

1

2,900,699

MOLD FOR MOLDING CONCRETE BLOCKS PRESENTING IRREGULAR SURFACES

Pierre François Danel, Grenoble, France, assignor to
Etablissements Neyrpic, Grenoble, France, a cor-
poration of the French Republic

Application July 8, 1954, Serial No. 442,148

6 Claims. (Cl. 25—118)

The present invention relates to a mold for use in the prefabrication of blocks of concrete and similarly moldable materials, and especially to molds for use in producing blocks of special shapes such as are used in the construction of hydraulic works such as breakwaters, jetties and various shore protection structures.

The invention has particular application for use in forming concrete blocks of the type known as "Tetrapods" and which are the subject of the copending U.S. application of Pierre Danel and Paul Angles D'Auriac, Ser. No. 214,097, filed March 6, 1951, now Patent 2,766,592, issued October 16, 1956. The tetrapod blocks as usually produced are characterized by four truncated cone shaped protuberances extending radially outwardly from a central zone or body portion of the block in equiangular relationship. The several protuberances merge into the body portion at their respective bases forming smooth concave profiles at the point of joinder with the body portion, and each protuberance defines relatively wide angles between itself and the adjacent protuberances. Although the overall block presents a regular geometric form, the surfaces are variously curved or contoured in different parts thereof, a quality which is desirable from the standpoint of creating hydraulic roughness, but such variously curved surfaces present problems in the manufacture of the blocks, both from the standpoint that the molds do not lend themselves readily to construction from the conventional materials and from the standpoint that a great many individual molds have been required when it is attempted to speed up the production rate. For example, and to take a simple case, let us suppose that it is desired to produce one tetrapod per day and that it is necessary to allow the concrete block to remain immobilized for eight days to permit the concrete to set and sufficiently cure so that it can be handled. It will be seen that eight molds would normally be required for a production of one tetrapod per day.

The present invention has for an object to provide a mold made up of interchangeable sections, each adapted to conform to or define the mold surfaces of one part of the variously curved surface of the block to be molded and each being of the same shape and size as each other section of the mold so that they may be freely interchangeable.

It is a further object of the invention to provide a mold of interchangeable sections each section of which is so formed as to serve as a supporting surface or pallet for the concrete block when the concrete has become sufficiently set to become self-sustaining but is yet insufficiently hardened to permit of handling separately from the supporting pallet.

It is a still further object of the invention to provide a mold adapted to be used in molding concrete blocks of the tetrapod or multi-protuberance type wherein the mold is constituted of a plurality of identical interchangeable sections corresponding as to number with the number of protuberances from the body of the block and so shaped as to make it possible, when the sections are assembled and the assembled mold is appropriately disposed on a

2

supporting surface, to mold the body and the protuberances of the block by pouring the concrete into the mold through an opening at the outer end of one of the like protuberances, to allow the concrete to initially set, and then to disassemble the sections and remove all of them except the one which is in a supporting relation to the concrete mass. This remaining section is left in supporting relation to the block until the required amount of setting time and hardening has taken place to permit the cast block to be handled independently of the supporting section.

It is still another object of the invention to provide a mold for the purposes above described wherein the interchangeable sections are so shaped as to permit of their being stored or transported in stacked or nested relation to one another with resultant conservation of space.

Further objects and advantages of the invention will become apparent as the description proceeds.

Fig. 1 is a perspective view of one form of the tetrapod block that may be molded with the use of the interchangeable mold sections of the present invention;

Fig. 2 is a top plan view of a mold assembly according to the present invention;

Fig. 3 is a perspective view of the mold assembly of Fig. 2 with the closure plates removed from the openings at the ends of the respective projections or legs of the mold;

Fig. 4 is a part side elevation of a partial assembly of the mold sections showing a different arrangement for closing the ends of the respective projections or legs of the mold with accessory plate members;

Fig. 5 is a plan view of one of the identical mold sections; and

Fig. 6 is a side elevation of the mold section of Fig. 5 with a portion of the wall broken away.

Fig. 1 shows a typical tetrapod unit constituted of four generally frusto-conical or tapered protuberances 1 extending radially outwardly from a central zone or body portion 2 of the block in equiangular relationship to one another. The several protuberances merge with the body 2 and with each other and present smoothly and variously curved concave surfaces 3. Each of the protuberances defines between itself and the protuberances adjacent thereto relatively wide angles 4.

As shown in Figs. 2 and 3 the assembled mold is made up of four identical sections 5, 6, 7 and 8, preferably made of metal. In Fig. 2 the section 5 is underneath with only a central portion of the same being directly visible in Fig. 2 through the opening 9 at the top of the mold assembly. In Fig. 3 portions of the underneath section 5 are shown at 10 and 11. The mold sections are preferably provided with out-turned flanges 12 extending along their marginal edges for engagement with the corresponding flanges of adjacent sections. These flanges may be of the same thickness as the bodies of the mold sections and formed integrally therewith, or may constitute reinforcing members, such as angle irons 13, welded or otherwise secured to the outer surface of each mold section at the marginal edge thereof that is to be brought into close engagement with the corresponding marginal edge of the adjacent mold section. The flanges 12 are provided with spaced holes 14 to receive bolts for drawing the mold sections together to hold them in assembled relation.

In the disposition of the mold sections shown in Figs. 2 and 3 the flanges 12 are continued around the arcuate end portions of the respective legs of the mold sections and are provided with spaced holes 14 for bolting closure plates 16 over the openings at the ends of the projections or legs which conform to three of the protuberances of the tetrapod, such openings being designated as 17, 18 and 19 in Fig. 2. The fourth opening 9 is left open to receive the concrete used in filling the mold.

3

In the modification of Fig. 4, the mold sections are provided with inturned flange portions 15 at the outer ends of the legs which serve as retaining rings for inwardly disposed circular closure plates 16'. In Fig. 4 sections 5 and 6 are shown with section 7 omitted to show the seating of the plate 16' against the flange 15.

As shown more particularly in Figs. 5 and 6, each of the four cooperating mold sections may be looked upon as presenting three shallow trough-like legs 20, 21 and 22 extending outwardly at equal angles from a central portion 23, the ends of the legs being inclined downwardly away from the central portion as shown more particularly in Fig. 6. It will be observed that the shape of the mold sections is such that they are individually relatively flat and can be stacked even though they present reinforcing ribs along their marginal edges.

Reinforcing ribs such as 13 of Fig. 4 may or may not be used depending to some extent on the size of the block that is to be molded. Usually a certain amount of flexibility of the mold walls is permissible and may be desirable since it permits of interchangeability of the mold sections without requiring that they be formed with great precision. A certain amount of flexibility is not troublesome because once the mold sections are clamped together they may behave somewhat as an inflated envelope, flexing to some extent without greatly altering the shape of the block being molded therein.

When the mold sections have been assembled for pouring of the concrete they may be disposed on a suitable support to which vibrations may be imparted to facilitate the settling of the concrete into the hollow spaces of the mold and to insure a satisfactory density of the molded product. When the concrete has solidified and has been allowed to take an initial set, say for a period of 24 hours, the three uppermost mold sections may be removed, leaving the molded block resting on the fourth section from which it is separated only after the molded mass has attained its final set and has hardened sufficiently to permit of handling, say after a setting period of eight days from the time of pouring. The three of the four principal mold sections that are thus separated are free immediately for use in another assembly with other identical sections to mold additional blocks.

It will be understood that the closure plates 16 or 16' represent only one of various forms of the auxiliary closure pieces and that by varying the shape of this member the ends of the protuberances on the molded block may be varied accordingly. For example, if it is desired to give the end of the protuberances a rounded shape, the member 16 may be suitably cupped outwardly in the area thereof that is circumscribed by the flange 12 or 15. Various other modifications in the details of the construction and the mold assembly may be made without departing from the invention which is not to be deemed as limited otherwise than as indicated by the language of the appended claims.

I claim:

1. A mold for forming concrete blocks having four equi-angularly related legs projecting from a central body portion, said mold comprising four identical interchangeable mold sections, each having a central surface portion conforming to one of the four sides of the central body portion of said block and three trough-like portions connected to and extending outward from said central surface portion in equi-angular relation to each other, said central portion and said trough-like portions being connected together in mutually supporting relation, said trough-like portions having a profile in cross-section conforming in shape and extent to one-third of the bounding surface of one of said legs, means for securing said sections in assembled relation to form the mold and means cooperating with the outer ends of said trough-like portions forming three legs of the mold for closing said mold at said outer ends.

4

2. A mold as claimed in claim 1 in which said mold sections are provided with outwardly extending cooperating flange members for securing said sections in assembled relation and at least certain of said mold sections cooperate in assembled relation to form a pouring opening at the extremity of one of said leg sections through which concrete may be introduced into said mold.

3. A mold as claimed in claim 1 wherein said mold sections are provided at the outer ends of said trough-like portions forming three legs of the mold with inturned projections in the walls thereof, said projections forming seats for receiving closure members for the leg sections thereof that are not currently serving to define a pouring opening.

4. A mold section for a split mold for forming a block having four equi-angularly related legs projecting from a central body of said block, said mold section having a central portion and three trough-like legs connected to and extending generally radially outwardly from said central portion in equi-angular relation to each other, the respective inner surfaces of said trough-like legs having generally like contours radially along said legs, said three trough-like legs being disposed generally in the same angular relation to the perpendicular to the general extent of the inner surface of said central portion of said section at the central point thereof, said angular relation of said legs with respect to said perpendicular to said inner surface of said central portion being generally the same as the equi-angular relation of said trough-like legs with respect to each other, said inner surfaces of said legs having generally like concave profiles in cross sections at equal distances radially outwardly from said central point, and means carried by said legs for engaging respective legs of similar mold sections when assembled to form the mold, said legs of said mold section at the outer ends thereof providing means for supporting closure means for closing the ends of the legs of the mold formed of the assembled sections.

5. A mold section as defined in claim 4 in which said means for engaging respective legs of similar mold sections comprising flanges disposed along the generally radially extending edge portions of the troughs of said legs of said mold section for effecting engagement of said edge portions with the edge portions of trough-like legs of like mold sections cooperating therewith to define the bounding surfaces of the respective legs of said block.

6. A mold for forming concrete blocks having four equi-angularly related legs projecting from a central body of said block, said mold comprising four interchangeable mold sections, each of said sections having a central portion and three trough-like legs connected to and extending generally radially outwardly from said central portion in equi-angular relation to each other, the respective inner surfaces of said trough-like legs having generally like contours radially along said legs, said three trough-like legs of each section being disposed generally in the same angular relation to the perpendicular to the general extent of the inner surface of said central portion of said section at the central point thereof, said angular relation of said legs with respect to said perpendicular to said inner surface of said central portion being generally the same as the equi-angular relation of said trough-like legs with respect to each other, said inner surfaces of said legs having generally like concave profiles in cross-sections at equal distances radially outwardly from said central point, said inner surfaces of said legs in shape and extent being substantially conformable to one-third of the bounding surfaces of one of said legs of said block, the inner surface of said central portion of each section in shape and extent being substantially conformable to one of the four sides of said central body of said block and means for securing said legs of said sections together in assembled relation to form the mold, said legs of said mold section at the outer ends thereof providing means for supporting closure

means for closing the ends of the legs of the mold formed of the assembled sections.

References Cited in the file of this patent

UNITED STATES PATENTS

1,116,394 Doebling ----- Nov. 10, 1914

1,117,449
1,130,507
2,681,494
2,704,875

Schenck ----- Nov. 17, 1914
Hadley et al. ----- Mar. 2, 1915
Weber ----- June 22, 1954
Kingston ----- Mar. 29, 1955

FOREIGN PATENTS

France ----- Apr. 19, 1919