an adjustable connection between the lower portion of each frame and the carrier, adjustable extensions connected to the upper ends of said frames, a transverse member connected to the upper ends of said extensions, said member being adjustable in length, a vertically adjustable cradle on the carrier, arms movably connected to said cradle and adapted to support said member, and additional supporting means carried by the cradle and adapted to engage said member by the adjustment of the cradle when said arms are moved out of operative relation to said member.

16. The combination, with a carrier, of a pair of side mold frames, an adjustable connection between the lower portion of each frame and the carrier, a longitudinally extensible and contractible transverse member, means connecting the opposite ends of said member to the upper portions of said frames, a vertically adjustable cradle on the carrier, and a pair of vertically spaced supports for said member on said cradle.

17. The combination, with a carrier, of a pair of side mold frames, an adjustable connection between the lower portion of each frame and the carrier, a longitudinally adjustable transverse member connected to the upper portions of said frames, a vertically adjustable cradle on the carrier, and supporting means on said cradle adapted by the adjustment of the same to be brought into operative relation to said member.

18. The combination, with a carrier, of a pair of side mold frames, means for moving the lower portions of said frame toward and from each other, one or more longitudinally adjustable transverse members connecting the opposed upper portions of said frames.

19. The combination, with a carrier, of a pair of side mold frames, means adjustably connecting the lower portions of said frames to the carrier, a plurality of longitudinally adjustable transverse members connected to the opposed upper portions of said frames, a car receiving track supported by said members, and means for supporting said members from the carrier.

20. The combination, with a carrier, of a pair of side mold frames, a plurality of adjustable transverse members connected to the opposed upper portions of said frames, a track supported by said members, and means for supporting said members from the carrier.

21. The combination, with a carrier, of a pair of side mold frames, means adjustably and detachably connecting the lower portions of said frames to the carrier, a plurality of longitudinally adjustable transverse members connected to the opposed upper portions of said frames, a car receiving track carried by said members and having a detachable inclined extension, a vertically adjustable cradle on the carrier, and supporting means for said members on the cradle.

22. The combination, with a carrier, of a pair of side mold frames, a plurality of transverse members connected to the opposed upper portions of said frames, a track carried by said members and having a detachable inclined extension, and vertically adjustable supporting means for said members on the carrier.

23. The combination of a pair of pivotally connected mold sections, adjustable side

extensions at the lower end of each mold section, a carrier, adjustable supports connecting said mold sections and carrier, and braces connected to said mold sections and supports.

24. In an apparatus of the type set forth, the combination, with a carrier, of a pair of side mold frames, said mold frames being independent of each other and each consisting of a plurality of angular ribs and hinged mold plates, adjustable means for connecting the bottom portions of said frames to the carrier, and adjustable means for connecting the top portions of said side molds to the carrier.

25. The combination, with a carrier, of a pair of side mold frames comprising each a plurality of ribs, a plurality of adjustable devices for connecting each side mold frame to the carrier and for collapsing and expanding such frames, and mold plates extending between and detachably connected to the adjacent ribs of each side mold frame.

26. The combination, with a carrier, of a pair of side mold frames comprising each a plurality of ribs, a plurality of adjustable devices for connecting each side mold frame to the carrier and for collapsing and expanding such frames, and hinged mold plates extending between and detachably connected to the adjacent ribs of each side mold frame.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

HARRY O. DAVIDSON.

Witnesses:
L. NUHFER,
LILLIAN M. DAVIDSON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."