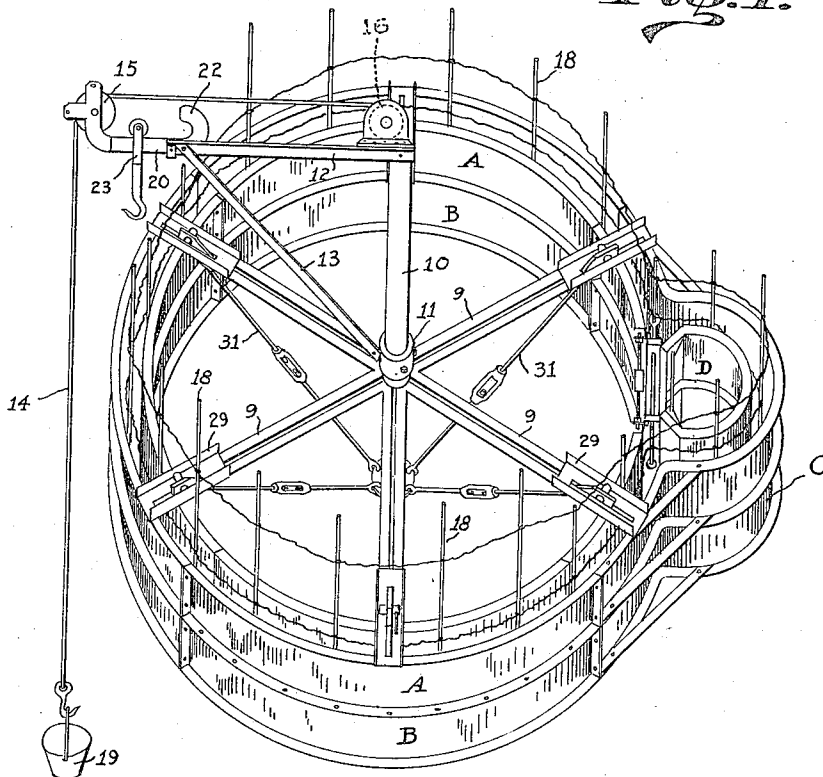


1,163,798.

*Fig. 1.*



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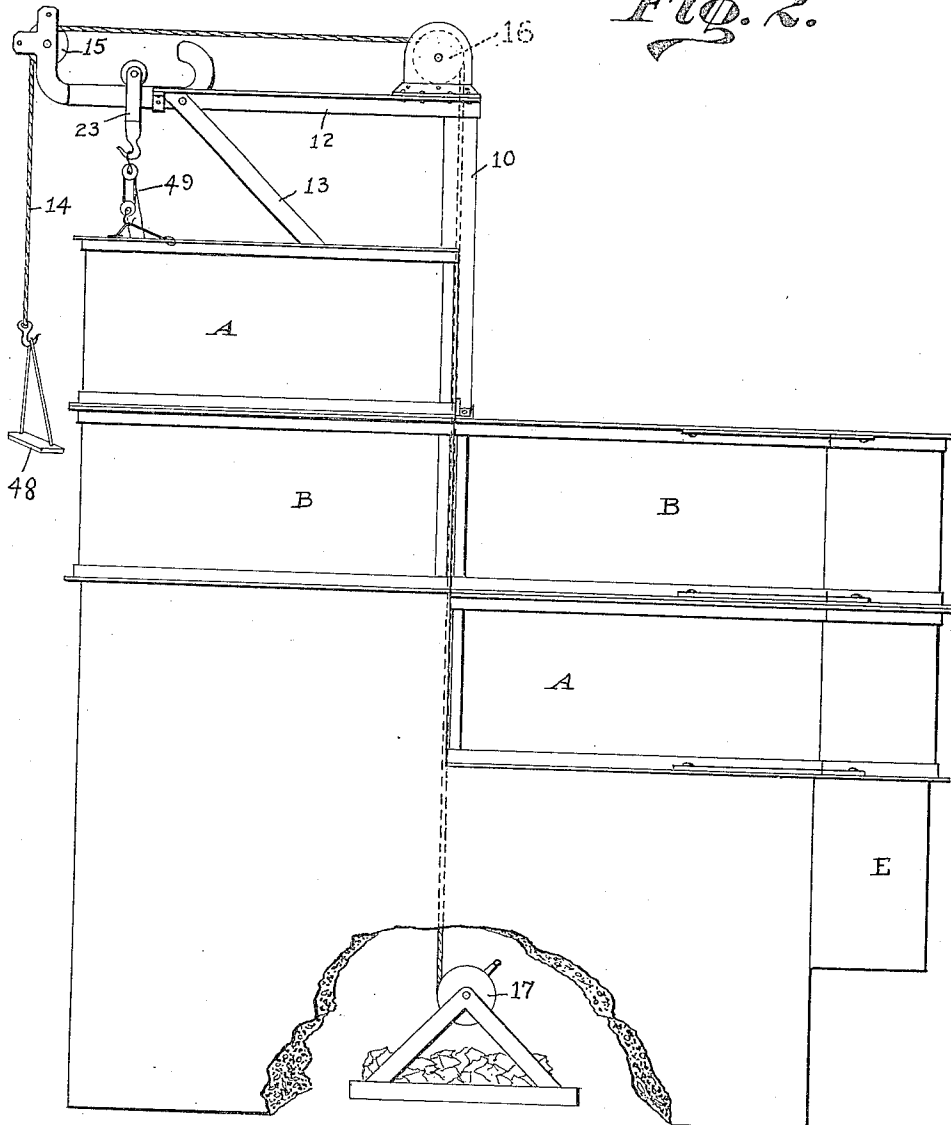
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APPARATUS FOR CONSTRUCTING CONCRETE SILOS AND THE LIKE.  
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3 SHEETS—SHEET 2.

*Fig. 2.*



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*Fig. 5.*

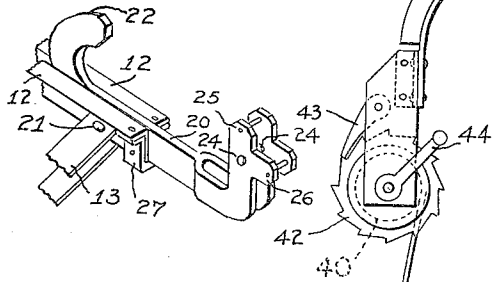


*Fig. 3.*

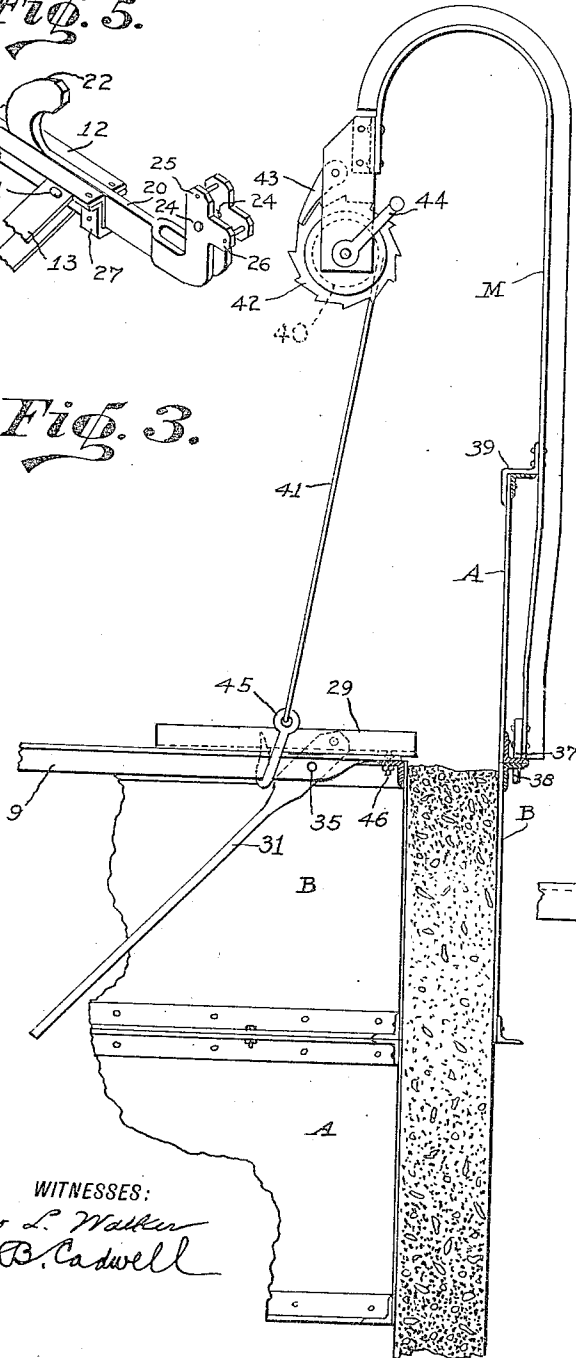


*Fig. 6.*

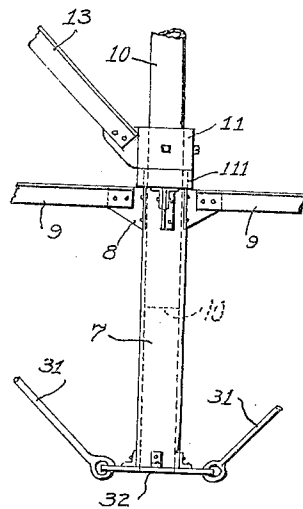
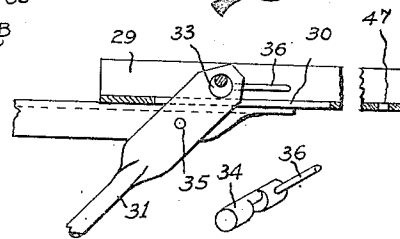


*Fig. 4.*



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# UNITED STATES PATENT OFFICE.

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APPARATUS FOR CONSTRUCTING CONCRETE SILOS AND THE LIKE.

1,163,798.

Specification of Letters Patent.

Patented Dec. 14, 1915.

Application filed November 14, 1914. Serial No. 872,116.

*To all whom it may concern:*

Be it known that I, LEE F. WILLIAMS, a citizen of the United States, and a resident of Pueblo, in the county of Pueblo and State of Colorado, have invented a certain new and useful Improvement in Apparatus for Constructing Concrete Silos and the like, of which the following is a full, clear, and exact description.

My invention is an improvement in apparatus for constructing silos, cisterns, tanks or other hollow structures of concrete or like material. Heretofore in building such devices it has been customary so far as I am aware to provide either scaffolding or a crane with a mast supported from the ground for handling the molds and the building material and, since these structures are now being built of considerable height, there has been required either an expensive scaffold or a crane with a long heavy mast. Inasmuch as the rigs for building these structures must be transported from place to place wherever it is desired to build, the question of weight is, as a matter of haulage, an important one aside from the added first cost in the case of heavy construction. I have discovered, however, that, due to their ring shape and the surface friction between the molds and the within formed structure, one set of the molds themselves may be relied upon to support not only their own weight and that of the operatives but also that of a crane while the latter is either hoisting or is being lifted to new position on top of the unfilled molds and my apparatus utilizes this discovery, thereby simplifying and much reducing the weight of the apparatus required.

In carrying out my method of operation I employ two complete sets of inner and outer molds, the one set B which incloses the portion of the structure made on the day previous to the one in question serving successively as a support for the crane while the outer molds A of the second preceding day are raised, as a resting place for the mechanism for lifting the crane until the crane has been placed in position on the last mentioned outer molds, and as a support for the crane while lifting the inner molds A of the second preceding day and while handling the material for the present day's work.

Further and more detailed objects and advantages of my method and apparatus will

be more clearly evident from the accompanying specification and from an inspection of the drawings accompanying the same in which—

Figure 1 is an isometric perspective of a set of molds such as are employed in making concrete silos, together with the crane portion of my apparatus in working position thereon; Fig. 2 is a side elevation of a partially completed silo showing a step in the method of operation, a portion of the silo being broken away to disclose a hoisting winch within the structure; Fig. 3 is a partial vertical section through an unfinished silo, showing the molds during the step of shifting them, and the apparatus for lifting the crane to its next position; Fig. 4 is a longitudinal section through the outer end of one of the crane supporting arms, a portion of the extension channel being broken away to shorten the figure; Fig. 5 is a perspective showing the construction of the outer end of the lifting arm of the crane; and Fig. 6 is a partial elevation of the lower end of the crane.

In carrying out my invention I employ two sets A and B of sectional, inner and outer molds, the sections being flanged at their ends so as to be joined by bolts to form an unitary structure and being provided on their sides with like flanges for joining the sets of molds together. The outer forms of each set are shaped to form a bay C which, together with the collapsible core member D, is adapted to form a fodder chute E on the silo. The crane which I prefer to employ is shown in Figs. 1 and 2, details appearing in Figs. 5 and 6. This crane consists of a hollow post 7 carrying near its upper end brackets 8 to which the horizontal supporting arms 9 are riveted. These arms, of which any convenient number may be employed (six being shown for purposes of illustration), are preferably made as shown of a pair of angles back to back and slightly spaced. The mast 10, slightly smaller in diameter than the post 7, fits inside the post and is rotatably supported on the post by the collar 11 which bears on a washer 111 on top of the post. From the top of the mast 10 there extends the hoisting arm 12, also preferably formed of a pair of spaced angles back to back, and the brace 13 extends from adjacent the outer end of the arm 12 to the collar 11 for supporting the arm. The hoisting cable

14 passes over the sheave 15 at the outer end of the arm 12, the sheave 16 at the top of the mast and down through the mast to a winch 17, which may be placed as shown in the center of the structure or on the outside, if preferred, the cable passing out through the opening at the bottom of the feed chute E.

In order that the end of the arm 12 may be swung around to deliver the mixed concrete at any desired point and at the same time clear the reinforcing rods 18 which at times project a considerable distance above the tops of the molds, it is desirable to provide the end of the arm 12 with mechanism whereby it may be shortened after the bucket 19 has been raised. Such means are illustrated in Figs. 1 and 2 and in detail in Fig. 5. In this preferred form the angles of which the major portion of the arm is constituted are of such length that they will clear the reinforcing rods and a supplemental section 20 is pivoted on a pin 21 which passes through the vertical members of the angles. The section 20 is U-shaped in general side view, the inner end being turned up at 22 to provide a retaining means for a trolley 23, and it is forked at its outer end to form a mounting for the sheave 15 which is journaled on a pin passing through the openings 24. Pins in the holes 25, 26, form retaining and guiding means for the cable 14. A U-shaped plate 27 is riveted to the ends of the angles forming the arm 12 in position to support the section 20 when in extended position.

In order to operate the device in the manner which I have devised it is necessary to provide means for extending and shortening the arms 9. To this end I mount short channels 29, shown in section in Fig. 4, on the outer ends of the arms. These channels are centrally slotted at 30, in which slots are received the upper ends of the tension rods 31 which extend from the ends of the arms 9 to a collar 32. An enlarged opening 33 in the end of the rod 31 receives a pin 34 (shown in detached view in Fig. 4) which is placed in position before the rivet 35 is secured. The pin 34 has a central eccentric reduced portion which engages the hole 33 and a lever 36 for operating. The parts are so proportioned that when they are in the position shown in Fig. 4 the outer larger portions of the pin 34 engage the bottom of the channel 29 and hold it tightly against the arm 9 and when the lever 36 is turned up the channel can readily be moved with relation to the remainder of the arm.

In Fig. 3 is shown one of the devices M for lifting the crane with relation to the molds; any desired number of these (up to six the number of arms 9 shown) may be employed though I have found three or four

to be sufficient. In the preferred form shown in the drawings this device consists of an upright formed of T-iron with the flat side in and provided at its lower end with a foot 37 adapted to rest on a mold flange and having a pin 38 adapted to enter a pair of the bolt holes in the mold flanges. An angle 39 is riveted to the inner side of M in position to extend over a mold as shown and form a latching means for steadying the hoist M. At its upper end the T-iron is bent on itself to extend over the end of the crane arm 9 and it carries a drum 40 on which a cable 41 may be wound. Ratchet and dog mechanism 42, 43, form means of holding the drum in any position and a crank 44 is provided for winding the cable.

Operation: At the start one of the sets of molds, for instance the set A, is set up on the foundation and filled during the first day. The next day the second set B is mounted on the set A and by this time the apparatus is high enough to support the crane which is placed on the top of the molds B on the second morning, the flattened ends of the angles forming the arms 9 resting on the flanges of the inner set of forms of the set B (as shown in Fig. 3) and the channels 29 are in extended position (as shown in Fig. 4) resting on the outer sections of B. Bolts 46 are passed through bolt holes in the arms 9 and the inner sections of B and other bolts are placed in the bolt holes 47 in the channels and corresponding bolt holes in the flanges of the outer sections of B. This bolting of the unfilled sections firmly to the crane assures an alinement of the sections and their preservation in such alinement during the operation of filling in the next section of the structure.

After the crane is adjusted in place as shown in Fig. 1 the molds B are filled, the crane through the cable 14 serving as a means of lifting the material. In this operation the cable is wound until the bucket is lifted to a point where it may be transferred to the trolley 23 which is done. Then the trolley is rolled toward the mast until it is supported on the angles forming the arm 12, the yoke of the trolley being wide enough to permit this; the section 20 may now be tilted up so that the arm may be swung around inside the line of the reinforcing rods to the point where it is desired to deliver the material, the trolley being retained between the now vertical body portion of the section 20 and the inner loop 22 thereof. The next morning the short channels 29 are retracted and the bolts holding the outer mold sections of the set A together and to set B are removed and the sections are lifted one by one and placed in position on the set B and these sections are

bolted together and to set B, the crane being available for this lifting. When the outer mold of set A is in position the next step is raising the crane. This is done by the use of several of the hoists M which grasp each one of the arms 9 by a hook 45, the cranks 44 being turned by operatives standing on the inner mold B or on the concrete. When the arms 9 are raised to a plane above the mold A the channels 29 are slipped out to extend over the outer mold A and set there by turning the levers 36 to the position of Fig. 4. Then the crane is lowered so that the arms 9 rest on small blocks (not shown) on the outer mold A. The next step is raising the inner sections A by the crane and securing them in position on the inner sections of B. The blocks mentioned are then removed or eased off to allow the angles of the arms 9 to rest on the flanges of the inner sections of A and the channels to rest on the outer sections of A. The operation of filling the newly set molds to form the next portion of the structure may now be repeated. As the structure gets higher a chair 48 for the use of the operatives in removing the bolts holding the sections together may be suspended from the crane, the sections being lifted by a tackle 49 suspended from the trolley; or this arrangement may be reversed, the chair being suspended from the block and tackle and the crane being available for lifting the sections.

I prefer to make the width of the molds such that the setting up and filling of one set will form a good day's work for a gang of men and I have found that about four feet is a good width for the molds for this purpose; and that the concrete so made will set amply to hold the molds for the following day's operations. Therefore as the work progresses on each morning the mold sections filled the second preceding day are raised as indicated in Figs. 2 and 3, the operation as described above being followed out as often as necessary to build a structure of the desired height.

Having thus described my invention what I claim and desire to secure by Letters Patent is:

1. An apparatus for forming hollow structures of concrete or the like comprising inner and outer molds, an interiorly located crane, arms supporting said crane adapted to overlie said molds, means for extending and retracting a portion of said arms to extend over and to clear, respectively, said outer mold.

2. An apparatus for forming hollow structures of concrete or the like comprising inner and outer molds, and interiorly located crane having supporting arms adapted to overlie said molds, said arms having fixed and longitudinally movable sections, said

fixed sections being of such length as to extend to and rest upon said inner mold sections but not to reach said outer mold sections, and said longitudinally movable sections being so proportioned and mounted as to extend over said outer mold sections in extended position but to clear them when in retracted position.

3. An apparatus for forming hollow structures of concrete or the like comprising inner and outer molds, an interiorly located crane having supporting arms adapted to overlie said molds, said arms having fixed and longitudinally movable sections, said fixed sections being of such length as to extend to and rest upon said inner mold sections but not to reach said outer mold sections, and said longitudinally movable sections being so proportioned and mounted as to extend over said outer mold sections in extended position but to clear them when in retracted position, and means for locking said longitudinally movable sections in any position.

4. In a device of the class described, inner and outer molds, an interiorly located crane having supporting arms adapted to overlie and be supported on said molds, and means adapted to be supported on said molds for raising said crane.

5. In a device of the class described, inner and outer molds, an interiorly located crane having supporting arms adapted to overlie and be supported on said molds, and a plurality of hoists adapted to be supported on said molds and to raise said crane.

6. In an apparatus of the class described, inner and outer molds, an interiorly located crane having horizontal supporting arms, said arms having fixed and longitudinally movable sections, said fixed sections being of such length as to extend to and rest upon said inner mold sections but not to reach said outer mold sections, and said longitudinally movable sections being so proportioned and mounted as to extend over said outer mold sections in extended position but to clear them in retracted position, and a plurality of hoists adapted to be supported on said molds and to raise said crane.

7. An apparatus for forming hollow structures of concrete or the like comprising inner and outer molds, and an interiorly located crane having a horizontal hoisting arm, said arm having a vertically swinging outer section.

8. An apparatus for forming hollow structures of concrete or the like comprising inner and outer molds, and a centrally mounted crane having a horizontal hoisting arm extending beyond said molds, said arm having a vertically swinging outer section of such length that when swung to vertical position said arm will clear objects projecting out of said molds.

9. An apparatus for forming hollow structures of concrete or the like comprising inner and outer molds, an interiorly located crane having a horizontal hoisting arm, said arm having a vertically swinging section pivoted to the outer end thereof, a sheave on the outer end of said swinging section, a hoisting cable running on said sheave, and a trolley adapted to run on said swinging section and on the outer end of the rigid portion of said arm.

10. An apparatus for forming hollow structures of concrete or the like comprising inner and outer molds, an interiorly located crane having a horizontal hoisting arm, said arm having a vertically swinging section pivoted to the outer end thereof, a sheave on the outer end of said swinging section, a hoisting cable running on said sheave, and a trolley adapted to run on said swinging section and on the outer end of the rigid portion of said arm, said swinging section

having upturned ends so shaped as to retain said trolley therebetween in any position of said swinging section.

11. In a device of the class described, inner and outer molds, an interiorly located crane having supporting arms adapted to overlie and be supported on said molds, and a plurality of hoists, each hoist comprising a foot adapted to enter bolt holes in the mold flanges, latching means adapted to engage the top of a mold, an inwardly projecting upper portion, and hoisting means on said inwardly projecting upper portion for engaging and lifting the supporting arms of said crane.

In testimony whereof I have hereunto affixed my signature in the presence of two witnesses.

LEE F. WILLIAMS.

Witnesses:

ANNA H. ARTHUR,  
W. W. BOUGHTON.

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