(No Model.) 2 Sheets—Sheet 1.

S. L. KNEASS.

APPARATUS FOR CASTING HOLLOW ARTICLES.

No. 538,835. Patented May 7, 1895.

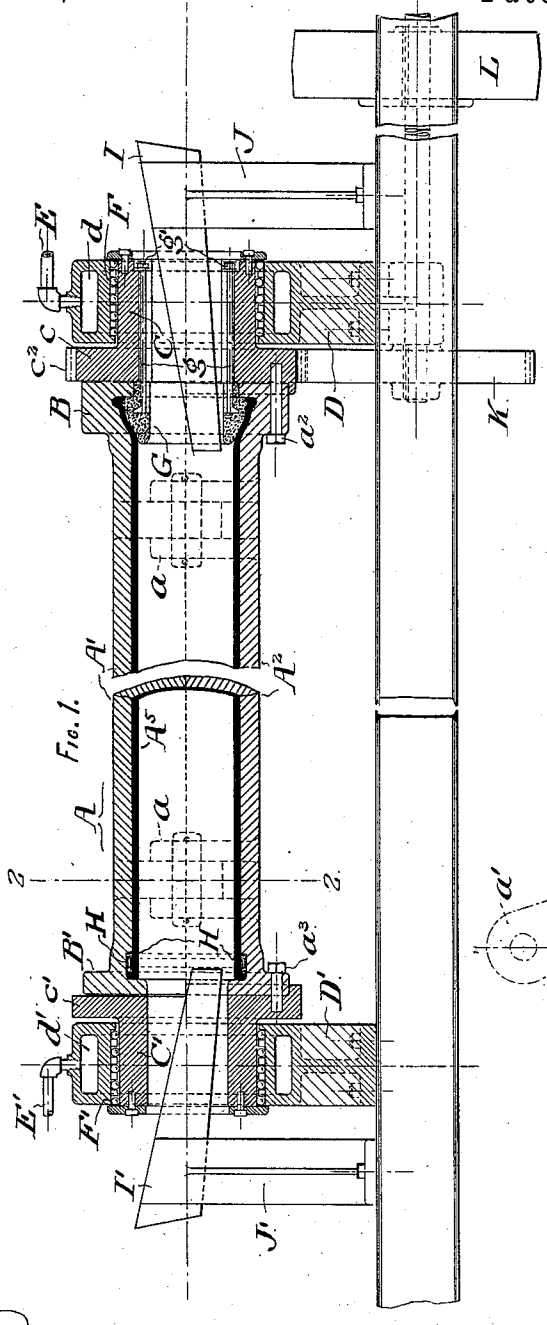

Fig. 1.

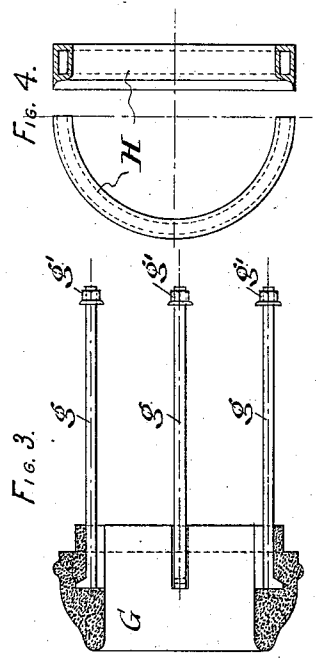

Fig. 4.

Fig. 3.

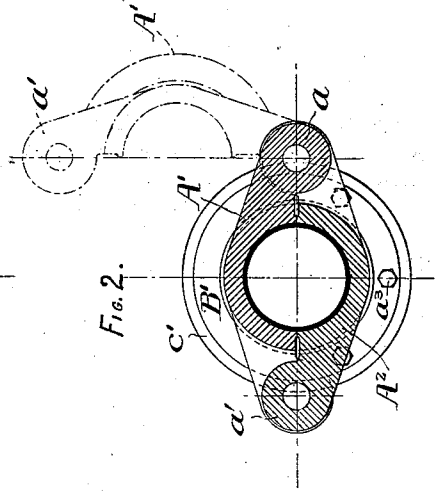

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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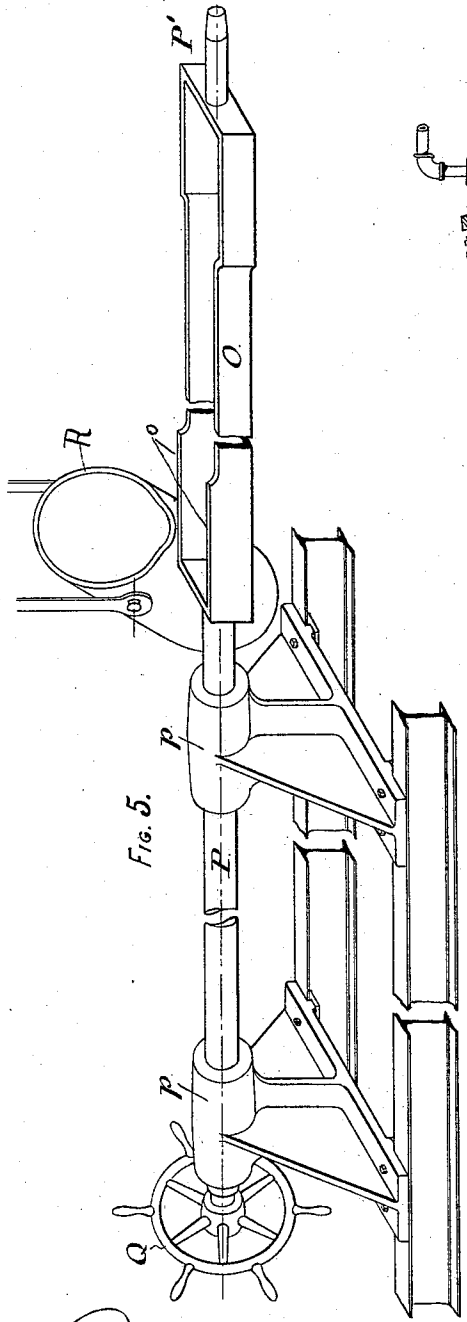

Fig. 5.

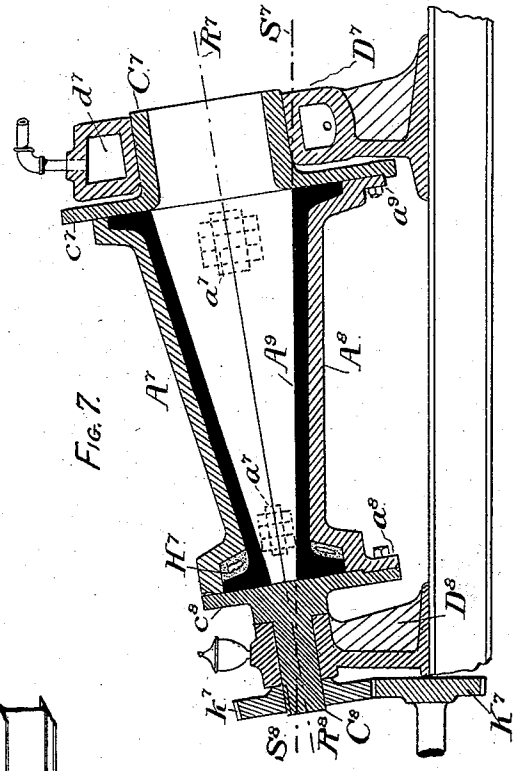

Fig. 7.

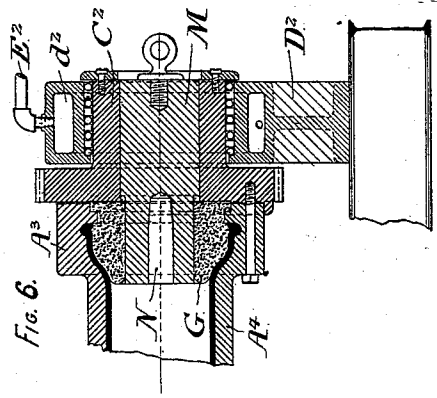

Fig. 6.

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APPARATUS FOR CASTING HOLLOW ARTICLES.

SPECIFICATION forming part of Letters Patent No. 538,835, dated May 7, 1895.

Application filed August 6, 1892. Serial No. 442,368. (No model.)

To all whom it may concern:

Be it known that I, STRICKLAND L. KNEASS, of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Apparatus for Casting Hollow Articles, of which the following is a specification.

My invention is adapted to the casting of hollow articles, generally, in which the interior cavity is in the form of a cylinder, cone or frustum of a cone, irrespective of the configuration which may be given to the exterior of the article.

An obvious application of my apparatus is found in the casting of iron pipe, and in Figures 1 to 6, both inclusive, of the accompanying drawings, it is exemplified as adapted to produce an iron pipe of the ordinary form.

In said drawings, Fig. 1 represents a vertical longitudinal section of the apparatus employed. Fig. 2 is a transverse section of the mold upon the line 2 2 of Fig. 1. Fig. 3 is a sectional view, on an enlarged scale, of the local core which is used as an adjunct in forming the bell-mouth of the pipe. Fig. 4 embraces, also on an enlarged scale, a partial end view and a sectional view of the collapsible ring, which is employed to permit the longitudinal contraction of the casting during cooling. Fig. 5 is a diagrammatic view, in isometric perspective, illustrating a modification of the device for introducing the melted metal into the mold; and Fig. 6 is a partial vertical longitudinal section of one end of a mold adapted to be used in connection with the devices shown in Fig. 5.

Another type of apparatus adapted to the production of a hollow casting, whose interior cavity is in form the frustum of a cone, is illustrated in Fig. 7, which represents a vertical longitudinal section through an apparatus adapted to produce such casting.

I will now proceed to describe the apparatus adapted to the casting of a pipe, by reference to Figs. 1 to 6.

A represents the mold, which, unless a "non-chilling" material is to be used for the casting, should be so constructed as not to impart a "chill" thereto. Said mold has the form of a hollow cylinder constructed in two longitudinal sections, A', A^2, hinged together by means of projecting lugs, a, placed at proper intervals along the side, corresponding lugs, a', being arranged along the other side to provide a means of locking the sections together. The mold in the present instance is rotatably mounted upon a true horizontal axis, a preferred arrangement of parts for the object being as follows: At the respective ends of the mold are annular flanges, B, B', respectively. Hollow trunnions, C, C', having enlarged annular face plates, c, c', respectively, are mounted in movable housings, D, D', at the proper distance apart and the flanges, B, B', fit closely against the said face plates, c, c', the flanges of the lower section, A^2, being secured to the said face plates by means of bolts a^2, a^3, while the flanges upon the upper section, A', are left free, with sufficient clearance space to permit of the movement of said section upon its hinges when it is desired to open the mold. The housings, D, D', are preferably provided with hollow channels, d, d', for water circulation, maintained through the pipes, E, E', respectively. Ball-bearings, indicated at F, F', respectively, may be used to permit the freest possible rotation of the trunnions within the housings. The outer periphery of the face plate, c, is provided with gear teeth, c^2, which engage with the teeth of the gear, K, suitably mounted for rotation by means of a driving pulley, L. At the end of the mold which is at the right hand side in Fig. 1, and at which the bell mouth of the pipe is to be formed, I provide a local core, G, annular in form, whose outer periphery has the configuration required to form the inner surface of the bell mouth, the adjacent end of the mold proper being of course suitably formed, to give the desired exterior surface to the said bell mouth. This core, G, is supported by means of bolts, g, (see Fig. 3) whose inner ends are anchored in the sand, or other material composing the core, and whose outer ends are provided with nuts, g', bearing against the outer face of the trunnion C. The molding surface at the other end of the mold, A, (to the left in Fig. 1) has the configuration required for producing the usual exterior flange around the pipe, such configu-

ration of course consisting of an annular groove of the proper depth, but as the pipe would be liable to break by reason of longitudinal shrinkage in the act of cooling, if the flange were rigidly held in said groove against movement in a direction longitudinal with the mold, I provide the following devices to avoid this danger; the groove is made of the desired depth but considerably wider than would be necessary to form such flange and a collapsible hollow ring, H, whose inner surface is flush with the inner surface of the mold proper, is placed within said groove, one of the faces of said ring fitting snugly against the wall of the groove which is farthest from the end of the mold, and thus reducing the width of the groove to the proper point. This ring may be composed of any friable material sufficiently cohesive and refractory to sustain the molten metal and give the proper support thereto until it has solidified, but of such character as to collapse when subjected to the longitudinal strain of the pipe in cooling.

At the respective ends of the molds are inclined troughs or conduits, I, I′, respectively, suitably supported upon uprights, J, J′, and extending through the hollow trunnions into the interior of the mold, A.

The process of casting a pipe by means of such an apparatus is as follows: The pulley, L, being actuated, the mold is caused to rotate at the desired speed and thereupon a quantity of molten metal equal in weight to the weight of the casting to be produced, and just sufficient to give the required thickness to the wall of the pipe is introduced through one or both of the hollow trunnions by means of the conduits, I, I′. The fluid metal spreads evenly over the interior surface of the mold, A, seeking the lowest level and building up radially inward. At that end of the mold where the bell mouth is to be formed the metal flows into the space between the local core, G, and the proximate surface of the mold until said space is full, but further accumulation of metal at this point is of course prevented by the core G. The cool surface of the mold causes the metal in immediate contact therewith to congeal at once, and a thin coating of solidified metal is thus formed which gradually increases in thickness as the inner portions congeal. The longitudinal shrinkage of the pipe, after solidification and during the cooling period, is permitted by the collapse of the hollow ring, H, and when the pipe is sufficiently cool to be removed, the mold is opened upon its hinges and the casting lifted out. The thickness of the wall of the pipe proper is determined entirely by the quantity of metal that is poured into the mold, and consequently can be varied at will without change in the device further than modifying the size of the local core at the bell mouth, the use of such local core being obviously only necessary when a portion of the pipe, or other article, is to have a greater diameter than the remainder, without an increase in the thickness of the wall at such portion.

Where the pipe, or other casting, is to be a very long one, I prefer to use the device shown in Figs. 5 and 6, in order to diffuse or spread the melted metal with the utmost regularity along the surface of the mold. Referring to the said figures, A^3, A^4, represent the upper and lower sections of the mold, respectively; only that end being shown at which the bell mouth of the pipe is formed. The method of rotatably supporting the mold by means of trunnions is precisely the same as that before described, but the hollow trunnion, C^2, at the end shown in Fig. 6, is provided with a central plug, M, which fits tightly therein, and the inner end of said plug has a central cavity, N, axially in line with the axis of the mold and trunnion. A long trough, O, of slightly less width than the internal diameter of the mold itself, is centrally mounted at one end upon a shaft, P, supported in elongated bearings, *p*, said shaft being provided with a hand-wheel, Q, or other device for rotating it. At the other end of said trough is a projecting stem or journal, P′, which fits freely in the cavity, N, of the plug, M. This trough, O, is of sufficient length to extend along the whole interior of the mold and project out beyond the hollow trunnion, at the end which is attached to the shaft, P, and it is thus rotatably mounted upon an axis coinciding with the axis of the mold. The sides of that portion of the trough which project out beyond the hollow trunnion are raised above the normal level of the remaining portion of the sides, as indicated at *o*, in Fig. 5. The mode of operation practiced with it is as follows: The trough, O, being placed in position within the mold, the latter is rotated as before, and the melted metal is poured from the vessel, R, into the outwardly projecting end of the trough, whence it flows along and distributes itself equally therein. When sufficient metal has been poured in, the trough is turned or tilted upon its longitudinal axis by means of the hand-wheel, Q, and the metal is thus poured out in an extended sheet along the whole length of the mold so as to become completely diffused along the surface before it has had time to chill at any point. The raised sides of the trough permit the operator to pour in the melted metal at the outwardly projecting end thereof without danger of overflow during the act of pouring; and, furthermore, when the trough is tilted to distribute the metal in the interior of the mold, these raised projections confine the overflow of the metal to the region which is within the mold proper.

The mode of operation, except in so far as it is modified by this system of distribution, is the same as that before described, and a similar result is of course produced.

In the use of the apparatus just described,

the interior cavity of the casting is cylindrical in form, (excepting, of course, at the point where the operation is modified by the presence of the local core, G,) by reason of the location of the axis of rotation in the plane of the horizon.

As the surface of the melted metal lying immediately above the longitudinal element of the mold, which is for the time being the lowest, tends to lie in practically a horizontal plane, each longitudinal element of the surface of the cavity in the finished casting will be rectilinear, and, in the instance just described, will be parallel to the axis of rotation.

When the apparatus is adapted to the production of a hollow casting whose cavity has the shape of a cone, or frustum of a cone, the position of the axis of rotation with reference to the plane of the horizon must be modified, and I will now proceed to describe the casting of a hollow conical column provided with flanges at each end and having the wall intermediate between said flanges of substantially uniform thickness. The apparatus proper for such application of the process is shown in Fig. 7.

The mold consists of two parts, A^7, A^8, hinged together as indicated at a^7, the lower section, A^8, being secured by its projecting flanges, a^8, a^9, to the faces, c^7, c^8, of the rotating trunnions, C^7, C^8, respectively. These trunnions rotate in inclined bearings, D^7, D^8, respectively. In the instance shown, only the trunnion, C^7, is made hollow to permit the introduction of melted metal, the other trunnion, C^8, being provided with a gear, k^7, actuated by means of a driving gear, K^7. The molding surface at each end is suitably enlarged to form the flanges upon the casting, and adjacent to one of said enlarged portions a collapsible ring, H^7, to permit longitudinal shrinkage of the casting, is provided. The axis of rotation of the mold is indicated by the lines R^7, R^8, which is inclined as shown to the plane of the horizon, indicated by the line S^7, S^8. The angle of inclination is of course determined by reference to the desired pitch of the conical cavity to be produced within the casting, A^9. The surface of the melted metal, as before stated, tends to lie in a horizontal plane, and therefore all the longitudinal elements which together constitute the surface of the cavity in the finished casting will lie at the same angle to the axis of rotation.

In both the illustrations given, of the application of my process, the longitudinal elements of the molding surface (disregarding the local enlargements for bell mouth, flanges, &c.), are substantially rectilinear, and in both instances the longitudinal element, which is for the time being lowest in rotation, lies in a substantially horizontal plane. Hence the wall of the casting, in each instance, is of the same thickness from end to end. Obviously, however, the thickness of the wall of the casting may be modified in any desired manner by modifying the molding surface, and, even with a molding surface whose longitudinal elements are rectilinear, a tapering wall may be produced by so inclining the axis of rotation that the longitudinal elements of the molding surface shall, when in their lowest position, lie at an angle to the plane of the horizon, the amount of taper being in accordance with the degree of inclination.

Having thus described my invention, I wish it to be understood that I do not broadly claim the use of a rotatable mold, since I am aware that such molds are not, broadly speaking, new. Furthermore, while it is one object of my invention to dispense with the use of a core in the casting of articles of this class, it is obviously in conformity with the spirit of the invention that a local core or cores should be employed to modify what would otherwise be the action of the apparatus throughout certain limited portions of the body of the casting.

I claim—

1. The combination of a mold rotatably mounted upon an axis in the described relation to the plane of the horizon and having a portion of its molding surface enlarged or extended radially outward from said axis, with a collapsible hollow ring partly filling said enlarged portion and arranged at that side thereof against which the longitudinal strain of the casting is exerted in the act of cooling, and means for rotating said mold and for introducing melted metal into the interior thereof.

2. The combination of a mold constructed in two longitudinal sections, said sections being provided with hinges and with locking mechanism, with a pair of trunnions rotatably mounted at each end of said mold upon an axis in the described relation to the plane of the horizon; means substantially as set forth whereby one section of said mold is secured at each end of said trunnions, respectively; means substantially as set forth for rotating said trunnions; and means substantially as set forth for introducing melted metal into the interior of the mold.

3. The combination of a two-part tubular mold rotatably mounted upon a horizontal axis and having its molding surface at one end extending radially outward from said axis to form a bell mouth for the casting, and its molding surface at the other end extending outward in the form of a groove, with a local core supported in proximity to said bell mouth end; a collapsible ring arranged in said groove at the other end of the mold and partly filling said groove, substantially as set forth; and means substantially as set forth for rotating said mold and for introducing the melted metal into the interior thereof.

4. The combination with a tubular mold rotatably mounted upon a horizontal axis, of a trough arranged within said mold and projecting beyond the ends thereof, the sides of the projecting portions of said trough being

raised above the normal line of the trough; journals at the respective ends of said trough, whose axis corresponds with the axis of rotation of the mold; means substantially as set forth for rotating said mold; and means substantially as set forth for turning said trough upon its journals whereby the melted metal may be poured in a diffused sheet along the interior surface of the mold, substantially as and for the purposes set forth.

STRICKLAND L. KNEASS.

Witnesses:
JAMES H. BELL,
E. REESE.