March 3, 1942. W. KELLY 2,275,080

MACHINE FOR MAKING CONCRETE CASINGS

Filed April 17, 1941 3 Sheets-Sheet 1

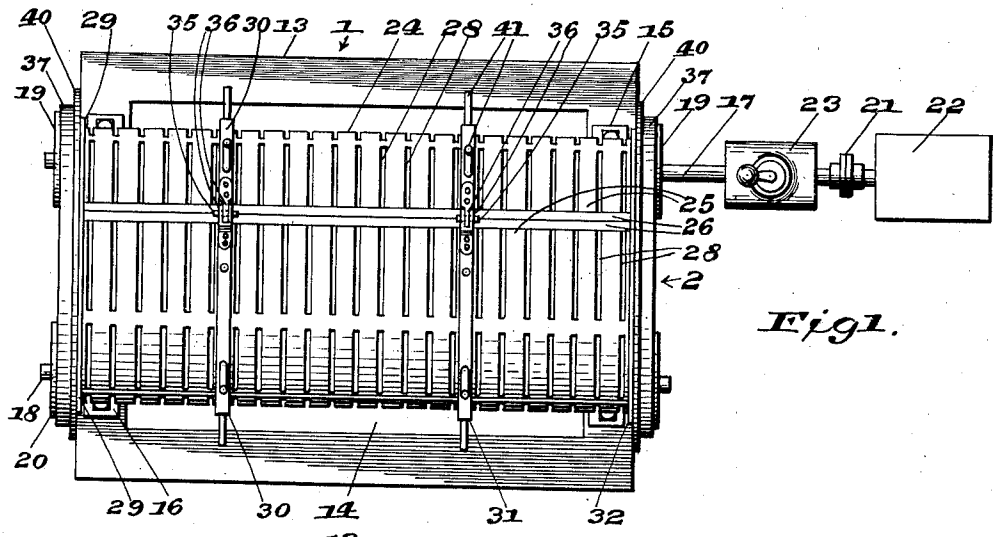


Fig 1.

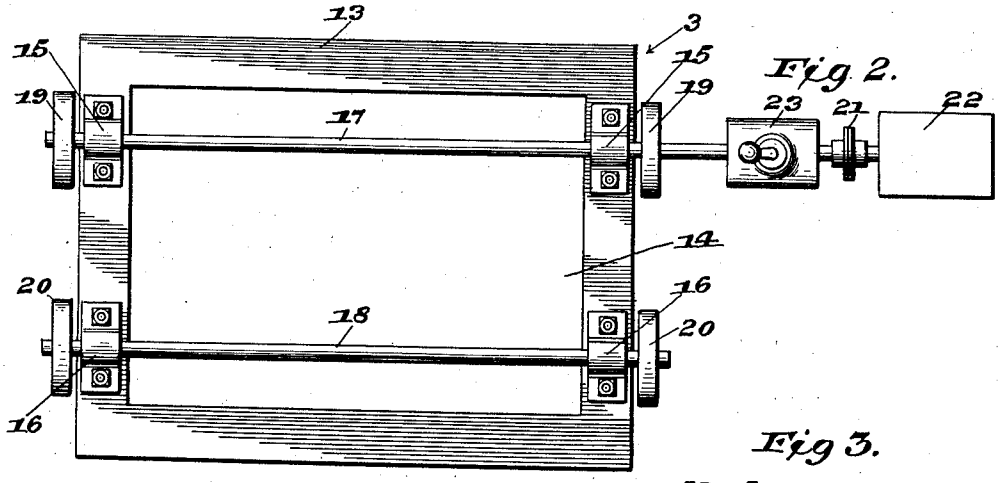


Fig 2.

Fig 3.

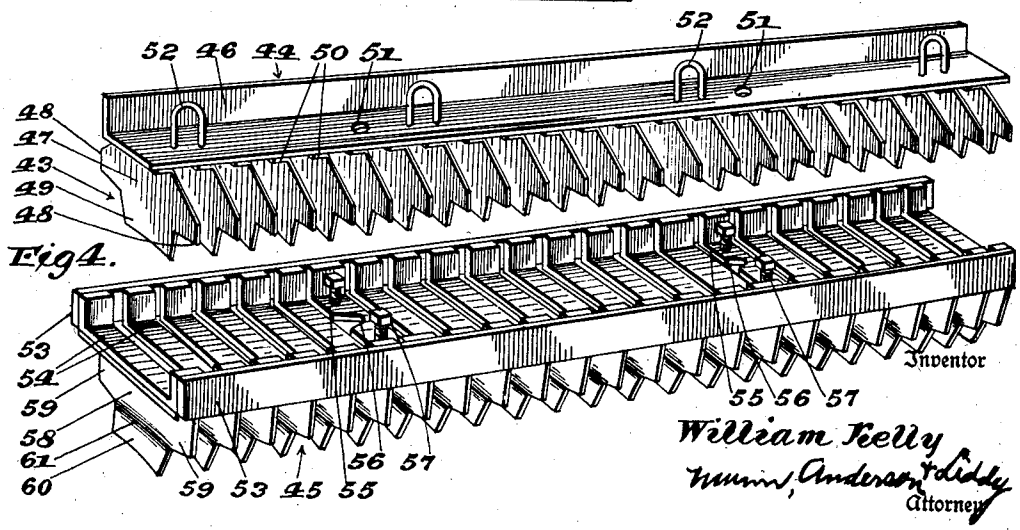


Fig 4.

Inventor

William Kelly

Munn, Anderson & Liddy

Attorneys

March 3, 1942. W. KELLY 2,275,080

MACHINE FOR MAKING CONCRETE CASINGS

Filed April 17, 1941 3 Sheets-Sheet 2

Fig 5.

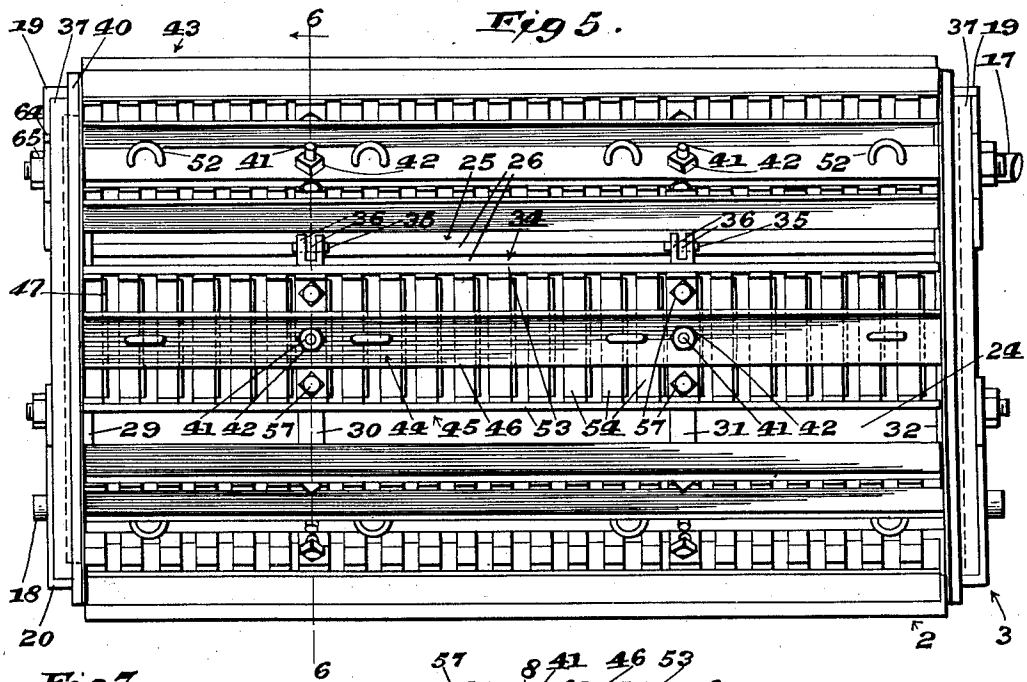


Fig 7.

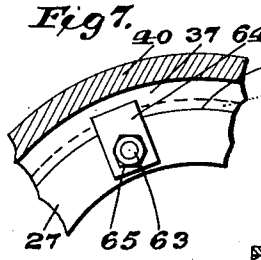
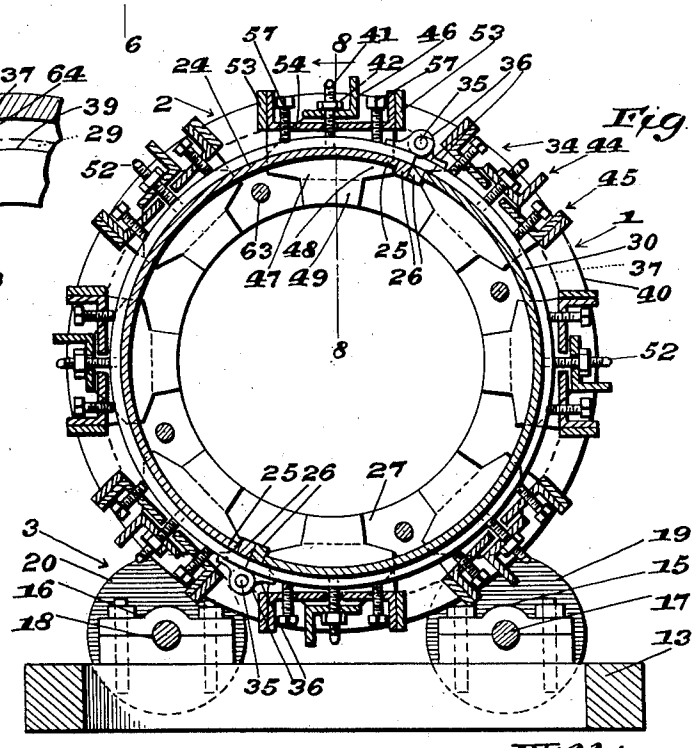


Fig 6.



Inventor

William Kelly

By

Munn, Anderson & Liddy

Attorneys

March 3, 1942. W. KELLY 2,275,080

MACHINE FOR MAKING CONCRETE CASINGS

Filed April 17, 1941 3 Sheets-Sheet 3

Fig 8.

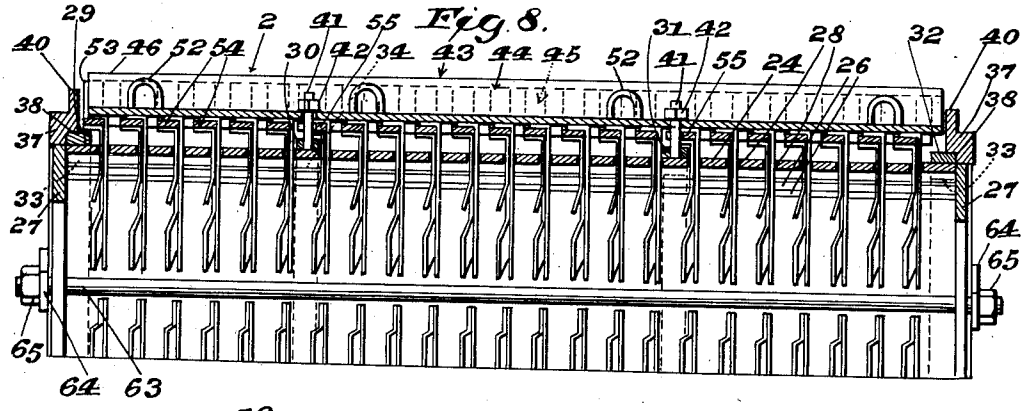


Fig 9.

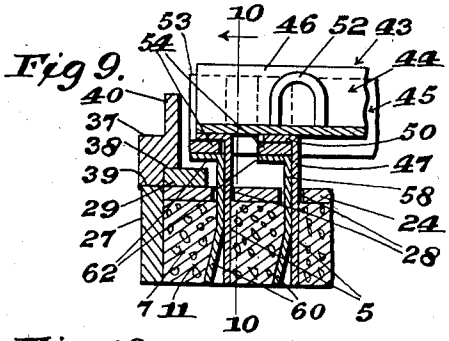


Fig 11.

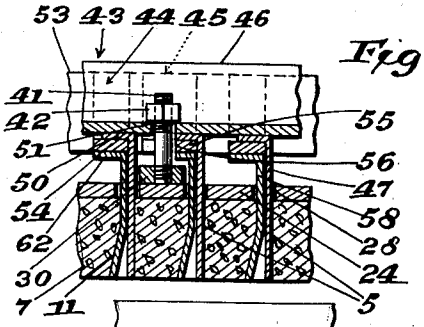


Fig 10.

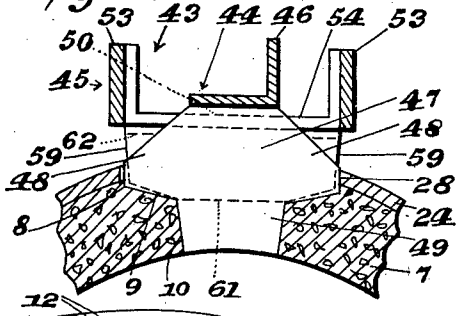
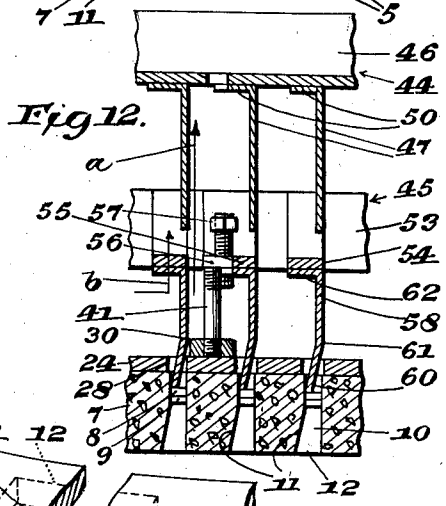


Fig 12.



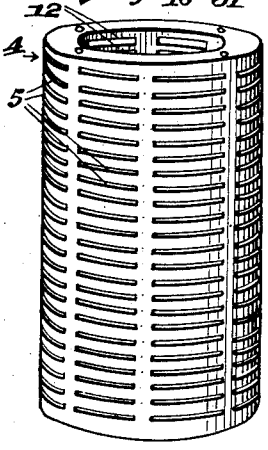


Fig 13.

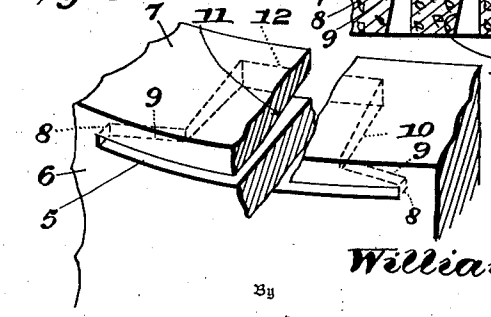


Fig 14.

Inventor

William Kelly

By

Munn, Anderson & Liddy

Attorney

Patented Mar. 3, 1942

2,275,080

UNITED STATES PATENT OFFICE

2,275,080

MACHINE FOR MAKING CONCRETE CASINGS

William Kelly, Grand Island, Nebr.

Application April 17, 1941, Serial No. 389,057

11 Claims. (Cl. 25—41)

This invention relates to improvements in the art of making concrete castings, its more specific purpose being to make either a plain well casing section or a well screen section. This manufacture is accomplished by the centrifugal method which, as herein appears, insures the desired packing or concentration of the concrete and altogether facilitates the making of the sections so that enough of the latter can be produced quickly for a casing string of the required length.

Although the machine is adapted to the manufacture of plain casing sections as suggested above, its primary purpose is to make screen sections because the technicalities involved in the latter are fairly exacting notwithstanding the simplicity of their nature. A screen section requires slots or openings cut or cast through the side of the tube to allow the entrance of water into the well.

These entrance slots should be narrow on the outside and enlarged or flared toward the inside so that any particle of sand or gravel that may start through a slot may readily pass on into the interior and not lodge inside of the slot where the fact of its obstruction would cause additional clogging and eventual closure of the slot. It is readily seen that if this fault were permitted to be multiplied in any considerable number of entrance slots there would be a serious retardation and even prevention of the inflow of water into the well.

In carrying out the purposes of the invention a consideration of utmost importance in the making of a screen section is to make sure of the free entrance of all available ground water. Usually about 7% of the outside of the tube surface is required to be devoted to the slotting for the accommodation of this water. It is also a consideration to preserve the strength of the tube, bearing in mind that the screen section which is located at the bottom of the well has superimposed upon it large numbers of plain casing sections, sometimes enough to carry the casing string to a depth of 200 feet.

The type of slot herein disclosed meets all of the foregoing requirements, it being notable that the slots are formed straight through the concrete and are a contribution both to the copious inflow of water and to the structural strength of the screen section.

With the foregoing preamble in mind the objects of the invention are as follows:

First, to provide a machine for making a screen section in fulfillment of the foregoing requirements, the formation of the entrance slots being accomplished as part of the method of driving the concrete against the inner perimeter of the mold cylinder by centrifugal force.

Second, to provide a machine of the character described, employing emplaceable and removable slotting plates, the contours and cross sectional form of which produce slots of the type desired when the concrete is cast around them.

Third, to provide a screen section making machine wherein the slotting blades which constitute the cores of the slots during the act of casting, are of a separable character to enable their abstraction from the slots in the set screen section.

Fourth, to provide a machine of the character described wherein the mold cylinder is completely separable for the purpose of removing the finished screen section.

Fifth, to provide a screen section for use in a concrete well casing string, said screen section having as its chief attribute a novel type of entrance slot which not only insures a copious inflow of water, but also the structural strength of the screen section.

Other objects and advantages will appear in the following specification, reference being had to the accompanying drawings in which:

Figure 1 is a plan view of the machine, showing the mold cylinder in place on the power unit, but omitting the two slotting bar assemblages.

Figure 2 is a plan view of the power unit.

Figure 3 is a perspective view of one of the single bar slotting assemblages.

Figure 4 is a perspective view of one of the double bar slotting assemblages.

Figure 5 is a plan view of the mold cylinder, showing the slotting bar assemblages in place.

Figure 6 is a cross section taken on the line 6—6 of Figure 5.

Figure 7 is a detailed view of a portion of one end of the mold cylinder.

Figure 8 is a longitudinal section of a portion of the mold cylinder taken on the line 8—8 of Figure 6.

Figure 9 is a detailed sectional view of the upper left corner of the mold cylinder in Fig. 8.

Figure 10 is a cross section taken on the line 10—10 of Fig. 9.

Figure 11 is a detailed sectional view illustrating one of the anchoring means for the slotting bar assemblages.

Figure 12 is a sectional diagrammatic view illustrating the procedure of abstracting the slotting bars from the mold cylinder and completed concrete casting.

Figure 13 is a perspective view of the finished screen section.

Figure 14 is a detailed view of a portion of the screen section, a part being broken out to illustrate the vertical, inward flare of the slot.

In carrying out the invention the machine, generally designated 1 (Fig. 1) comprises a rotary mold 2 and a power unit 3. The rotary mold 2 is emplaced upon the power unit 3 (Fig. 1) where it remains largely by gravity, and when it is rotated by the power unit with the required

rapidity, the casting of the concrete screen section 4 (Fig. 13) is accomplished in the manner herein set forth.

This screen section in itself is an improvement on the patent for Well point, No. 1,256,906, granted to William Kelly Feb. 19, 1919. In that patent the slotting of the casing string was confined to the joints between sections, necessitating the making of the latter in one foot lengths, and in turn responding in an undesirably high cost of manufacture. The instant screen section 4 is manufactured in four foot lengths with the advantage of being able to make it either longer or shorter and of any diametrical size.

It has been pointed out that a great deal of importance rests upon the specific type of slot employed herein (Fig. 14), the virtue of the instant machine being that this slot is capable of being formed by the centrifugal casting operation of said machine. While on the subject of the slot (Fig. 14) it is to be observed that the entrance opening 5 which occurs in the outer wall 6 of the concrete body 7, is long and narrow; the preferred slot size at this point is 6¾ inches by $\frac{3}{16}$ inch. The opening 5 extends inwardly a slight distance at 8 whereupon at 9 it narrows in the lateral direction and widens slightly in the inward direction, then merges into the main passageway at 10. The slot flares in the vertical direction all the way through the cast body as at 11 (Fig. 14), ending at the exit opening 12 which measures 3 inches by ½ inch.

While the foregoing configuration and measurements are preferred, yet in practice any and all of the factors can be varied to suit specific requirements. Another matter of preference which is subject to variation in practice is the distribution of the slots 5 (Fig. 13) in eight circumferentially spaced rows of 23 slots each in a four-foot section. Reverting now to the machine, the power unit 3 (Fig. 2) comprises a heavy oak or other suitable frame 13 which is usually anchored to the floor in some suitable way. This frame incidentally defines a pit 14 which is useful in catching surplus cement and water escaping from the rotary mold 2 during the centrifugal action.

Bearings 15, 16 are secured to alined cross rails of the frame for the respective support of power and idler shafts 17, 18. The power shaft 17 carries a pair of drive rollers 19. The idler shaft 18 carries a pair of idler rollers 20. The power shaft is coupled at 21 (Fig. 1) with an appropriate prime mover 22, a variable speed device 23 being interposed to enable regulating the speed of rotation of the mold 2.

Said mold is set upon the rollers 19, 20 (Fig. 6). It comprises the mold cylinder 24 which consists of a heavy metal tube. It is made in two halves (Fig. 6), the confronting edges 25 being reinforced by metal strips 26 which abut each other as shown. The ends of the cylinder are originally open, but when assembled in the machine are made to abut a pair of end closure rings 27, the radial dimension of which determines the thickness of the body 7 of the concrete casting (Figs. 9 to 12).

The mold cylinder 24 is sloted at 28 according to a plan which will produce the rows of slots 5 in Fig. 13. The slots 28 are well shown in Fig. 1. In order to hold the halves of the cylinder 24 use is made of four heavy circular bands 29, 30, 31 and 32. The outermost bands 29, 32, are perfectly plain and are made in two halves, to correspond with the cylinder 24. One of the splits of each of these bands is shown at 33 (Fig. 8). The innermost bands 30, 31 are spaced from each other and are located in positions immediately of the ends of the cylinder 24. They are also made in two halves, one of the splits of each of said bands being shown at 34 (Fig. 8).

The ends of the bands 30, 31 are connected by pins 35 which are inserted through the knuckles 36 of connecting hinges. These pins are subject to being driven out when the time arrives for disassembling the rotary mold. The two end bands 29, 32, are firmly held in position on the cylinder 24 by having circular tracks 37 emplaced upon them. Each of these tracks is internally rabbeted at 38 to contain portions of the bands 29, 32. The circular core 39 of each of the tracks is occupied by the outer rim of the respective closure ring 27 with a fairly tight fit. Each of the tracks 37 has a flange 40.

Now it can readily be seen that when the rotary mold 2 is mounted upon the power unit 3 it remains in place largely by gravity, being cradled between the pairs of driving and idler rollers 19, 20 (Fig. 6), but inasmuch as the flanges 40 go next to the insides of said rollers it follows that said flanges effectively prevent end motion of the mold 2 during rotation. It is during the latter that the centrifugal casting operation occurs.

Upstanding studs 41 are provided in sets of eight on each of the bands 30, 31. These studs are positioned radially (Fig. 6), and when the nuts 42 on said studs are screwed home they serve to firmly anchor the respective slotting bar assemblage 43 (Figs. 3 and 4). Since each of these assemblages is alike the description of one will suffice for all. The assemblage 43 comprises a pair of slotting bars respectively identified as the single slotting bar 44 and the double slotting bar 45. The reason for the distinction is the structural differences which are presently made plain.

An angle iron 46 constitutes the single mount of a plurality of blades 47 of the single slotting bar 44. Each of these blades is winged at 48 to aid in forming the portions 8, 9 of the slot 5 (Fig. 14). These wings merge into a central lip 49, which aids in the formation of the portions 10, 12 of the slot. Said blades are flanged at 50 so as to easily enable affixation to the bottom of the iron 46 either by welding or riveting. Holes 51 accommodate the studs 41 and a sufficient number of loops 52 is provided to provide for the attachment of a hoisting device with which to remove the single slotting bar 44 from the completed casting.

A pair of bars 53 (Fig. 4) characterizes the double slotting bar 45. These bars are held in spaced relationship to each other by U-shaped straps 54, the ends of which are either welded or riveted to the bars 53 so as to compose a rigid construction. These straps 54 are spaced from each other to let the blades 47 through (Fig. 8). All of the straps 54 are alike with the exception of the pair 55 which are made slightly wider than the others. Said straps are notched at 56 to fit around the studs 41 and to enable a slight preliminary end motion relative to the cylinder 24 in one direction (Fig. 12) in abstracting the double slotting bar 45 from the casting 7.

Said straps 55 also carry pairs of adjusting screws 57, the points of which are adapted to rest upon the bands 30, 31 (Fig. 6) for regulating the depth to which the blades of the assemblage 43 extend into the mold cylinder 24. The blades

of the double slotting bar **45** are designated **58** (Fig. 4). They are winged at **59** and these wings coact with the wings **48** in completing the portions **8**, **9** of the slot **5** (Fig. 14). Said wings terminate in central lips **60** which coact with the lips **49** in completing the portions **10**, **12** of said slot. But in order to produce the inward flare **11** of the slot (Fig. 14), each of the lips **60** is bent at **61** so as to offset the lip **60** from the lip **49** (Fig. 9) when the two slotting bars **44**, **45**, are set together in the assemblage **43**. The blades **58** are flanged at **62** to provide for either welding or riveting to the straps **54**.

Rods **63** (Fig. 6) span the longitudinal distance of the rotary mold **2** (Fig. 8) and occupy holes in the closure rings **27**, beyond which they extend as shown. Clips **64** (Fig. 7) are fitted on the extensions, the latter being threaded to take the nuts **65**. The clips overlap the circular tracks **37** and when the nuts **65** are driven home the rings **27**, tracks **37** and bands **29**, **32**, are connected tightly at the ends of the cylinder **24**.

The operation

is readily understood. In assembling the rotary mold **2** the slotting assemblages **43** are mounted upon the various studs **41** in the various radial positions. In each assemblage the double-slotting bar **45** (Fig. 4) is set first. The slots **28** in the cylinder **24** are of ample width to accommodate the offset lips **60**. Any necessary end motion of the double bar **45** in making the emplacement of the slotting assemblage is accommodated by the notches **56** which, as shown in Fig. 4, are open on one side so as to fit around the studs **41**.

The single slotting bar **44** is emplaced next. The blades **47** pass through the spaces between the straps **54** and through the remainder of the slots **28** in the cylinder **24**, taking positions at the right of the previously emplaced blades **58** (Figs. 8 and 9). Those parts of the blades **47**, **58** now occupying the interior of the cylinder **24** constitute the cores of the slots **5** (Fig. 14) and their interior contours. The blades **47**, **58** of the latter of which the offset is a part, constitute a two-part core which is substantially equal in thickness to the least depth of the entrance opening or inlet slot **5**. On the same principle the thickness of the slot **28** also substantially corresponds with the least depth of the slot **5**. There is thus a fairly tight fit around the two-part core and the latter is necessarily made in two parts; in other words, has two plates **47**, **58** to enable the eventual two-step abstraction of the core. The studs **41** go through the holes **51**, and when the nuts **42** are screwed home the entire assemblage **43** is anchored tightly to the mold cylinder **24**.

The adjustment of the screws **57** (Fig. 6) regulate the extent of insertion of the blades **58**. The blades **47** are slightly longer than the blades **58** (Fig. 9) but the length is so made that when the single bar **44** is emplaced upon the double bar **45** the ends of the lips **49**, **60**, will register. The depth of adjustment by the screws **57** should bring the inner extremities of these lips flush with the interior circumference of the rings **27**. It is observed that the closing function of these rings obtains only to the extent of the internal space occupied by the concrete body **7**. Otherwise the mold cylinder is internally open.

The mold **2** is now set to rotating and the concrete mix or other desired plastic is placed in the rotating mold, the centrifugal force holding it in place against the interior of the cylinder **24**. A surplus amount of concrete or plastic is desirably placed into the mold, and while the latter is in rotation a leveling bar is emplaced axially of the mold and is rested upon the inner circumferences of the rings **37** so as to scrape off the surplus and leave the bore of the casting **7** smooth and round.

The mold **2** is then rotated at the proper speed and for a sufficient length of time to thoroughly pack the concrete around the slotting blades **47**, **58**, as well as to drive out all surplus moisture. The inner edges of the lips **49**, **60**, will just show on the interior of the casting **7**. To remove the latter from the mold it is first necessary to unscrew the nuts **42** from the studs **41**. The single slotting bar **44** is then pulled straight out (arrow *a*, Fig. 12). The slotting bar **45** is then pulled by giving it an initial end motion to dislodge the offset lips **60** from the flare **11** of the slot, and then straight out (arrow *b*, Fig. 12). The loops **52** are used in hoisting the bar **44**, but after this bar is removed it is relatively easy to lift the bar **45**.

After assemblages **44** and **45** are removed, mold **2** is picked up by a suitable hoisting gear and raised clear of rollers **19** and **20** (Fig. 2), circular tracks **37** are removed, mold **2** with its casting **7** is then stood on end resting on end enclosure **27**, nuts **65** are removed from bottom ends of rods **63** which are then removed thru top enclosure ring **27**, top enclosure ring **27** is lifted off the top, pins **35** (Fig. 6) are driven out of the four hinges **36** and the two halves of mold **2** are then opened up, casting **7** is left standing on lower enclosure ring **27** until cured, when casting **7** can be removed from enclosure ring **27**.

The holes left in the body **7** by the removal of the rods **63** are eventually used for the threading through of cables or long rods to hold the screen section **4** in line with superimposed casing sections.

I claim:

1. A casting machine for producing an inwardly flared entrance opening in a moldable substance, said machine comprising a container having a space for the substance in plastic form, said container having at least one slot which conforms substantially to the dimensions of the entrance opening, and a core filling the slot and extending into the substance-space, said core including an outwardly bent lip to form the flare and being of plural parts to enable progressive abstraction of the parts through said slot from the entrance opening when the substance has set.

2. A casting machine for producing an inwardly flared entrance opening in a moldable substance, said machine comprising a cylinder having an internally peripheral space for the substance in plastic form, said cylinder having at least one slot which is in substantial correspondence with the dimensions of the entrance opening, and a core filling the slot and extending into the substance-space, said core including an outwardly bent lip to form the flare and being of plural-blade form to enable progressive abstraction of the blades through said slot from the entrance opening when the substance has set in tubular form.

3. A casting machine for producing an inwardly flared entrance opening in a moldable substance said machine comprising a container having a space for the substance in plastic form, said container having at least one slot which is in substantial correspondence with the dimensions of the entrance opening, and a core filling the slot and extending into the substance-space, said core

consisting of a pair of blades laid face to face, one of the blades being offset from the other to form the flare and both blades being separately maneuverable through the slot both into and out of position in said space.

4. A casting machine for producing an inwardly flared entrance opening in a moldable substance, said machine comprising a cylinder having an internally peripheral space for the substance in plastic form, said cylinder having at least one slot which is in substantial correspondence with the dimensions of the entrance opening, means to rotate the cylinder thus to employ centrifugal force in driving the plastic substance outwardly into said space, and a core filling the slot to plug it against any material escape of the solids of said substance, extending into the space for the packing of the substance therearound, said core having twin blades one of which is straight and the other offset to define the aforesaid flare, said blades being separately movable in abstracting the core from the devious form of the opening.

5. A casting machine comprising a mold having at least one slot and an internal space for the occupancy of a moldable substance, means with which to form in said substance an entrance opening enlarging inwardly of said substance from the size of the slots, said means consisting of a pair of blades extending through the slot into the internal space, a pair of bars to which the blades are individually attached, and means by which the bars are anchored to the mold in superimposed positions, supporting said blades in filling positions in said slot and in core position in said space.

6. A casting machine comprising a mold having at least one slot and an internal space for the occupancy of a moldable substance, means with which to form in said substance an entrance opening enlarging inwardly of said substance from the size of the slot, said means comprising a core having a portion substantially filling the slot and another portion occupying the space in core position, a pair of blades which compose the core, one of the blades being offset from the other to form said inward enlargement, bars to which the respective blades are attached, being separately maneuverable both for the introduction of said offset into and back through the slot, and means by which said bars are anchored on the mold in superimposition upon each other, thus to support the core.

7. A casting machine comprising a mold having a row of slots and an internal space for the occupancy of a moldable substance, means with which to form in said substance a row of entrance openings in conformity with the slots, each of said openings enlarging inwardly of said substance from the size of the respective slot, said means consisting of a plurality of straight blades to form one side of each opening and a plurality of offset blades to form the flared sides of the openings, a bar carrying all of the straight blades, a double bar having spaced straps carrying the offset blades, and means for anchoring the respective bars to the mold and to each other in superimposed positions with the straight blades extending through the spaces between the straps closely beside the offset blades in occupancy therewith of the slots in suspended positions in said space.

8. A casting machine comprising a mold having at least one slot and an internal space for the occupancy of a moldable substance, means with which to form in said substance an entrance opening enlarging inwardly of said substance from the size of the slot, said means consisting of a support having a straight blade and another support having an offset blade, said supports having openings, and studs on the mold upon which said supports are fitted at the openings and secured in superimposition with said means extending through the slot into said space, one of said openings being elongated to allow endwise movement of the respective support in abstracting the offset blade from the substance when set.

9. A casting machine comprising a mold having a row of slots and an internal space for the occupancy of a moldable substance adjacent to the row, closures for the ends of said space extending inwardly of the mold only a fractional distance thereof, means for rotating the mold thus to centrifugally drive said substance outwardly in the mold into said space, cores occupying the slots and extending into the space, each of said cores consisting of companion blades at least one of which is offset to form a slot of devious shape in said substance, a pair of bars by the respective ones of which the blades of each kind are carried, means to anchor the bars together and to the mold, and means carried by at least one of the bars to rest against the mold and limit the extension of the cores to a line on a level with the inner limits of said end closures thus to allow striking off surplus volumes of the substance during the rotation of the mold.

10. A centrifugal casting machine comprising a power unit including confronting pairs of rollers, and means for driving at least one of the pairs of rollers, an entirely separate rotary mold emplaceable upon the power unit, said mold including a cylinder having tracks rested on the rollers in cradled positions between the pairs thereof thus to remain in place by gravity but be subject to rotation by the action of the rollers, cores carried by said mold, extending to the inside of the cylinder for the formation of slots in a moldable substance driven to the inner periphery of the cylinder by its rotation, and closure rings for the ends of the cylinder being of a radial dimension equal to that of the depth of inward extension of the cores thus to allow the application of a straight edge through the open center of the mold for striking off surplus volumes of the substance during rotation.

11. In a centrifugal casting machine, a rotary mold including a longitudinally halved cylinder, a plurality of circular bands for the cylinder, all of said bands being halved and two of the bands being located at the respective ends of the cylinder, circular tracks at said ends of the cylinder being fitted over the respective bands to hold them together, separable hinge connections for the ends of another one of said bands encircling the cylinder medially of its ends, closure rings separably combined with the tracks, and rods situated longitudinally of the cylinder, being affixed to the closure rings to hold them tightly against the ends of the cylinder.

WILLIAM KELLY.