April 7, 1925. 1,532,537

J. B. LADD

METHOD AND APPARATUS FOR CENTRIFUGAL CASTING

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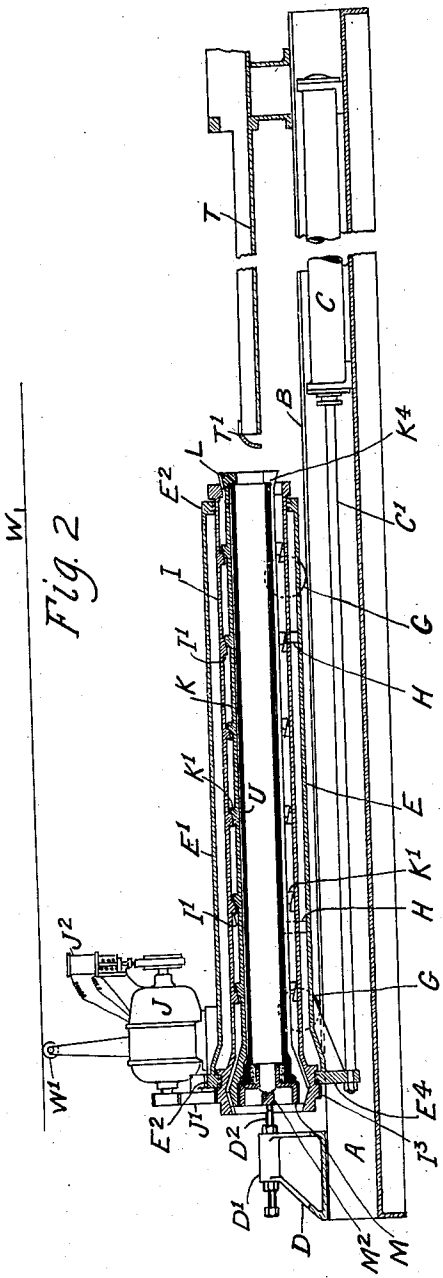


Fig. 2

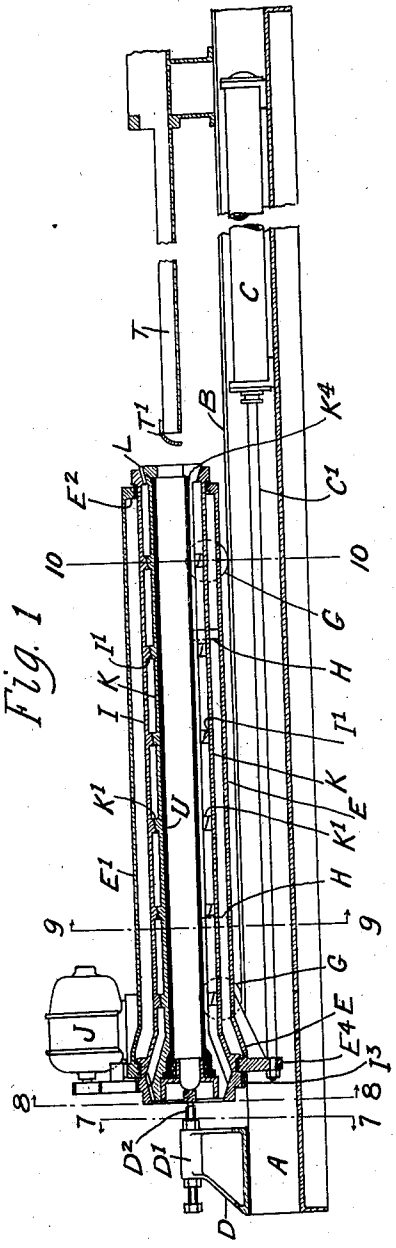


Fig. 1

INVENTOR
James B. Ladd
BY
ATTORNEY

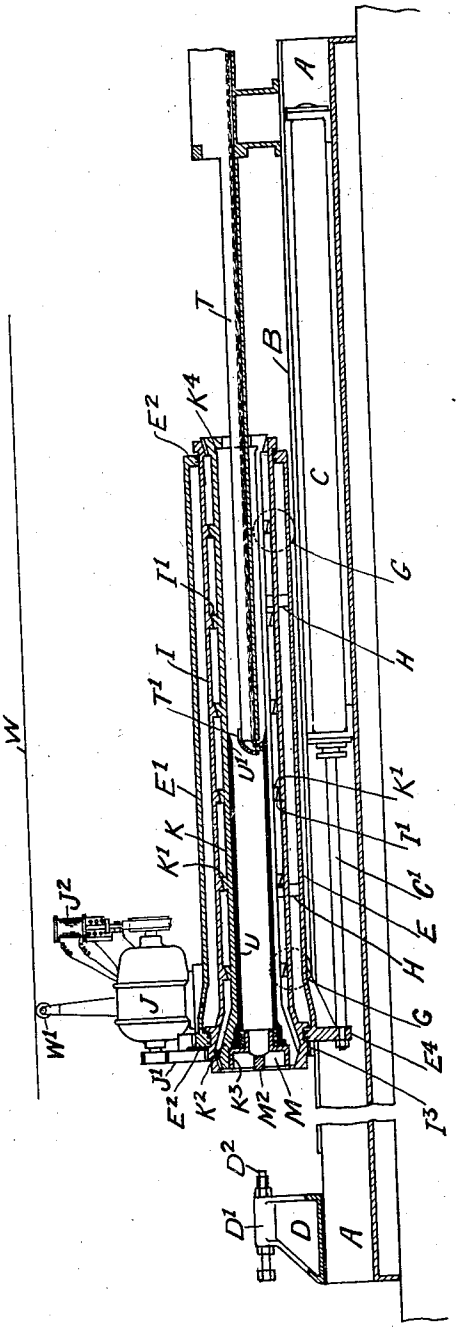
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J. B. LADD

METHOD AND APPARATUS FOR CENTRIFUGAL CASTING

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Fig. 3



INVENTOR
James B. Ladd
BY
Francis D. Chamberlain
ATTORNEY

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J. B. LADD

METHOD AND APPARATUS FOR CENTRIFUGAL CASTING

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Fig. 4

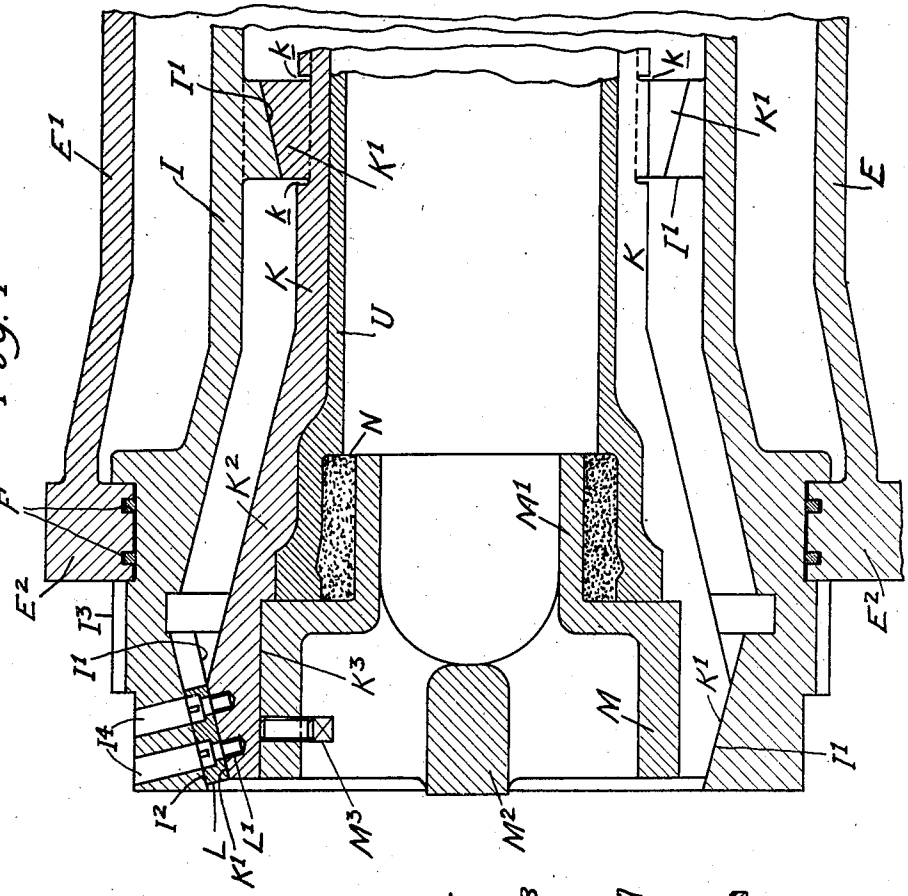
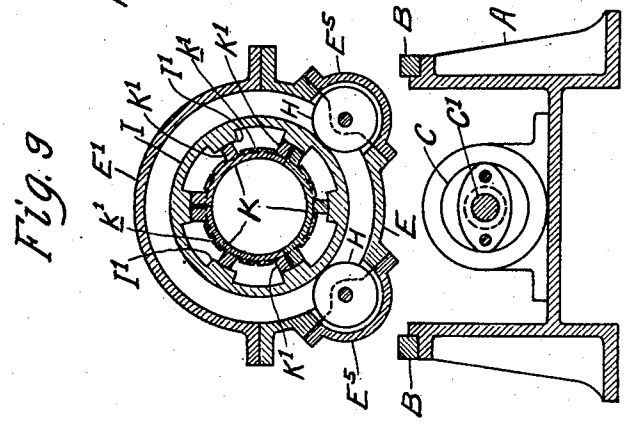


Fig. 9



INVENTOR
James B. Ladd
BY
James C. Chambers
ATTORNEY

April 7, 1925. 1,532,537

J. B. LADD

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Fig. 6

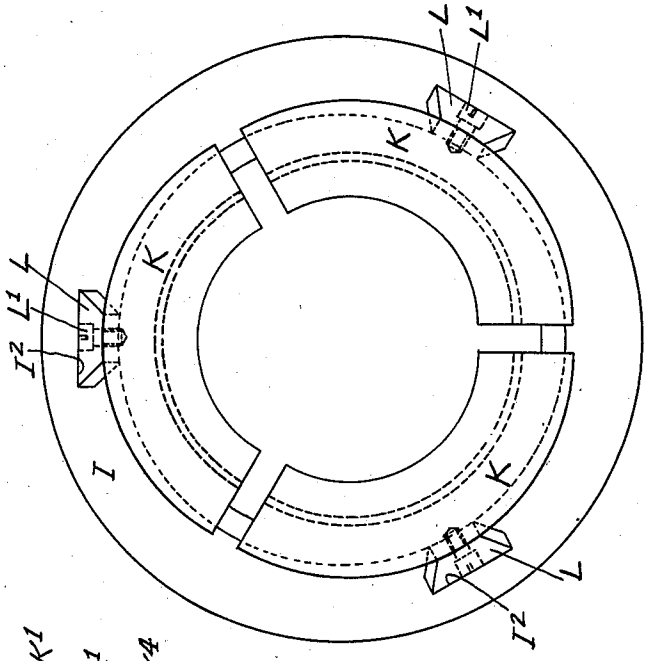
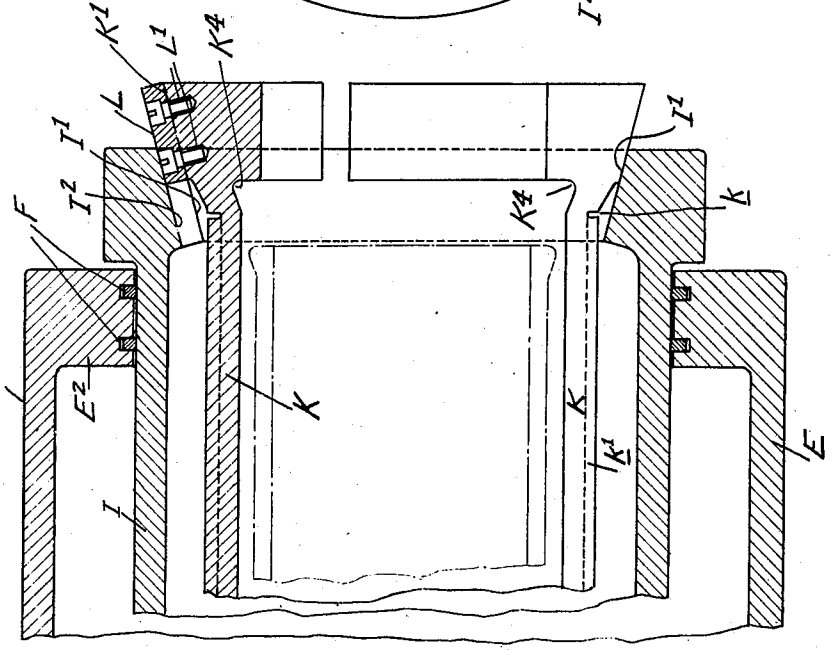


Fig. 5



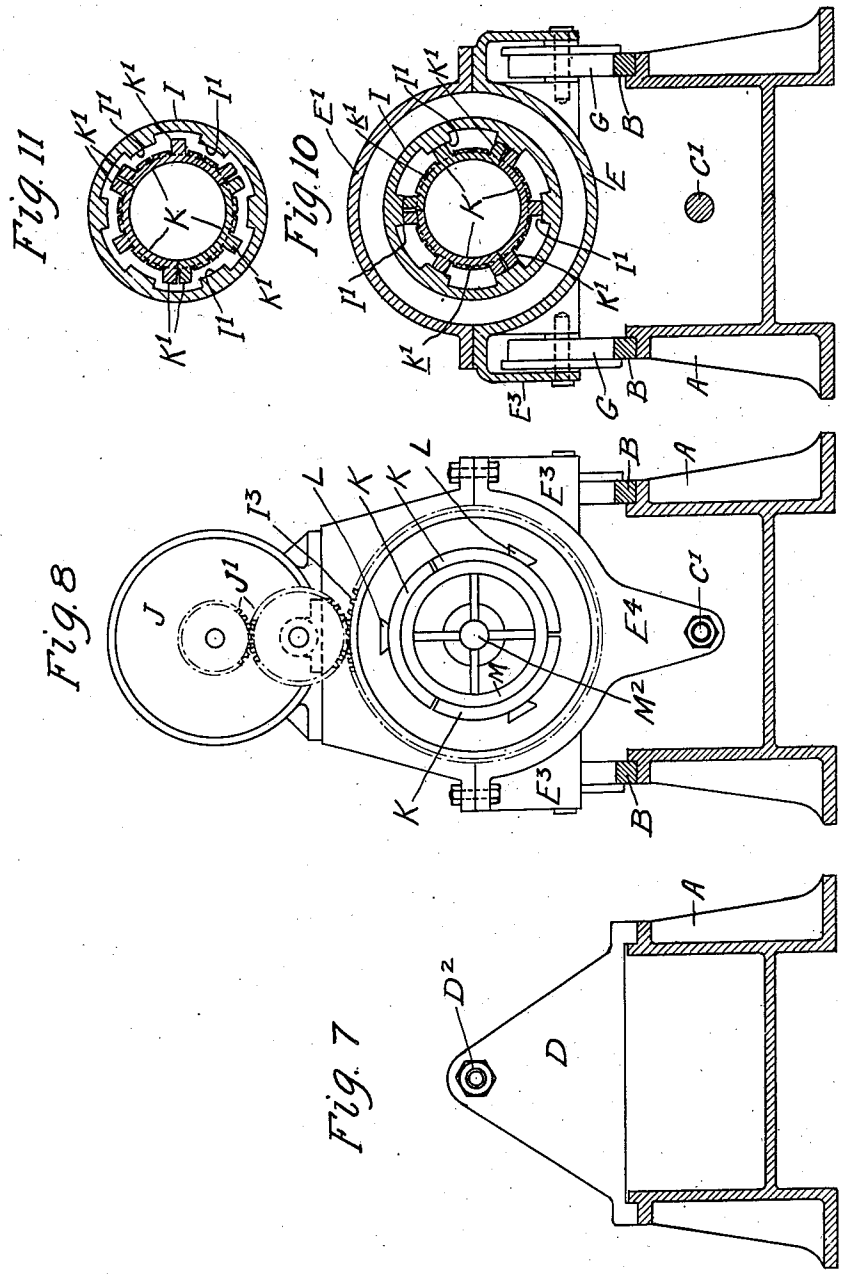
INVENTOR
James B. Ladd
BY
Francis Chamberlain
ATTORNEY

April 7, 1925. 1,532,537

J. B. LADD

METHOD AND APPARATUS FOR CENTRIFUGAL CASTING

Filed Nov. 28, 1922 5 Sheets-Sheet 5



INVENTOR
James B. Ladd
BY
Francis J. Clarke
ATTORNEY

Patented Apr. 7, 1925. 1,532,537

UNITED STATES PATENT OFFICE.

JAMES B. LADD, OF ARDMORE, PENNSYLVANIA, ASSIGNOR TO UNITED STATES CAST IRON PIPE & FOUNDRY COMPANY, OF BURLINGTON, NEW JERSEY, A CORPORATION OF NEW JERSEY.

METHOD AND APPARATUS FOR CENTRIFUGAL CASTING.

Application filed November 28, 1922. Serial No. 603,756.

To all whom it may concern:

Be it known that I, JAMES B. LADD, a citizen of the United States of America, and resident of Ardmore, county of Montgomery, State of Pennsylvania, have invented certain new and useful Improvements in Methods and Apparatus for Centrifugal Casting, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

My invention relates to an improved method of making centrifugal castings and to improvements in apparatus especially adapted for use in practising the said invention but capable of use in other methods of making centrifugal castings.

It has heretofore been proposed to use sectional molds for the casting of pipes and similar tubular castings with a special view of casting pipes with bell and bead ends which could not be extracted from a solid mold. It has also been proposed in the construction of molds of this character to make up a portion of the mold in which the bead end of the pipe, for instance, is cast, of a collapsible construction of molding sand so that the contraction of the casting in cooling will not result in breaking the casting. The object of my new method of casting pipes is to enable me to cast a bell and bead end pipe in a segmental mold and under conditions which will enable me to cast bead end pipes in molds having no collapsible or yielding sections.

The object of the mechanical part of my invention is to provide improved mechanism especially adapted for use in carrying my new method into practice but also adapted for use to a highly beneficial extent in the construction of any centrifugal molding apparatus in which it is necessary to use a longitudinally divided segmental mold.

The nature of my invention both in its method and mechanical features will be best explained in connection with the drawings which illustrate my improved apparatus as constructed especially for use by my improved method and in which—

Figure 1 is a sectional elevation of my improved centrifugal casting machine with the parts in the position in which a pipe has just been cast.

Figure 2 is a similar sectional elevation showing the machine in the position in which the mold sectors have been retracted radially to release the casting.

Figure 3 is a similar side elevation showing the casting machine in a position of the parts during the pouring of the metal into the mold.

Figure 4 is an enlarged detail view of the left hand end of the apparatus in the position of the part shown in Fig. 1.

Figure 5 is a similar enlarged detail view of the right hand end of the apparatus in the position of the part shown in Fig. 2.

Figure 6 is an end elevation of the apparatus as shown in Fig. 5.

Figure 7 is a cross sectional view on the line 7—7 of Fig. 1, looking toward the left.

Figure 8 is a cross sectional view on the line 8—8 of Fig. 1, looking toward the right.

Figure 9 is a cross sectional view taken on the line 9—9 of Fig. 1, looking toward the right.

Figure 10 is a cross sectional view on the line 10—10 of Fig. 1, and

Figure 11 is a detail view illustrating the angular positions of the mold sectors and casing during the operation of inserting the mold in the casing.

A indicates the framing on which the machine is supported and which supports at its top tracks indicated at B, B, on which the mold sustaining apparatus moves backward and forward preferably on an incline, as shown. C is a power cylinder supported on the framing A and C′ a piston rod extending from the piston, not shown, and connected with a downwardly extending lug E^4 of the casing section E. D is a bracket supported on the frame A having at its top a tubular head indicated at D′ in which is adjustably supported a stop indicated at D^2 the purpose of which will be hereafter explained. E, E′, are respectively the lower and upper sections of a divisional casing having inwardly turned flanged ends as indicated at E^2, E^2. From the sides of this casing extend brackets indicated at E^3, E^3, for supporting the wheels indicated at G, see Fig. 10, which wheels rest upon the tracks B. E^5, E^5, see Fig. 9, indicate removable sections of the casing section E on which are supported the rollers indicated at

H, H, which in turn support the rotatable casing I. F, F, indicate packing rings for making a tight joint between the casing E, E′, and the rotatable casing I so that the space enclosed between the casings E, E′, and I, may be used as a water jacket for cooling the casing I and the parts in contact with it.

The casing I, as shown, is provided with a multiple series of inwardly projecting wedge shaped lugs indicated at I′, these lugs being spaced apart to permit of the insertion and withdrawal of the mold segments. The outer inclined lugs I′ at both ends of the casing have under-cut slots formed in them, as indicated at I^2, for purposes to be hereafter described. 1^3 indicates gear teeth formed in the left hand end of the casing I by means of which it is rotated, and I^4, I^4, see Fig. 4, are openings formed through the left hand end of the casing I for the insertion of screw bolts L′. J indicates an electric motor supported on the casing section E′ and connected by gears indicated at J′ engaging the gear wheel I^3. J^2 indicates an electric brake for stopping the action of the motor and parts driven by it when the current is cut off from the motor.

K, K, etc., indicate the several segments, three, as shown, making up the segmental mold. These segments are provided with outwardly extending lugs indicated at K′ with inclined wedge surfaces adapted to contact with the inclined lugs I′ of the casing I and, in the construction illustrated, force the mold sectors together when the sectors are moved toward the left relatively to the casing I. L, L, are under-cut wedge pieces shaped to fit in the under-cut recesses I^2 of the casing I and secured to the ends of the mold sectors by bolts L′ and, to permit the under-cut wedge pieces I^2 to be properly assembled at the left hand side of the machine, the openings I^4 are formed in the casing I so that the under-cut pieces L can be inserted, after the mold sectors are assembled in the casing I, and secured in place by screw bolts L′ inserted through these openings. *k*, *k*′, are respectively circular and longitudinal slots formed on the outside of the sectors K for the purpose of making these sectors more flexible and insure that they will fit properly together when pressed together by the inter-acting wedge lugs. K^3 is a seat formed in the left hand end of the mold sectors to receive the core iron M which supports the core N for the bell end of the pipe. K^4, as best shown in Fig. 5, indicates the annular recess at the right hand end of the mold segments for the casting of the bead on the end of the pipe. M is a core iron for supporting the core for the bell end of the pipe, this core, indicated at N, being supported on the portion M′ of the core iron and the core iron having a central boss indicated at M^2 which is located in alignment with the stop D^2. The core iron is secured to one of the mold sectors by a bolt as indicated at M^3 and is readily removable from the end of the mold. T indicates the runner through which melted metal is run into the mold and, as shown, is provided with a lip indicated at T′ for directing the metal downward into the mold. U indicates the casting formed in the mold. U′, Fig. 3, indicates a freshly poured portion of the casting when made by the process of pouring indicated in Fig. 3. W indicates the line wire by which the electric current is fed to the motor through the roller indicated at W′.

In assembling the apparatus the segmental mold is inserted in the casing I as indicated in Fig. 11 and is then turned so that its wedge lugs K′ will come into the operative position with regard to the wedge lugs I′. As shown in Fig. 10, when in proper angular relation, the under-cut wedge pieces L are secured to the mold sectors and inserted in the under-cut recesses I^2 of the casing I, these pieces securing each mold sector in proper angular position to the casing I and also so securing the parts together that movement of the mold sectors with reference to the casing I toward the right results in an outward radial movement of the sectors while a reversed longitudinal movement moves the sectors together and, in connection with the intermediate lugs K′ and I′, clamps the sectors tightly together, the flexibility of the sectors brought about by the slots *k*, *k*′, insuring that their edges can be forced into tight contact with each other.

Preparatory to casting a pipe in the mold the mold sectors are moved toward the left in the casing I until they are tightly clamped together, the core iron M having, first, been secured to one of the sectors. The wheel supported casing E, E′, carrying with it the casing I and the mold, is then moved toward the right until the end of the runner T is at the extreme left hand end of the mold. The mold is then rotated and melted metal is permitted to flow into the mold through the runner T, the mold remaining perfectly stationary longitudinally until sufficient metal has entered the mold to fill the bell end and then the mold is moved by the cylinder and piston indicated at C, toward the left and, the mold being in full rotation through the action of the motor J, the metal is laid in the moving mold in spiral coils, the casting being thus progressively formed as indicated in Fig. 3, and the cooling and hardening of the casting being preferably accelerated by the cooling effect of water in the water jacket formed between the casings E,

E' and I, drawing heat from the mold through the contact points between the contacting wedge lugs and the mold sectors on the casing I, so that the metal is not only progressively laid into the mold but is progressively cooled therein so that the metal at the left hand end of the mold will progressively cool, harden and contract while the metal progressively fed to the mold towards its right hand end is still fluid, the result of which, obviously, is that such contraction as occurs in the casting during the progressive pouring of the metal exerts no disruptive strain on the casting and is fully compensated for by the flow of the fluid metal and these conditions are maintained during the entire pouring of the casting until and after the metal enters the portion K^4 of the mold which forms the bead at the end of the pipe. But obviously, any contraction in the casting which occurs after the solidification of the metal forming the bead would tend to disrupt the casing and it is of the essence of my method invention that the mold sectors should be moved apart to release the bead immediately on the solidification of the metal forming the bead and before such further contraction in the casting takes place as would tend to disrupt it. This opening of the mold sectors I automatically provide for by the adjustment of the stop D^2 which, immediately after the casting of the bead, comes in contact with the boss M^2 of the core iron M and causes a thrust on the segmental mold which holds it in position while the casing I continues to move toward the left with the effect that the under-cut wedge pieces L move the mold sectors rapidly outward to the position indicated in Figs. 2 and 5, releasing the bead and permitting the casting to contract as indicated in Fig. 5.

Immediately on or contemporaneously with the outward movement of the mold sectors, current is cut off from the motor and the brake brought into action, stopping the rotative movement of the motor and of the mold and thereafter the core iron M is removed, the cast pipe withdrawn from the mold, mold sectors again clamped together and the new pipe cast.

A metallic mold which is exposed to the direct contact with molten metal must have considerable thickness of walls and where the mold is made up of segments the segments are liable to distortion from strains arising from rapid heating and cooling. When distorted the edges of the segments will not normally fit together and, owing to the thickness of the segments they are not sufficiently flexible to be forced into contact.

In my pending applications filed July 12, 1922, Serial Numbers 574,469 and 574,470, I have described as a means for diminishing disruptive strains in solid pipe molds the cutting of narrow grooves in the inner or outer or inner and outer surfaces of the molds and in making up segmental molds I have discovered that the slotting of the mold segments will not only diminish disruptive strains but will make the segments sufficiently flexible to be forced into contact with each other even when distorted while, at the same time, preserving the necessary wall thickness of the segments.

While, as shown and described, my improved machine is especially designed for the casting of pipes by the method above described it will be obvious that it embodies many novel features of construction which are capable of use in connection with collapsible or yielding molds for the casting of the bead end of the pipe and in another application filed November 29, 1922, Serial No. 603,757, I have described and claimed the combination of a similar segmental mold and mold actuating mechanism with a yielding and collapsible mold section in which the bead is cast.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A centrifugal casting apparatus comprising a rotatable casing in combination with a segmental mold and means connecting the mold segments with the casing and whereby the segments can be moved radially towards and from the center line of the mold.

2. A centrifugal casting apparatus comprising a rotatable casing in combination with a segmental mold and means connecting the mold segments with the casing and whereby the segments are moved in and out in radial planes when shifted longitudinally in the casing.

3. A centrifugal casting apparatus comprising a rotatable casing in combination with a segmental mold and interengaged inclined surfaces connecting the mold segments with the casing whereby the mold segments are moved in and out in radial planes when shifted longitudinally in the casing.

4. A centrifugal casting apparatus comprising a rotatable casing having inwardly extending inclined bearings for the mold segments in combination with a segmental mold the segments of which are provided with inclined bearings adapted to co-act with the bearing of the casing to lock the mold segments together when the mold is moved longitudinally in one direction and to permit the segments to separate when the mold is moved in the other direction.

5. A centrifugal casting apparatus comprising a rotatable casing in combination with a segmental mold, interengaged inclined surfaces connecting the mold segments with the casing whereby the mold

segments are moved in and out in radial planes when shifted longitudinally in the casing and a series of inclined bearing surfaces formed in the casing and on the mold segments for clamping the segments together along their length.

6. A centrifugal mold for casting made up of longitudinal segments slotted to increase their flexibility.

7. A centrifugal mold for casting made up of longitudinal segments longitudinally and circumferentially slotted to increase their flexibility.

8. A centrifugal mold for casting made up of longitudinal segments externally slotted to increase their flexibility.

9. A centrifugal casting apparatus comprising a rotatable casing in combination with a segmental mold, the segments of which are slotted to increase their flexibility and means located between the casing and mold for clamping the mold segments together at multiple points along their length.

10. A centrifugal casting apparatus comprising a rotatable casing in combination with a segmental mold, interengaged inclined surfaces connecting the mold segments with the casing whereby the mold segments are moved in and out in radial planes when shifted longitudinally in the casing, a series of inclined bearing surfaces formed in the casing and on the mold segments for clamping the segments together along their length and a water jacket enclosing the rotatable casing.

11. A centrifugal casting apparatus comprising a rotatable casing in combination with means for moving said casing longitudinally, a segmental mold located in the casing and longitudinally movable therein, means located between the casing and mold segments for clamping the segments together when they are moved longitudinally in one direction and means located in the path of the moving casing for shifting the mold segments in a direction to unclamp them and permit them to move apart.

12. A centrifugal casting apparatus comprising a rotatable casing in combination with means for moving said casing longitudinally, a segmental mold located in the casing and longitudinally movable therein, means located between the casing and mold segments for clamping the segments together when they are moved longitudinally in one direction, a bell core ring secured to the end of one of the mold segments and means located in the path of the moving casing adapted to contract with the core ring and shift the mold segments, to unclamp them and permit them to move apart.

13. A centrifugal casting machine comprising a rotatable casing having projecting inward therefrom a series of inclined bearing surfaces arranged in longitudinally running rows with clear spaces between said rows, in combination with a segmental mold each segment of which is provided externally with one or more rows of inclined bearings extending outwardly and of such breadth that they will pass between two rows of bearings of the casing to permit the insertion and withdrawal of the mold and means for holding the mold segments in operative position in the casing.

14. In the operation of a centrifugal pipe casting machine comprising a segmental mold the segments of which are movable in radial planes and formed when assembled to cast a pipe with bell and bead ends, the method of casting which consists in pouring the metal progressively into the mold beginning at the bell end so that such solidification and contraction of the casting as occurs before the bead end is solidified can take place without disruptive tendency and moving the mold sectors apart immediately on the solidification of the bead end to relieve the casting of disruptive strains.

JAMES B. LADD.