May 5, 1942. T. P. ANTHONY 2,281,867

CENTRIFUGAL SOIL PIPE CASTING MACHINE

Filed Nov. 8, 1939

FIG. I.

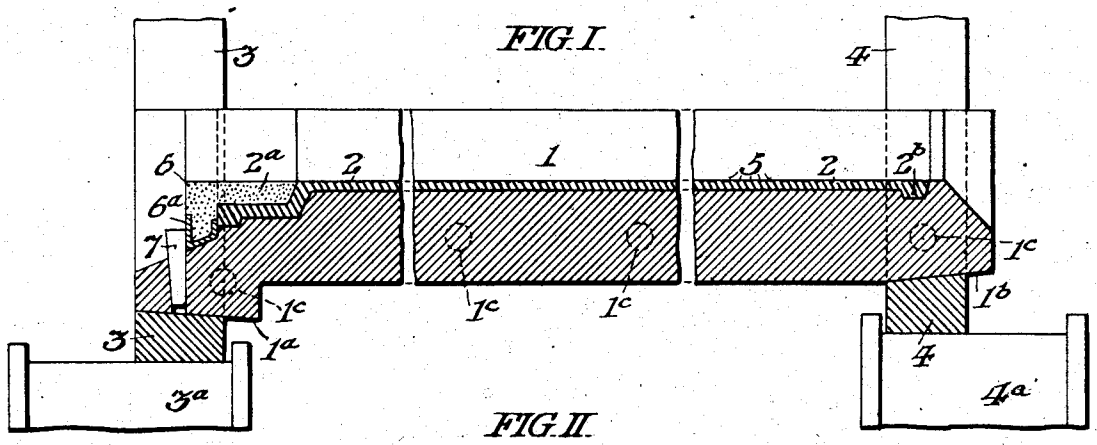


FIG. II.

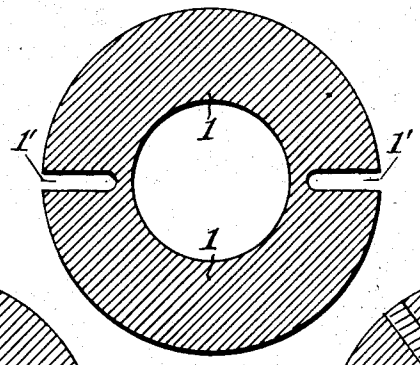


FIG. III.

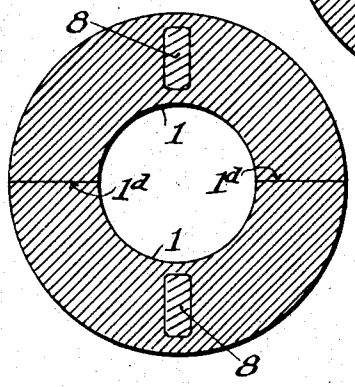


FIG. IV.

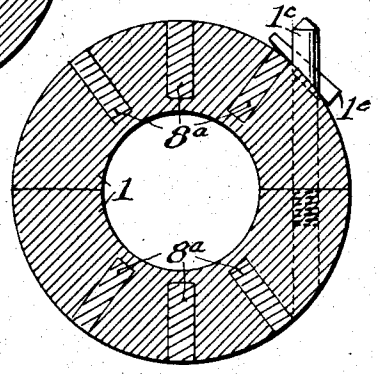


FIG. VI.

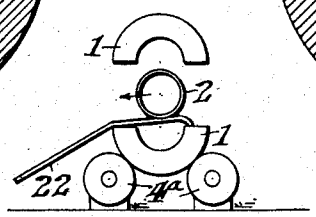
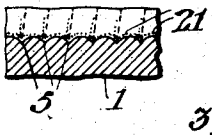


FIG. V.



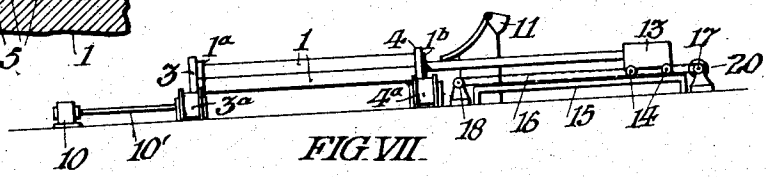


FIG. VII.

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CENTRIFUGAL SOIL PIPE CASTING MACHINE

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Application November 8, 1939, Serial No. 303,449

3 Claims. (Cl. 22—65)

My invention relates particularly to cast metal molds in which may be centrifugally cast pipes which are cylindrical intermediate of their ends but have enlargements at both ends. For instance, what are known to the trade as double bell, bell and spigot, flange pipe, lug pipe, and universal pipe, the latter having opposite end flanges which are turned and bored for a circular series of bolts extending parallel with the axis of the pipe. Molds for pipe with such enlargements must be split longitudinally to permit the castings to be removed laterally with respect to their axes, as distinguished from the ordinary molds for making centrifugally cast pipe, in which the castings are withdrawn axially with respect to the molds. However, there are several features of my invention which may be advantageously employed in molds of the latter character.

The split molds above contemplated can be made in halves with planed joints, or made in one piece and partly cored apart and split with wedges after boring. In any case, an essential feature of my invention is that the cylindrical portion of the mold between the enlarged ends thereof is provided with corrugations on its inner surface extending transversely to its axis forming shallow grooves in which the molten metal extends. The principal purpose and effect of such indentations in the inner surface is that the cast metal engages them so that the stress of shrinkage as the casting cools and contracts axially is distributed throughout the length of the casting, whereas, if the inner surface of the mold is turned smooth, the shrinkage causes the casting to crack at the junction of its cylindrical portion with its enlarged ends, where such stresses are then concentrated. A secondary purpose and effect of such corrugations is to receive and retain therein a dry refractory powder conveniently consisting of two parts of silica sand of particles all of which will pass through a ninety mesh sieve, mixed with one part of powdered lampblack. Such powder is simply dumped into the mold while it is being rotated and the centrifugal effect of rotation distributes it uniformly over the inner corrugated surface. I prefer to make such corrugations by what is known to the machinists' trade as a "roughing boring tool" which produces a groove which is helical with respect to the axis of the mold. However, suitable corrugations in the bore of the mold can be made with ordinary knurling tools.

The molds herein contemplated are of massive character, for instance, for ordinary soil pipe the walls of the mold are two and one-half inches thick. Such molds, when made entirely of ordinary cast iron, dissipate the heat of the cast metal radially therefrom very slowly. Therefore, another feature of my invention is to include in the mold walls material which will facilitate the interchange of heat from the cast metal to the exterior of the mold. Such means may be bars of copper or copper alloy which extend longitudinally and radially in the cast metal of the mold, or may be pieces of such copper or alloy extending radially in the mold, or copper may be included directly in the iron of which the mold is formed. For instance, the molds may be made of an alloy which is principally iron but includes, say, 8% of copper, .50% of chrome, and .30% of molybdenum. I have found in practice that if centrifugal molds are made of ordinary cast iron in semi-cylindrical sections, those sections become distorted by expansion of the metal intermediate of their arcs so that the pipes cast therein are somewhat elliptical in cross section instead of cylindrical. The means aforesaid for increasing the heat conductivity of the molds prevents such distortion.

Another feature of my invention utilized with the longitudinally split molds above contemplated is that the ends of the mold sections are turned to outwardly converging conical form and the sections are clamped together by forcing correspondingly conically tapered rings thereon, which rings have outer cylindrical surfaces so that they serve to support the mold by resting upon pairs of flanged rollers which are mounted in parallel spaced relation at the opposite ends of the mold.

My invention includes the various novel features of construction, arrangement, and method of operation hereinafter more definitely specified.

Fig. I is a vertical longitudinal sectional view of the lower half of a mold embodying my invention, with fragments of supporting rollers for the same.

Fig. II is a cross sectional view of a cylindrical casting for a mold embodying my invention with diametrically opposite cored slots in its perimeter extending nearly through the thickness of its wall, so that it may be split longitudinally at that diameter after it has been bored.

Fig. III is a cross sectional view of a cylindrical mold embodying my invention, formed of two semi-cylindrical castings planed upon their contiguous longitudinal surfaces.

Fig. IV is a cross sectional view of the mold shown in Fig. III, including a dowel pin and

wedge key clamp for holding the two sections thereof together.

Fig. V is a fragmentary longitudinal sectional view of a part of the wall of a mold embodying my invention showing the transversely extending corrugations therein.

Fig. VI is a diagrammatic cross section indicating the semi-cylindrical sections of a longitudinally split mold separated to permit the removal of a pipe cast therein, supporting rollers being indicated below the lower section.

Fig. VII is a diagrammatic side elevation of centrifugal pipe casting apparatus embodying a mold of the type shown in Fig. I, with means for pouring molten metal therein.

Referring to Fig. I; the mold comprises two similar semi-cylindrical sections 1 for a bell and spigot pipe 2 having the bell 2^a and spigot bead 2^b at its opposite ends. The bell end of said mold has the circular conical enlargement 1^a and the opposite end has the conical surface 1^b, for respective engagement of the steel rings 3 and 4 having inner conical surfaces respectively fitted to the mold parts 1^a and 1^b so that when said rings are driven inwardly the opposite semi-cylindrical sections of the mold are tightly clamped together. I find it convenient to provide the mold with dowel pins 1^c near its opposite ends and intermediate thereof serving to engage the mold sections in proper registry. Said rings 3 and 4 have outer cylindrical surfaces so that they serve to support the mold by resting upon respective pairs of flanged rollers 3^a and 4^a which are mounted in parallel spaced relation at the respectively opposite ends of the mold. See the pair of rollers 4^a in Fig. VI. Said rollers are of such axial extent as to permit the movement of the rings 3 and 4 to and from engagement with the mold sections without removal of the rings from the rollers.

Said mold is preferably made of what is primarily a single casting which, as shown in Fig. II, has opposite cored slots 1' in its perimeter extending nearly through the thickness of its wall so that it may be split longitudinally at that diameter conveniently by driving wedges in said slots, after it is bored. However, as indicated in Fig. III, the mold may be formed of two semi-cylindrical castings planed upon their contiguous longitudinal surfaces indicated at 1^d.

As indicated in Fig. IV, the dowel pins 1^c may have one end screwed in one mold section and the other end extending through a drilled hole in the other section, and such a dowel pin may be slotted to receive a wedge key 1^e. I find it preferable to include two such key dowels intermediate of the length of the mold.

In any case; while the mold sections are in complementary position forming a complete cylinder, they are bored throughout the length of the cylindrical portion of the pipe 2 to form corrugations 5, preferably as indicated in Fig. V. As above indicated, such corrugations may be made by a roughing boring tool which forms a single groove extending helically throughout the length of the mold thus bored, with ridges between the adjoining convolutions. Suitable corrugations may be otherwise made in the inner surface of the mold, for instance, by suitable knurling tools.

Such transverse corrugations, with respect to the axis of the cast pipe, also have the advantage of facilitating the breaking of the pipe transversely when, as is frequently the case with soil pipe, it is necessary to have a piece of pipe less than the full length of the initial casting.

In the form of mold shown in Fig. I, I find it convenient to employ the socket core 6 of suitable cementitious material molded in a continuous metal ring 6^a. Such a core may be secured in the mold by driving two wedge keys 7 in diametrically opposite position in the respective mold sections.

As indicated in Fig. III; the opposite semi-cylindrical portions of the mold may have embedded therein bars of copper 8 at the crest of the curvature of each semi-cylinder to increase the heat conductivity of the sections at those regions to avoid the elliptical distortion above contemplated. However, as indicated in Fig. IV, the inclusions of copper or copper alloy may consist of radially extending pieces 8^a either cast, driven, or screwed into the respective mold sections to increase the heat conductivity thereof.

As above contemplated, copper or alloys thereof may be included in the molten metal of which the mold sections 1 are formed, for the same purpose.

As diagrammatically indicated in Fig. VI; I find it convenient to effect the discharge of the cast pipe from the mold by positioning the latter with its split horizontal and lifting the upper section far enough to permit the pipe to be removed transversely with respect to the axis of the mold.

Referring to Fig. VII; I find it convenient to operate the mold 1 with its axis inclined to the horizontal at a slight angle, for instance, 3°, with the bell end of the mold lowermost to facilitate the distribution of the molten metal therein from right to left in Fig. I. The electric motor 10, indicated in Fig. VII has its armature shaft 10' operatively connected with one or both of the supporting rollers 3^a to forcibly turn them to rotate the mold. The molten metal to form the pipe 2 may be poured from the ladle 11 into the trough 12 which extends in a substantially axial relation to the mold, as shown in Fig. VII. Said trough is supported by the carriage 13 having supporting wheels 14 resting upon the track 15 upon which the carriage is progressed by the sprocket chain belt 16, the opposite end bights of which extend around the sprocket wheels 17 and 18, the former being fixed on the armature shaft of the electric motor 20, which may be reversed to shift said carriage, and trough into and out of said mold. However, before beginning to pour the molten metal into the mold to form the pipe 2, I prefer to deposit in the mold a sufficient quantity of a suitable refractory powdered material 21 to coat the entire inner surface of the mold therewith, as indicated at 21 in Fig. V. As above noted, such refractory material may consist of a mixture of fine silica sand and lampblack. Such a coating prevents sudden chilling and consequent hardening of the surface of the outer casting and facilitates the separation of the cast metal from the mold. I find it desirable to maintain the mold temperature at from 700 to 900° F. during the casting process, and find it convenient, for that purpose, to spray the outer surface of the mold with water during its rotation. The casting is not withdrawn until its temperature has been reduced to less than 500° F., when it may be rolled out from the position shown in Fig. VI upon suitable portable skids 22.

However, I do not desire to limit myself to the precise details of construction, arrangement, or method of operation herein set forth, as it is obvious that various modifications may be made

therein without departing from the essential features of my invention as defined in the appended claims.

I claim:

1. A mold for centrifugally casting pipe therein, including complementary semi-cylindrical sections of ferrous alloy, having cuprous metal inclusions therein at the respective crests of the semi-cylindrical sections; affording greater heat conductivity at the region of said inclusions than elsewhere in said sections; whereby semi-elliptical distortion of the respective sections by the heat of the molten metal therein is prevented.

2. A mold as in claim 1; wherein the inclusions of cuprous metal are in the form of bars extending longitudinally in the respective sections of the mold parallel with its axis and radially with respect to its axis.

3. A mold as in claim 1; wherein the inclusions of cuprous metal extend radially with respect to the axis of the mold.

THOMAS P. ANTHONY.