

May 4, 1948.

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2,440,754

METHOD AND APPARATUS FOR PRODUCING CONCRETE BEAMS

Filed Sept. 11, 1946

6 Sheets-Sheet 1

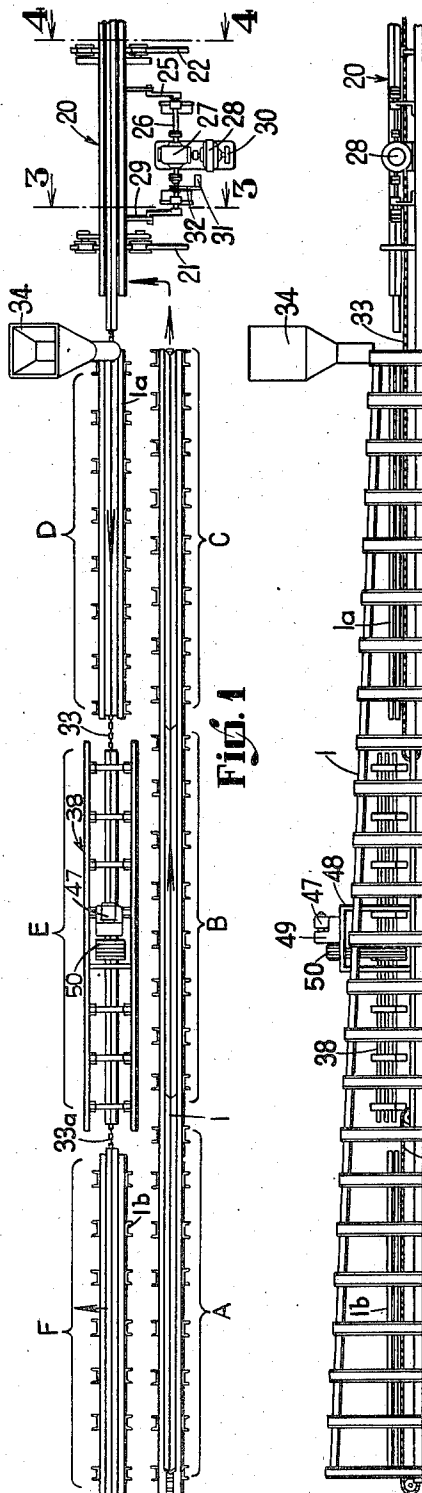


Fig. 1

Fig. 2

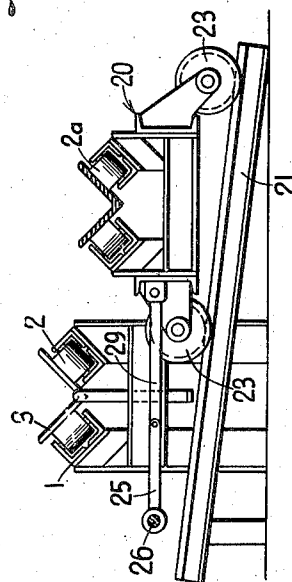


Fig. 3

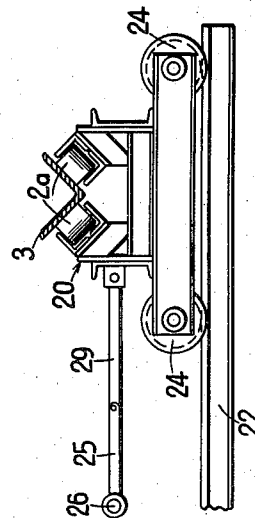


Fig. 4

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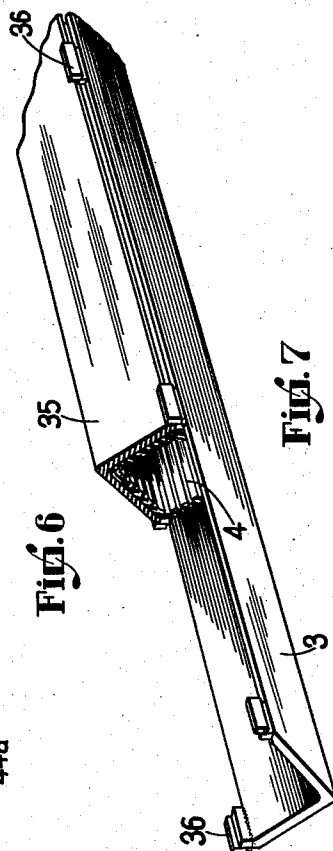
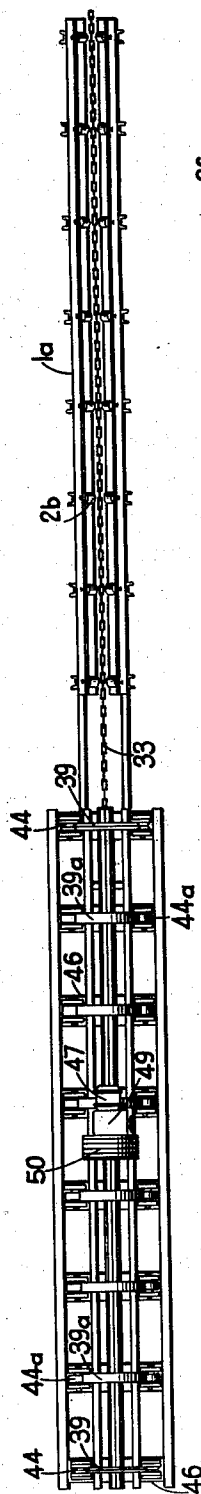
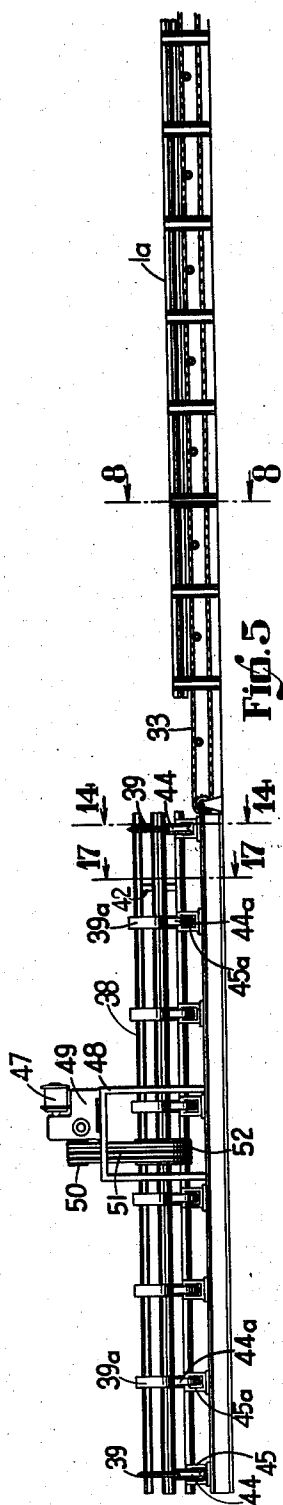
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METHOD AND APPARATUS FOR PRODUCING CONCRETE BEAMS

Filed Sept. 11, 1946

6 Sheets-Sheet 2



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METHOD AND APPARATUS FOR PRODUCING CONCRETE BEAMS

Filed Sept. 11, 1946

6 Sheets-Sheet 3

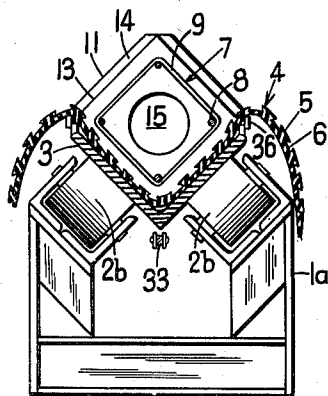


Fig. 8

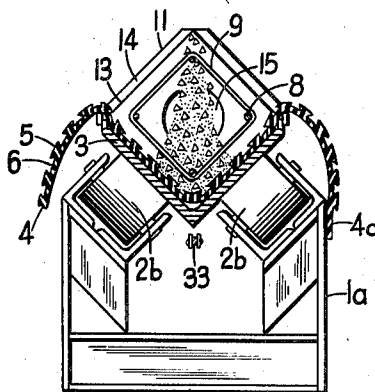


Fig. 9

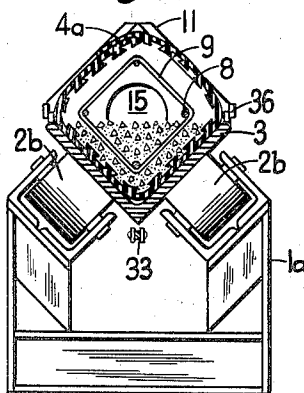


Fig. 10

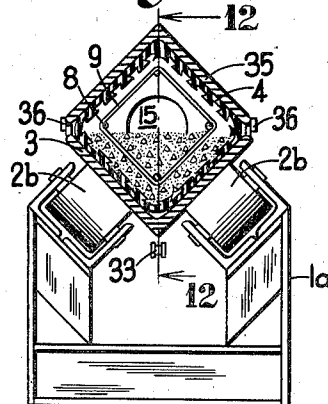


Fig. 11

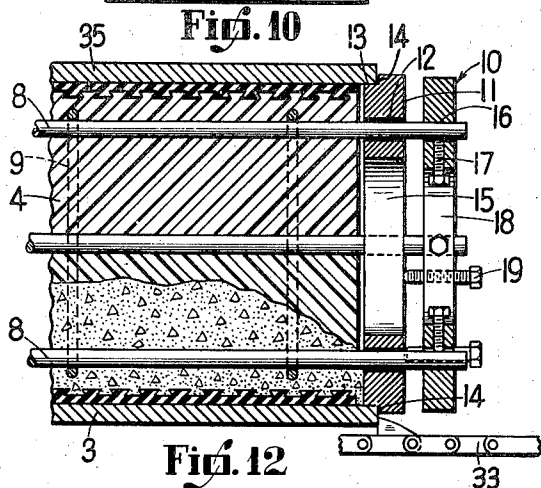


Fig. 12

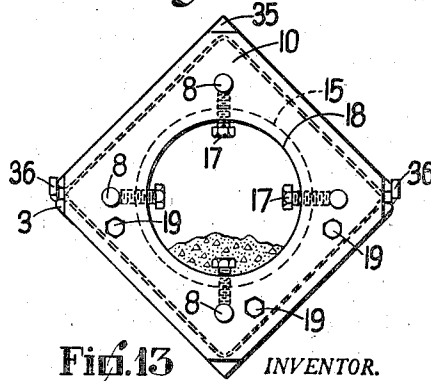


Fig. 13

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6 Sheets-Sheet 4

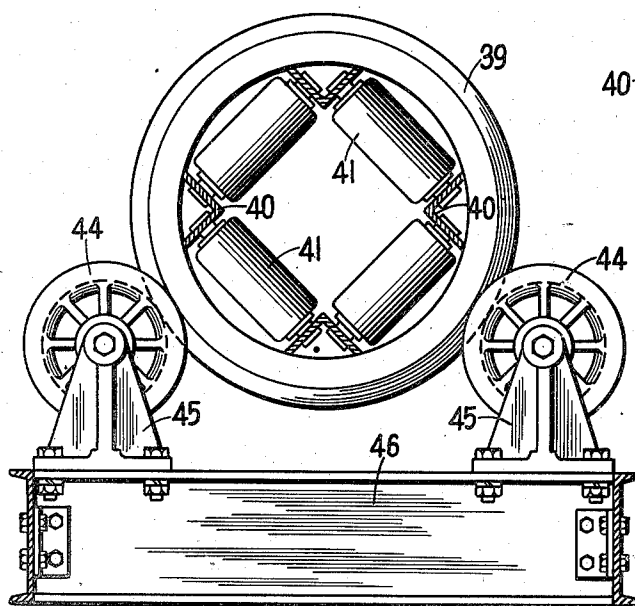


Fig. 14

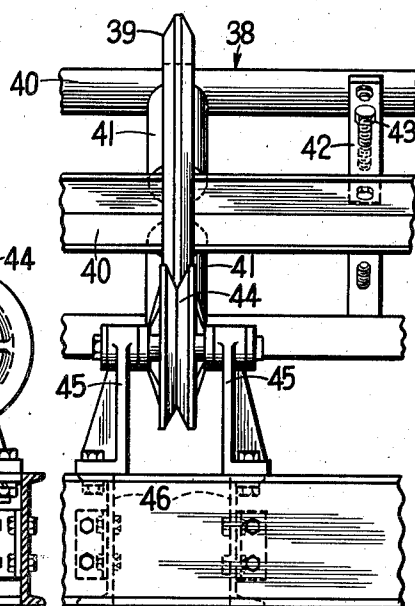


Fig. 15

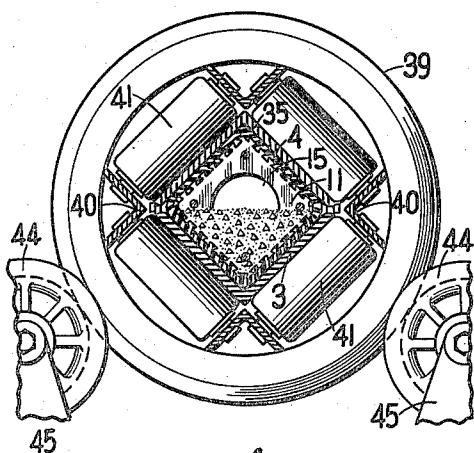


Fig. 16

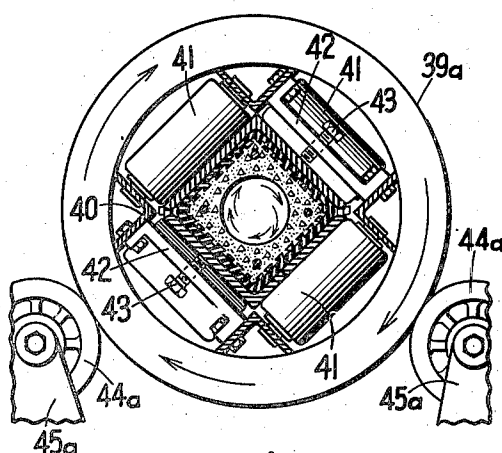


Fig. 17

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6 Sheets-Sheet 5

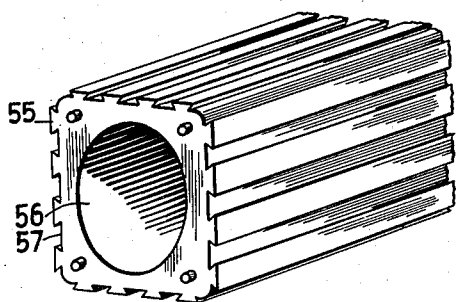


Fig. 18

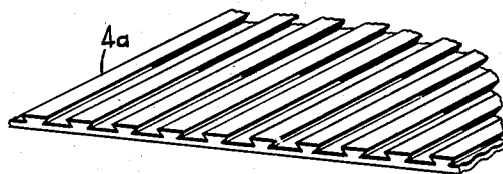


Fig. 19

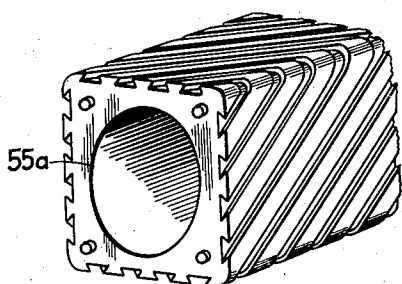


Fig. 20

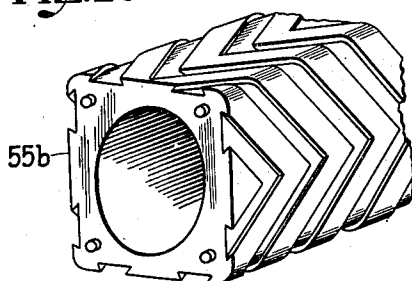


Fig. 21

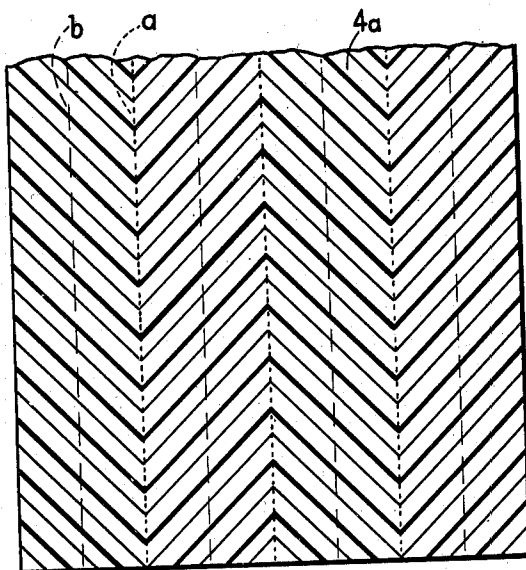


Fig. 22

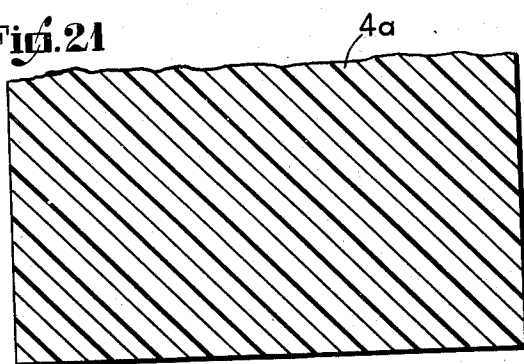


Fig. 23

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6 Sheets-Sheet 6

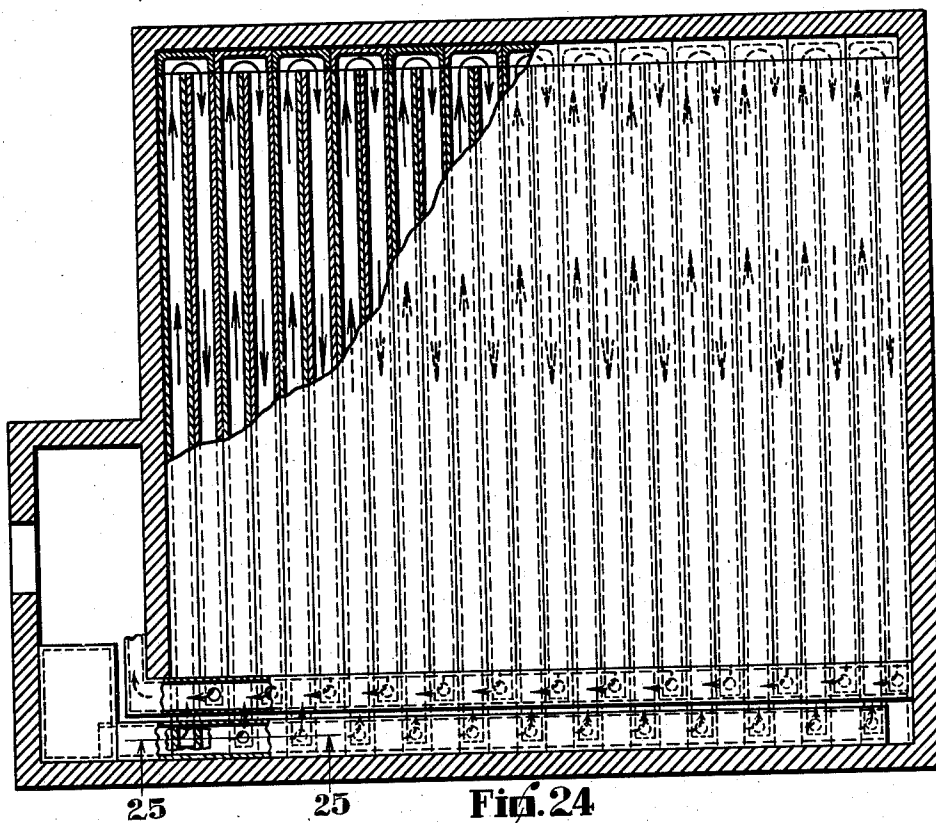
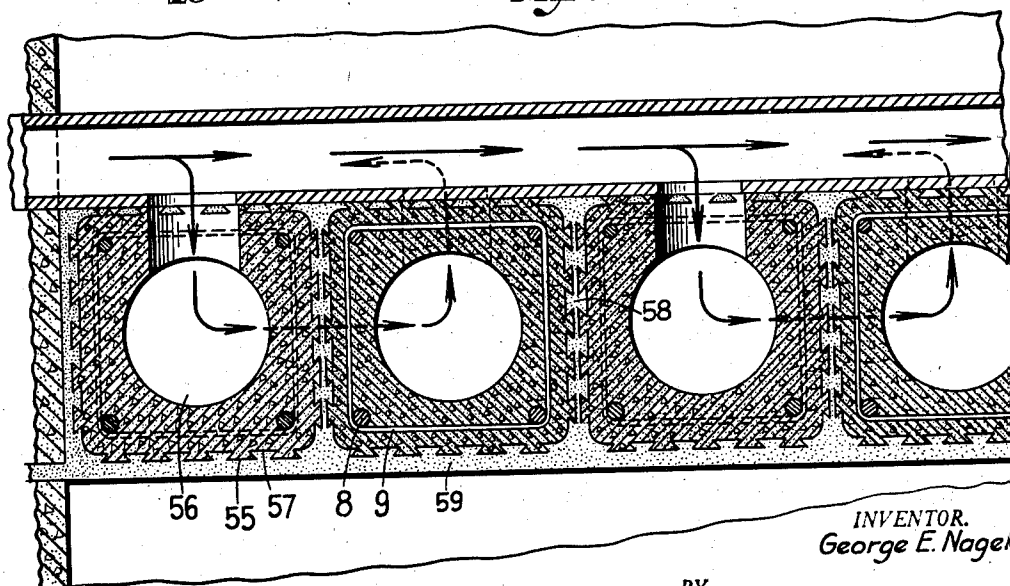


Fig. 24



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Fig. 25

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UNITED STATES PATENT OFFICE

2,440,754

METHOD AND APPARATUS FOR PRODUCING
CONCRETE BEAMS

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Application September 11, 1946, Serial No. 696,106

7 Claims. (Cl. 25-41)

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My invention relates to method and apparatus for producing concrete beams. It has to do, more particularly, with a method and apparatus for producing a cored concrete beam which may be used in floor and roof constructions or similar constructions.

Cored concrete beams have been provided in the prior art and have been used in floor and roof constructions. These beams are usually provided with a plurality of cores extending therethrough. The cores are used as channels for pipes, electric conduits, etc. The prior art beams with which I am familiar are of non-symmetrical or rectangular cross-section and, in addition, usually have heavy metal reinforcing tension rods in one of the wide faces only of the beam which is to be lowermost and is to form the tension face of the beam. As a result, when the beam is set into the structure it must be set with its wider faces forming its top and bottom sides and with the face, that has the reinforcing tension rods embedded therein, lowermost. In incorporating this type of concrete beam in a floor or similar structure, a series of the beams are placed side-by-side, the upper surfaces serving as a floor or sub-floor surface and the lower surfaces serving as a ceiling surface to which plaster may be applied. It is desirable for the upper and lower surfaces of the beams to be provided with dovetail grooves to permit keying of a mastic floor surfacing material or a mastic ceiling material to the respective surfaces. It is also desirable to provide similar grooves on the side surfaces of the beams so that adjacent beams may be keyed together with grout or similar material that is poured therebetween so that all the beams will be tied together and will function as a single beam. In the past, it has not been possible to provide such dovetail grooves in the various surfaces, due to the methods used in producing such beams, although grooves have been formed in the side surfaces of prior art beams but these grooves have not been of the dovetail or undercut type because they could not be formed with prior art molding operations.

Due to the necessity of forming the cores in the concrete beams, casting or molding methods have been used in the prior art which are very complicated and inefficient, and which require complicated and cumbersome apparatus and considerable manipulation thereof. One method has employed inflatable tubes which must be held in a predetermined exact relationship with respect to the metal reinforcement and with respect to the sides of the form in which the concrete is cast.

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According to this method, the outer surfaces of the beam are formed by the rigid walls of the mold or form and, therefore, it has been impossible to form dovetail or undercut grooves in such surfaces, inasmuch as such formations would prevent removal of the forms or molds from the cast beams.

One of the objects of my invention is to provide a method and apparatus for producing a cored concrete beam which is of symmetrical or uniform cross-section and which has the metal reinforcing uniformly distributed therein so that the beam may be positioned in the structure with any side up and will still function properly as a beam.

Another object of my invention is to provide a method and apparatus for producing a concrete beam which has dovetail or undercut grooves formed on all of its longitudinally extending outer surfaces to provide proper keys for floor surfacing or ceiling surfacing materials and proper keys for tying together adjacent beams of a structure.

Another object of my invention is to provide a simple, effective and economical method for forming cast concrete beams of the type indicated above.

Another object of my invention is to provide a method which is of such a nature that simple apparatus which can be manipulated easily can be employed in performing the method.

Another object of my invention is to provide simple, rugged, efficient and easily operable apparatus which can be built at a relatively low cost and can be operated economically for producing cast cored concrete beams of the type indicated.

Another object of my invention is to provide a method of producing cored concrete beams, wherein the core can be produced easily during a simple casting operation without the use of core forms which are difficult to position in the mold before the casting operation and to remove therefrom after the casting operation.

Another object of my invention is to provide a method of forming concrete beams whereby undercut or dovetail grooves may be produced in the surfaces of the beams without interfering with the removal of the molds or forms therefrom.

Still another object of my invention is to provide a method of the type indicated in the preceding paragraph whereby any desired configuration or arrangement of the grooves may be obtained.

According to my invention, the beam produced

is an elongated cast or molded concrete beam. It preferably is of substantially square cross-section with a core of circular cross-section centrally located at the axis thereof and preferably extending for the full length thereof. Longitudinally extending metal reinforcing is embedded in all sides of the beam and is uniformly arranged therein so that regardless of which side of the beam is in contact with the supports at its ends, the beam will function properly in a manner similar to an I-beam. Furthermore, all side surfaces of the beam are uniformly provided with dovetail or undercut grooves so that keying grooves are provided on all surfaces where needed.

The method which I employ for producing the beams is a centrifugal casting or molding method. I provide an elongated mold or form of a size and shape proper for forming a beam. The mold consists of a lower pallet and an upper cover, both of which are formed of angle iron and which when combined form a box-like form or mold for the beam. A lining for the wall of the mold is provided and this lining is of flexible material, such as rubber. This lining is in the form of a mat which has projections on the surface thereof, which will be innermost in the mold, that will serve to produce the dovetail grooves in the cast beam.

In using the mold, the cover is removed and the flexible lining is placed on the pallet, which is of V-shape cross-section and serves as a trough for receiving the concrete, with the lining hanging a considerable distance over both sides thereof. The metal reinforcing, in the form of a wire cage is placed in the pallet on the lining. A predetermined weight of suitable concrete mix is then placed in the pallet, being poured through the reinforcing cage and onto the lining resting on the pallet, and is roughly distributed along the pallet. Means is provided at each end of the mold pallet for closing the mold with the exception of at a centrally disposed opening of an area corresponding to the area of the core opening to be formed on the beam. Associated with this mold closing means is a structure for exerting an axial pull on the longitudinally extending reinforcing members of the cage. This structure is used for pre-tensioning such reinforcing members before the casting operation. After the reinforcing is pre-tensioned, the hanging sides of the lining are folded upwardly around the metal cage until the side edges of the lining overlap. Then the cover of the mold is placed on the pallet with the two edges of the cover angle resting on the two edges of the pallet angle, interfitting lugs being provided on the two sections of the mold to hold them in alignment with each other and the ends of the cover cooperating with the closure means.

The mold with the concrete therein is now ready for the casting operation. The entire unit is now placed in a mold receiving cage of a centrifugal machine. The mold receiving cage is first rotated about its longitudinal axis slowly and the centrifugal force will serve to distribute the concrete uniformly to the various sides of the mold and to shift it uniformly along the entire length of the mold, leaving a centrally disposed core opening extending therethrough. It will be understood that a sufficient amount of concrete is supplied to the mold so that during the casting operation a beam will be formed which will be of square cross-section with walls of predetermined thickness having the concrete uniformly distributed to the various sides and with a core therein of predetermined diameter. The mold

carrying cage is now rotated at a high rate of speed and this will cause the concrete to be compacted, forcing the surplus moisture inwardly into the core opening from one end of which it may be drained off. The outer surfaces of the concrete are compacted against the mold lining which will thus form the dovetail grooves therein.

After the spinning process is completed, the mold box is removed from the cage. The cover section is removed and the lower mold section which serves as a pallet for carrying the beam may be used in transporting the beam to the curing room where it is cured while the reinforcing is still maintained under tension. Then it is removed from the pallet. The rubber lining may again be used in a casting operation. Rubber linings having various designs and configurations of ridges therein may be employed in the mold to obtain various arrangements of the grooves in the surfaces of the beam.

The foregoing and other objects and advantages of the present invention will appear from the following description and appended claims when considered in connection with the accompanying drawings forming a part of the specification wherein like reference characters designate corresponding parts in the several views and wherein:

Figure 1 is a diagrammatic plan view of apparatus which I preferably use for performing my method.

Figure 2 is a side elevational view of the apparatus shown in Figure 1.

Figure 3 is a transverse sectional view taken along line 3—3 of Figure 1.

Figure 4 is a transverse sectional view taken along line 4—4 of Figure 1.

Figure 5 is a side elevational view of the centrifugal casting machine of my apparatus and the associated mold-receiving cradle.

Figure 6 is a plan view of the structure shown in Figure 5.

Figure 7 is a perspective view, partly cut away, of the pallet and cooperating cover of the mold illustrating the flexible mold lining in position therein.

Figure 8 is a transverse sectional view taken substantially along line 8—8 of Figure 5, showing the pallet of the mold with the rubber lining and beam reinforcing positioned therein.

Figure 9 is a view similar to Figure 8, but showing the concrete being poured into the mold.

Figure 10 is a similar view showing the flexible lining with its sides folded up so that the adjacent edges overlap, ready for the mold pallet to receive the cover.

Figure 11 is a similar view showing the cover positioned on the pallet and the mold ready for the casting operation.

Figure 12 is a longitudinal sectional view taken substantially along line 12—12 of Figure 11 illustrating tensioning means associated with the mold for tensioning the reinforcing rods before the casting operation.

Figure 13 is an end view of the structure shown in Figure 12.

Figure 14 is a transverse sectional view taken along line 14—14 of Figure 5 showing the mold receiving cage of the centrifugal casting machine.

Figure 15 is a side elevational view of the structure shown in Figure 14.

Figure 16 is a view similar to Figure 14, but showing the mold positioned in the mold receiving cage showing the concrete in the condition it is in before the cage is rotated.

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Figure 17 is a view similar to Figure 16, but showing how the concrete has been uniformly distributed in the mold by the rotation of the cage.

Figure 18 is a perspective view of a section of a cored beam produced by my method and apparatus, the dovetail grooves in the surface thereof having been produced by the type of flexible mold lining shown in Figure 19.

Figure 19 is a perspective view of a section of the mold lining used in the production of the beam of Figure 18.

Figure 20 is a view similar to Figure 18, but showing a different arrangement of the dovetail grooves produced by using a lining of the type shown in Figure 22.

Figure 21 is a view similar to Figure 18 showing an arrangement of dovetail grooves also produced by the lining of Figure 22 which is positioned differently in the mold to produce this different arrangement of the grooves.

Figure 22 is a plan view of the lining used in producing the dovetail grooves in the beams of Figures 20 and 21.

Figure 23 is a plan view of another type of lining used in producing another arrangement of dovetail grooves in the surfaces of the beam.

Figure 24 is a plan view showing a number of cored beams produced according to my invention incorporated in a floor construction, the cored beams being used as the radiators of a heating system.

Figure 25 is a transverse sectional view taken along line 25—25 through several of the beams and illustrating how adjacent beams may be secured together.

Before explaining in detail the present invention, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. It is to be understood also that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

In Figures 1 to 4, inclusive, I have illustrated the apparatus which I preferably employ in carrying out my process. The apparatus comprises an elongated and downwardly inclined conveyer 1. This conveyer includes a frame which supports on its upper side a plurality of longitudinally spaced pairs of rollers 2. The rollers of each pair are arranged in V relationship so as to form a cradle for receiving the pallet 3 of the mold which is used in forming the concrete beam. This pallet 3 is in the form of an angle iron of suitable size to form two sides of the beam. The rollers 2 of each pair are of proper size and are properly spaced so that the pallet will rest thereon in the manner indicated in Figure 3. The rollers 2 may be replaced with different size rollers and are preferably adjustable relative to each other, so as to receive different size pallets.

The pallet is deposited by a crane on the upper end of the conveyer 1, that is, the left hand end of Figure 1 at the station A. The pallet is pushed along the conveyer, aided by gravity, to the station B where it receives the flexible mold lining 4. This mold lining is preferably made of rubber and is indicated best in Figures 8 to 11. It has, formed on its inner surface, alternating ribs 5 and grooves 6. The ribs 5 are of dovetail cross-section so as to produce dovetail grooves in the side surfaces of the beam to be formed in the mold. The lining 4 is placed on the pallet in the

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manner indicated in Figure 8 with its sides overhanging the sides of the mold to a considerable extent.

The pallet with the rubber lining therein is now shoved to the station C at the lower end of the conveyer 1. At this station, it receives the metal reinforcing. The metal reinforcing is in the form of a cage 7 extending substantially the full length of the pallet. This cage is illustrated best in Figures 8 to 13. It includes the longitudinally extending tensile rods 8 which are held in spaced relationship by means of the square transversely disposed wire members 9 which are disposed at longitudinally spaced intervals.

While the pallet is at the station C, the reinforcing is pretensioned, and is centered on the pallet. As shown in Figures 12 and 13, the means for pretensioning the longitudinal members 8 of the reinforcing comprises a unit 10 which co-operates with a closure member 11 for the end of the mold. The same arrangement is provided at each end of the mold. To pretension the reinforcing members 8, the end closures 11 of the mold are mounted on the pallet 3, as shown best in Figure 12. It will be noted that the ends of reinforcing rods 8 extend beyond the ends of the mold pallet and the mold closures 11 are provided with openings 12 to permit slipping of the closure members over the reinforcing rods 8 into mold closing position.

When the closures 11 are mounted on the ends of the reinforcing cage 7 and on the ends of the mold pallet, they serve to center the cage within the mold pallet so that it will be spaced from the sides thereof. It will be noted that each member 11 is provided with a reduced inner square portion 13 which fits within the end of the mold pallet to properly locate it relative thereto. Thus, there is a shoulder 14 provided on member 11, which abuts the end of the mold pallet. A large opening 15 is provided at the center of each closure 11 to permit the escape of water from the ends of the mold. The tensioning unit 10 is similar in shape to the closure 11 and is provided with a series of openings 16 which receive the projecting ends of members 8. Set screws 17 threaded outwardly from the large central opening 18 of unit 10 into the openings 16 anchor the unit 10 to the rods 8 when desired. Longitudinally extending bolts 19 are threaded through unit 10 and engage the outer face of closure 11. The set screws 17 are first tightened before the bolts 19 are tightened. The bolts 19 of each unit 10 are so located (Figure 13) that all three of them will be located below the center line of the mold pallet 3 so that when they are tightened uniformly the member 10 will not tilt laterally. It will be apparent that tightening the bolts 19 will move the members 10 outwardly away from members 11. Consequently, this will pretension the rods 8, including the uppermost rod.

From the station C, the pallet 3, with the lining 4 and cage 7 in position therein, is shoved onto a pallet-receiving cradle formed on a transversely movable carriage 20. The pallet-receiving cradle is formed by pairs of longitudinally spaced rollers 2a which are like the rollers 2 and are supported on the carriage 20 in the same manner that the rollers 2 are supported on the conveyer 1. The end of the pallet-receiving cradle on the carriage 20 which is adjacent the lowermost end of the conveyer 1 is at substantially the same height as such end of the conveyer 1. The opposite end of the carriage is at a lower level. In other words, the carriage

will support the pallet at the same inclination as when it is supported by the conveyor 1. To accomplish this, the end of the carriage 20 adjacent conveyor 1 is supported on an inclined track 21 while the other end of the carriage is supported on a horizontal track 22. The wheels 23, which operate on the track 21, are at different levels so that the carriage will not be tilted transversely. The wheels 24, which operate on track 22, are at the same level. The carriage 20 is adapted to move the pallet from a position in alignment with conveyor 1 to a position in alignment with the conveyor 1a. The conveyor 1a is parallel to the conveyor 1, but is disposed at a lower level. When the carriage 20 is moved so that the pallet is in alignment with the conveyor 1a, the pallet will be horizontally disposed, due to travel of wheels 23 down track 21, and will be at the same level as the conveyor 1a.

In order to shift the carriage 20 back and forth, I provide the structure shown best in Figures 1, 3 and 4. This structure comprises crank arms 25 which are keyed on a shaft 26 that is supported for rotation substantially in alignment with the conveyor 1. The shaft 26 is driven by a worm gear unit 27. This unit is driven by an electric motor 28. The arms 25 are pivotally connected to the ends of links 29 which, in turn, are pivotally connected to the carriage 20. It will be apparent that rotation of the shaft 26 will shift the carriage between its two lateral positions. Movement of the carriage may be automatically controlled by means of a magnetic brake unit 30, associated with motor 28, and a cam-type limit switch 31 which is actuated by a radially extending arm 32 keyed on the shaft 26.

When the carriage 20 moves the pallet 3 into alignment with the conveyor 1a, the pallet is moved from the carriage onto the horizontally disposed conveyor 1a. This conveyor is provided with rollers 2b (Figures 5 and 6) which are the same as the rollers 2 and 2a and are arranged in the same manner to provide a cradle for receiving the pallet. To aid in moving the pallet from the carriage 20 onto the conveyor 1a, a chain 33 is provided beneath the conveyor 1a and this chain may be moved by a suitable motor whenever desired. This chain extends to the right (Figure 1) a substantial distance so that it will be located beneath the pallet when it is moved into alignment with conveyor 1a. The pallet may be detachably hooked to the chain so that it will move therewith by any suitable means. As the pallet is moved from the carriage 20 onto the conveyor 1a, a proper amount of concrete is deposited therein by means of a hopper 34 located above the conveyor 1a and at the end thereof. This hopper 34 will supply a measured quantity of concrete into the pallet. Since the concrete is deposited in the pallet as it moves by the hopper 34, it will be roughly spread along the length of the pallet and on the reinforcing and rubber lining carried thereby, as shown in Figure 9.

When the pallet reaches the station D, the lid or cover 35 of the mold is applied on the pallet. This cover is the same shape and size as the pallet 3. Its longitudinal edges rest on the corresponding edges of the pallet 3, as shown in Figures 7 and 11, and the two members are held in proper alignment by means of lugs 36 carried at longitudinally spaced intervals on each of the upper edges of the pallet 3. The ends of the

cover 35 will fit within the shoulders 14 at the upper portions of closures 11, as shown in Figure 12. Since the reinforcing cage has been centered previously relative to the pallet it will also be centered relative to the cover and will be spaced from the sides thereof. Before the cover 35 is mounted on the mold pallet 3, the rubber lining 4 is folded up into the position shown in Figure 10 with the thin flap 4a provided at one edge, overlapping the other edge of the lining, thereby forming a closed chamber around the reinforcing cage and the concrete in the pallet.

The closed mold with the reinforcing cage 7 and the lining 4 in position therein, as shown in Figures 11 and 12, is next moved to the spinning or centrifugal casting machine at the station E. This machine is in alignment with the conveyor 1a. This machine is illustrated best in Figures 5, 6 and 14 to 17. It includes a revolving cage 38 which is composed of a pair of V-edge end rings 39 and a plurality of flat surfaced axially spaced intermediate rings 39a, which are secured together by means of four longitudinally extending angle members 40 which may be welded or otherwise secured to the inner edges of the rings. The angle irons 40 are arranged with their vertices directed inwardly so that they provide supports for the shafts of sets of four rollers 41, the rollers of each set being arranged in the form of a square, as indicated best in Figures 14 to 17. A set of rollers 41 is provided within each of the rings 39 and 39a. The rollers 41 are of such size that they form between them a socket into which the complete mold is inserted. If molds of different size are used, a different size cage 38 will also be used. Adjacent one end of the cage 38, the members 40 carry oppositely disposed brackets 42 which extend transversely thereof. These brackets carry inwardly directed bolts 43 which are adapted to engage opposite sides of the mold (Figure 17) to hold the mold in fixed axial position within the cage 38.

The rings 39 have a peripheral edge of V-form. For supporting the rings, cradles are formed by pairs of rollers 44 which are provided with V-grooves in their peripheries. These rollers 44 are carried by upstanding brackets 45 which are attached to the base 46 of the machine on opposite sides thereof. The surfaces of rings 39a are smooth and are supported similarly to rings 39 by smooth rollers 44a which are carried by brackets 45a.

The cage 38 is revolved by means of a motor 47 which is carried above the cage 38, as shown in Figures 5 and 6, by means of a standard 48. The motor 47 drives a gear unit 49 which, in turn, drives a multiple-groove pulley 50. This pulley 50 drives a series of belts 51 which extend around a large multiple-groove sheave 52 carried by the cage 38. The motor 47 is of the variable speed type.

When the mold is positioned in the cage 38, the concrete in the mold will be in the condition illustrated in Figure 16. The cage 38 is preferably first rotated slowly to distribute the concrete, by centrifugal force, against the four side walls of the mold and throughout the length of the mold. Centrifugal force will produce a uniform distribution of the concrete in the mold, as indicated in Figure 17. A concrete unit will thus be formed which will have four side walls of uniform size and shape and an axially extending core which extends from one end of the unit to the other. After the concrete is distributed as indicated, the speed of rotation of the cage is increased to cause

the concrete to be compacted, forcing the surplus moisture inwardly into the core opening, as shown in Figure 17, so that it can drain from the ends of the mold through the central openings 15 in the closures 11. The outer surfaces of the concrete unit are compacted against the mold lining 4 which will thus form the dovetail grooves therein.

After the spinning operation, the bolts 43, carried by the cage 38, are loosened, permitting the removal of the mold from the cage by pushing it on the rollers 41 and out of the opposite end of the cage. Movement of the mold from the cage 38 may be aided by a chain 33a (Figure 1), similar to chain 33, which extends beneath the cage 38 and is driven, when desired, by a suitable motor. This chain 33a extends beneath a conveyor 1b which is of the same structure as the conveyor 1a. When the mold reaches the station F where it is completely on the conveyor 1b, the cover 35 is removed, while the units 10 and 11 are still kept in position on the ends of the pallet to maintain tension on the rods 8. The pallet 3 with the finished concrete beam carried thereby may then be transported by a crane to the curing room. At the curing room, the beam is cured while the rods 8 are still maintained under tension. Then the units 10 and 11 are removed from the pallet and the beam is removed from the pallet. The pallet and the units 10 and 11 may now be used over again. Also, the rubber lining 4 is stripped from the surfaces of the concrete beam and can be used over again.

Cast concrete beams of the type shown in Figures 18, 20 and 21 are produced by the method described above. As shown in Figure 18, the beam 55 will be of square cross-section with all of its walls uniform and with the concrete distributed uniformly in each side wall. The core 56 will extend the full length of the beam, will be axially disposed and will be of circular outline. The undercut or dovetail grooves 57 will be formed in each side surface of the beam. For example, the grooves in the beam 55 of Figure 18 will be formed by a rubber mat or lining 4a of the type shown in Figure 19. The rubber lining can be stripped from the beam after the concrete sets sufficiently without disturbing the grooves formed therein due to the yieldable nature of the lining. The reinforcing will be uniformly distributed in the side walls of the beam. Thus, because of the uniform nature of the beam, it may be used with any of its sides down in a floor or roof structure.

The type of groove and the arrangement of the grooves formed in the surfaces of the beam may be selected by selecting a suitable rubber lining. For example, grooves of the type formed on the beam 55a of Figure 20 may be produced with a rubber mat of the type shown in Figure 22. Also, grooves of the type formed on the beam 55b of Figure 21 may be formed by the rubber lining of Figure 22 which is positioned in the mold differently than when used for forming the beam 55a. In the position necessary to form beam 55a, the lining will be so positioned that the corners of the compartment formed by the lining corresponding to the corners of the mold, will be along the dotted lines a of Figure 22. In the position necessary to form beam 55b, the corners will be along the broken lines b. Figure 23 shows another type of lining which can be used for producing a different arrangement of the grooves.

In Figures 24 and 25, I show an example of an installation of my beams in a floor construction. The beams 55 are disposed in side-by-side

relationship. To secure all the beams together so that they function as a single beam, it is merely necessary to pour grout in the spaces between adjacent beams, as indicated in Figure 25 by the numeral 58, which will harden and form keys that cooperate with the dovetail grooves 57 to secure the beams together. The grooves 57 will also serve as keying means for the ceiling surfacing material 59 and for similar floor surfacing material.

In the construction shown in Figures 24 and 25, the beams are used as the radiators of a heating system. The cores of the beams will serve as passageways for the hot air. In the example shown in Figure 24, two adjacent beams are connected together at one end, the opposite end of one beam being connected to an inlet duct and the corresponding end of the other beam being connected to a return duct. Variations of this system may be made.

It will be apparent from the above description that I have provided a method and apparatus for producing cored concrete beams which is simple, economical and effective. The use of core-forming members has been rendered unnecessary by my novel method and apparatus.

Various other advantages will be apparent from the preceding description, the drawings and the following claims.

Having thus described my invention, what I claim is:

1. The method of casting a concrete beam of square cross-section with an axial core therein which comprises placing on a pallet composed of an angle member, a sheet of rubber which covers both sides of the pallet and hangs over the edges thereof, depositing a measured quantity of concrete in said pallet on said rubber sheet along the length of the pallet, folding said rubber sheet upwardly until its edges overlap and form a continuous chamber for the concrete, placing a cover of the same size and shape as the pallet on the pallet to form a complete mold, the rubber sheet completely lining the two sides of the cover, closing the ends of said mold with the exception of a central opening in at least one end of the mold to permit drainage of moisture, and then spinning the mold about its axis to distribute and compact the concrete in the mold.

2. A method according to claim 1 wherein the rubber sheet has projections thereon which are wider at their outer sides than at their bases and will form undercut keying sockets in the surfaces of the concrete beam.

3. A method according to claim 1 wherein a reinforcing cage of square cross-section is placed on the pallet before the concrete is deposited therein, said reinforcing cage including longitudinal tensile members, said members being placed under tension after the mold is closed and before the spinning operation.

4. A method according to claim 1 wherein the mold is first spun at a low speed to distribute the concrete in the mold and form the axial core and is then spun at a high speed to compact the concrete and squeeze the moisture into the core from whence it is drained.

5. A method according to claim 1 wherein the cover of the mold is removed leaving the beam supported on the pallet for transportation to a curing room where it is removed from the pallet.

6. Apparatus for casting a concrete beam of square cross-section comprising an elongated mold formed of two cooperating sections of an angle iron, a conveyor for receiving one of said

sections and comprising longitudinally spaced pairs of rollers arranged to form a cradle along which the mold section will move to several stations, said conveyer being inclined; a mold receiving carriage at the lower end of said conveyer; a second conveyer disposed parallel to the first conveyer and having rollers similarly arranged to form a mold receiving cradle, means for moving the carriage between a position where it aligns with one conveyer and a second position where it aligns with another conveyer; a mold spinning machine in alignment with the second conveyer; said machine including a cage for receiving the complete mold and holding the two sections in cooperation; said cage including rollers which will engage all sides of the mold.

7. Apparatus according to claim 6 wherein the second conveyer is lower than the first, said carriage being carried by a pair of wheels at the end adjacent the lower end of the first conveyer which are at different levels and at the other end by wheels which are at the same level, an inclined

track for the first pair of wheels and a level track for the second pair of wheels.

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