No. 870,870. PATENTED NOV. 12, 1907.

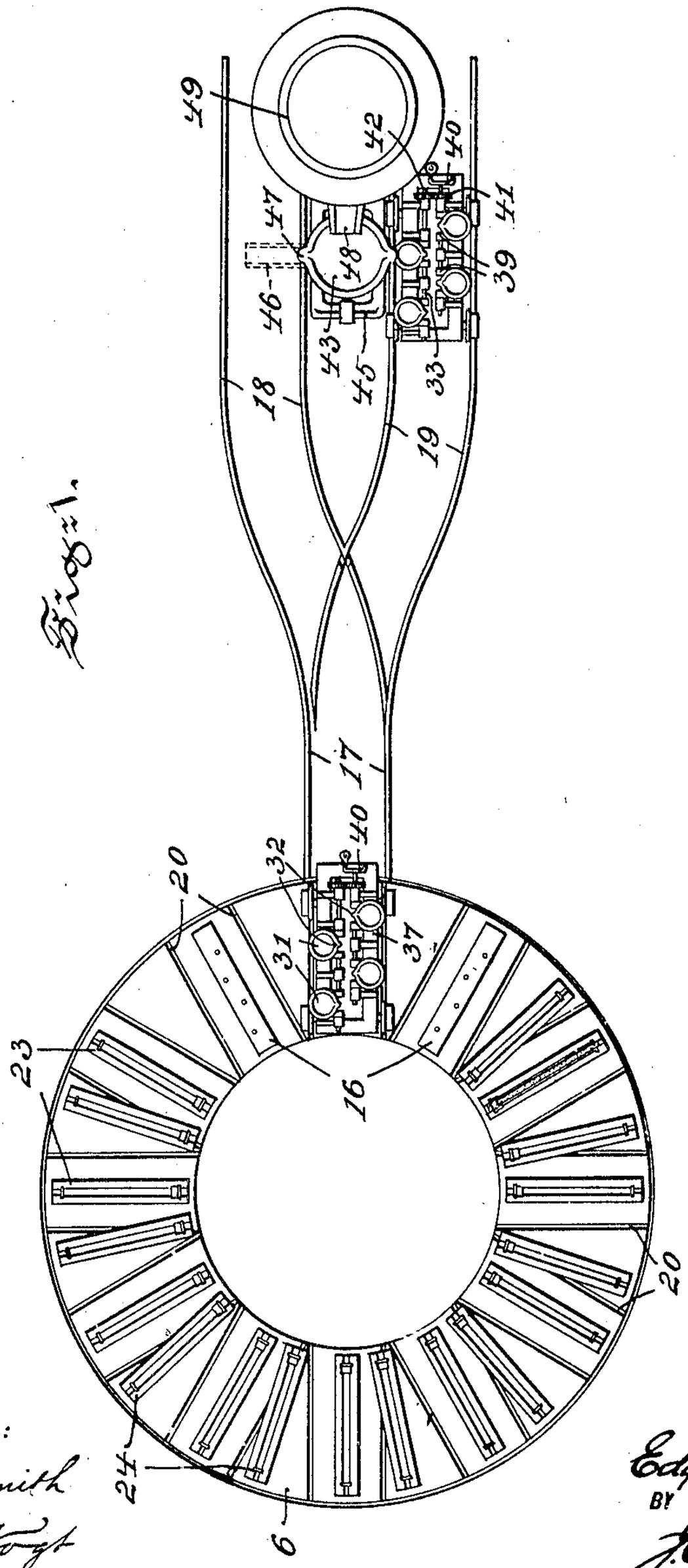
E. A. CUSTER.

APPARATUS FOR CASTING METAL PIPES.

APPLICATION FILED MAY 3, 1907.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

Thomas M. Smith

Wilhelm Voigt

INVENTOR

Edgar A. Custer,

BY

J. Walter Douglas

ATTORNEY.

No. 870,870. PATENTED NOV. 12, 1907.

E. A. CUSTER.

APPARATUS FOR CASTING METAL PIPES.

APPLICATION FILED MAY 3, 1907.

3 SHEETS—SHEET 2.

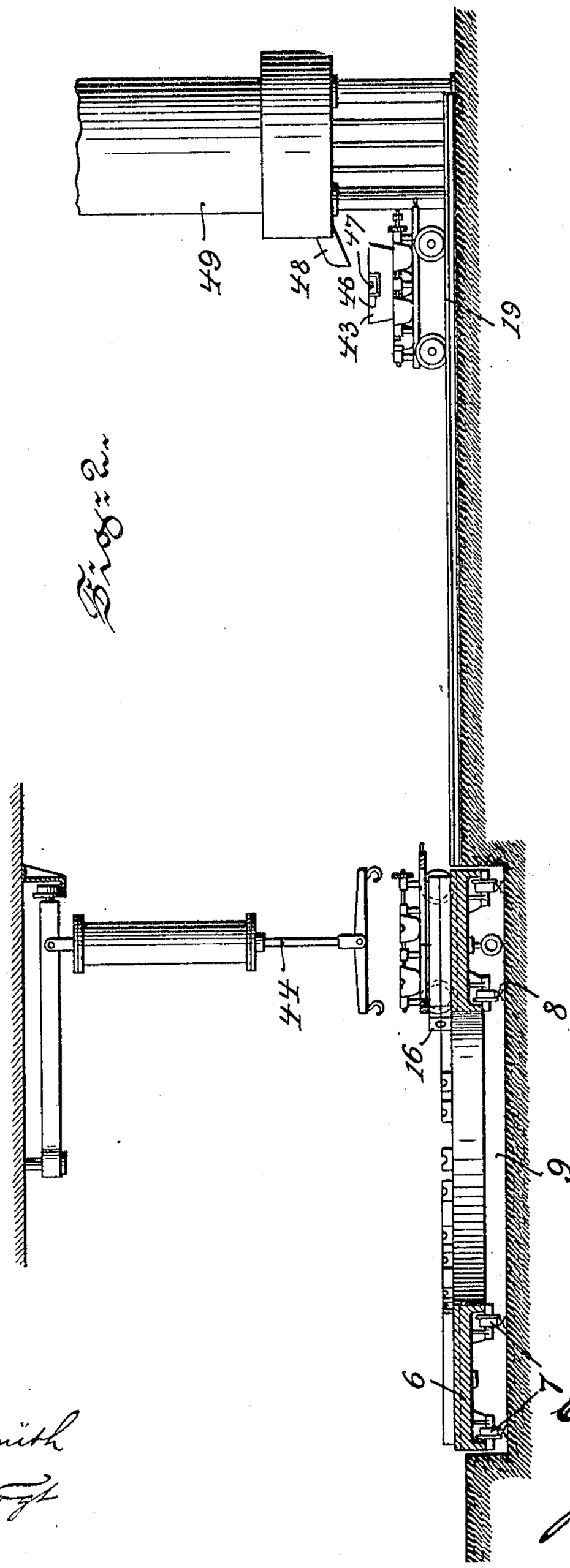


Fig. 2.

WITNESSES:

Thomas M. Smith

Wilhelm Voigt

INVENTOR

Edgar A. Custer,

BY

J. Walter Brayton

ATTORNEY.

No. 870,870. PATENTED NOV. 12, 1907.

E. A. CUSTER.

APPARATUS FOR CASTING METAL PIPES.

APPLICATION FILED MAY 3, 1907.

3 SHEETS—SHEET 3.

Fig. 3.

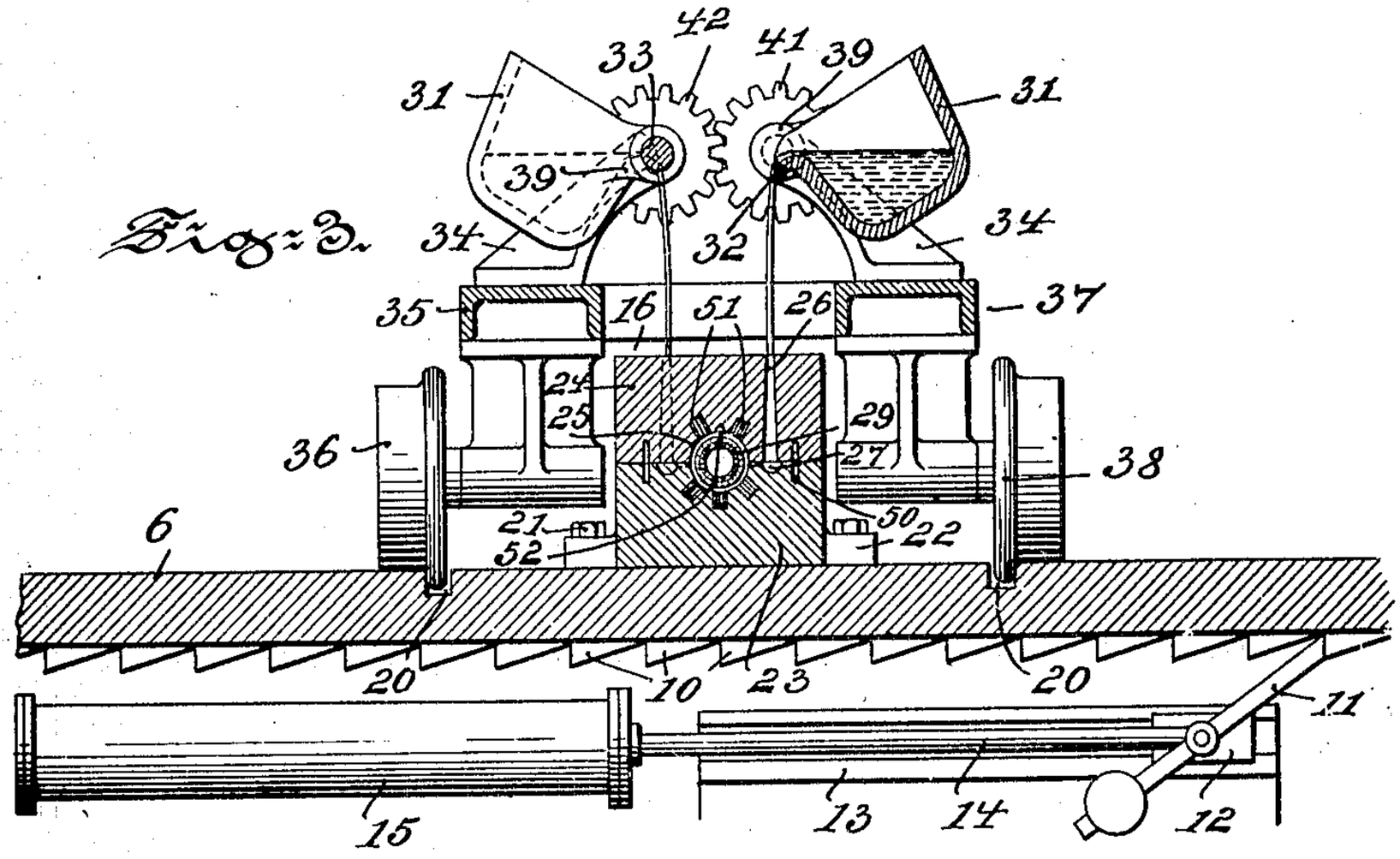


Fig. 4.

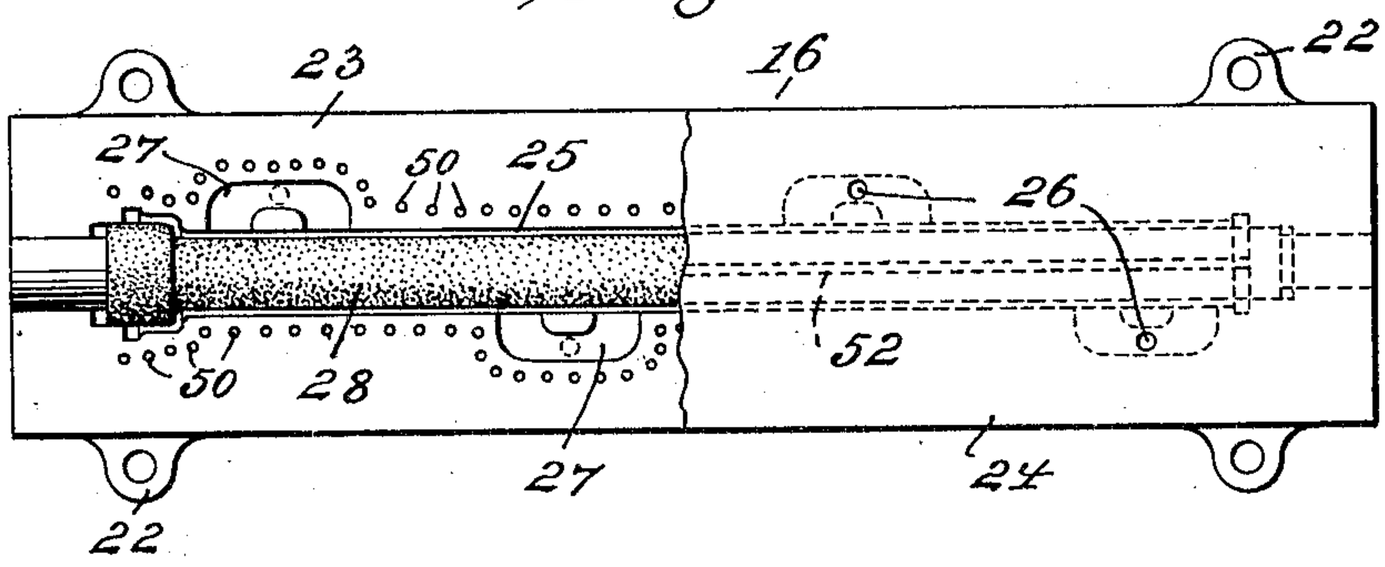
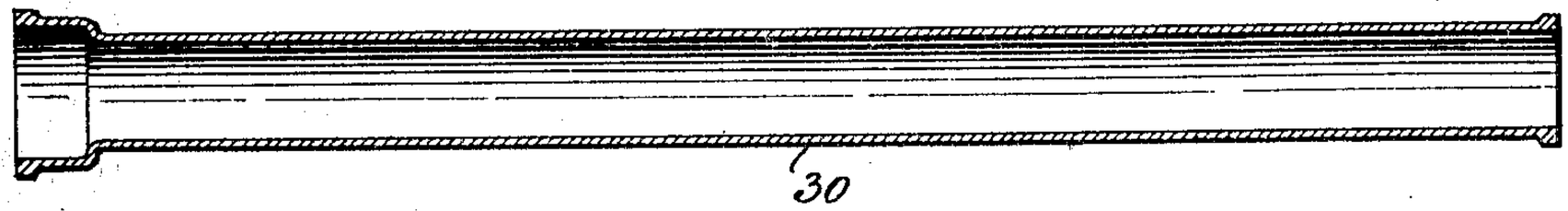


Fig. 5.



WITNESSES:
Thomas M. Smith
Wilhelm Voigt

INVENTOR
Edgar A. Custer,
BY
J. Wallace Douglass
ATTORNEY.

UNITED STATES PATENT OFFICE.

EDGAR A. CUSTER, OF PHILADELPHIA, PENNSYLVANIA.

APPARATUS FOR CASTING METAL PIPES.

No. 870,870. Specification of Letters Patent. Patented Nov. 12, 1907.

Application filed May 3, 1907. Serial No. 371,677.

To all whom it may concern:

Be it known that I, EDGAR A. CUSTER, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Casting Metal Pipes, of which the following is a specification.

My invention has relation to an apparatus for casting metal pipes; and in such connection it relates more particularly first, to operating means to permit of the casting of a metal pipe perfect in outline or shape, ready for use, after casting; second, to means to permit of the casting of such a pipe from molten metal in a permanent mold, without employing gritty material such as sand as a mold for the formation of the pipe; and third to means to permit of the casting of a water, soil or other pipe free from blow and sand holes, cracks and shot formations thereon, to be removed and a pipe which when removed from the permanent mold and after natural cooling, is ready for use, without further finishing thereof.

The principal objects of my invention are first, to provide means including a turntable provided with radially arranged molds, each consisting of a drag and a cope formed of permanent unyielding material to permit of the casting of a pipe with a smooth exterior surface, said turntable having arranged on each side of a mold grooves to form continuations of trackways which serve to guide and hold a pouring truck in an operative position over one of the molds; second to provide such means with a melting furnace adapted to melt the metal necessary for the casting of a pipe in molds and with a stationary ladle for receiving molten metal for distributing the metal into movable pouring ladles; third, to provide such means with a truck provided with a series of pouring ladles adapted to hold and convey molten metal from the receiving ladle of the furnace to molds and to introduce the molten metal of each ladle simultaneously and from a uniformly maintained height into each mold of the turntable to insure uniformity of flow of molten metal into the molds; and fourth, to provide means for imparting to the turntable, a rotary step-by-step movement in one direction to bring each of the molds, successively, into an operative position opposite the furnace and each set of grooves of the table opposite the trackway for conveying and pouring simultaneously the molten metal from the ladles of the trucks into the molds of said table.

The nature and scope of my present invention will be more fully understood from the following description taken in connection with the accompanying drawings, forming part hereof, in which

Figure 1 is a view, illustrating in top or plan, a turntable having a series of radially arranged molds partly occupying a closed or operative and partly occupying open or inoperative position, in which the cope is placed alongside its drag, a groove arranged on each side of a mold and one set of grooves arranged opposite a trackway for connecting the table with a melting furnace and receiving ladle for molten metal, and metal conveying and pouring trucks, one in position over a mold occupying a pouring position on the table and one opposite a receiving ladle to receive the molten metal in a series of small or pouring ladles for conveying to the molds of the turntable. Fig. 2 is a view, illustrating partly in section and partly in elevation, the apparatus shown in Fig. 1, and also hoisting means for removing and replacing copes of the molds of the turntable. Fig. 3 is a detail view, enlarged, illustrating partly in section, and partly in elevation, a portion of the turntable, means for imparting to the table a step-by-step rotary movement in one direction, a mold formed of unyielding permanent material and a metal conveying truck for pouring metal from the ladles thereof into molds by the holding or maintaining of the spouts thereof, in a substantially fixed position with respect to the molds. Fig. 4 is a similar view, illustrating in top or plan, a portion of a drag and a cope of a mold of the turntable and a core employed in conjunction therewith; and Fig. 5 is a similar view, illustrating in longitudinal section, a pipe cast in and shown removed from one of the molds of the turntable.

Referring to the drawings 6, represents an annular turntable, supported by flanged-wheels 7, engaging rails 8, arranged in a pit 9. One mode of imparting to the turntable a rotary step-by-step movement in one direction, consists of providing the underside of the table with ratchet-teeth 10, engaged by a counterweighted pawl 11, pivotally connected with a slide block 12, supported by a guide 13, which block and pawl are reciprocated in the guide 13, by the piston-rod 14, of a cylinder 15, as shown in Fig. 3. The distance of rotary step-by-step movement imparted to the table 6, by the pawl 11, is equal to the distance of the molds 16, from each other, which are radially arranged on the table 6, and which by this movement are brought successively centrally opposite a trackway 17, branching into tracks 18 and 19. On each side of each of the molds 16, is arranged a groove 20, which when the table 6, occupies proper position are located directly opposite the inner side of the trackway 17, and thus form the continuation thereof, as shown in Fig. 1. Each of the molds 16, of the table 6, consists of a permanent unyielding material, such as metal, and is divided into two sections, of which the lower section forms a drag 23, and is removably secured to the table 6 preferably by bolts 21, passing through ears 22, thereof, as shown in Fig. 3, while the upper section forms a cope 24 and is held upon the drag, by its own weight having been made for this purpose similar to the drag 23, of a solid block of metal, of comparatively large size, in cross-section so as to retain heat absorbed from molten metal

introduced into the mold, and to prevent warping or bending due to any want of uniformity in the heating of the mold, by the molten metal.

The drag 23, and cope 24, are each provided with a semi-circular depression 25, forming combined in the mold an annular oblong chamber of the contour or outline of a pipe, as shown in Figs. 3 and 4. The cope 24, is provided with pouring holes 26, arranged a defined distance apart and extending through the same and registering with gates 27, arranged in the drag 23. In order to provide for the free expansion of the metal of the mold, adjacent to the depressions 25 thereof, are arranged small openings 50, extending certain distances into the body of the drag and also the cope of the mold. These openings 50, provide a means, whereby any cracking of the metal of the mold, about the same will be limited, upon reaching such openings, thereby retarding extent thereof. In addition to the openings 50, in the drag 23, and cope 24, are arranged grooves 51, extending radially from the depressions 25, and lengthwise in the drag and cope. These grooves 51, form pockets for the reception of inert material, such as mica, which permit of a certain compression by the expanding metal, and thus serves to counteract any cracking of the mold in any part throughout the same. The core 28, used in conjunction with the mold so formed preferably consists of a perforated hollow body 29, serving as a support for a coating, consisting of finely divided gritty material, such for instance as sand. The cope in conjunction with the depression 25, in the drag and also in cope forms an annular space, into which the metal is introduced to form a pipe. Before however, the metal is poured into the mold, the depression 25, of the cope 24, and drag 23, may be coated with a semi-liquid composition to permit the molten metal to lay close to the depressions during casting and hence to obviate any receding of the metal from the mold.

In order to cast a pipe 30, which when removed from the mold 16, is ready for use, free from cracks, blow and sand holes and shot formations upon the exterior surface, which must be removed before the pipe can be used, it is necessary to introduce simultaneously the metal into each of the pour holes 26, of the cope 24, in equal portions and with the same velocities and under the same pressures, to insure a uniform flow of the metal, within the two parts of the mold. This is accomplished by pouring ladles 31, provided with pouring spouts 32, of substantially the same size, which are held in the central longitudinal axis of the shafts 33, at and during the discharge of the metal therefrom, which shafts 33, in conjunction with bearings 34, of a platform 35, supported by flanged-wheels 36 forming in conjunction with the platform a metal conveying truck 37, hold the ladles with their spouts 32 directly above the pour-holes 26 of the cope 24. The grooves 20, arranged on each side of the mold 16, of the turntable 6, by receiving and guiding the flanges 38, of the wheels 36, of the truck 37 hold the same and the ladles 31, in the proper position above the mold 16, on the turntable 6, as shown in Fig. 3. The shafts 33, are held by the bearings 34, in alinement with each other and are connected with the ladles 31, by engaging projections 39 preferably, formed integral therewith. This arrangement permits of the holding of the spouts 32 of the ladles 31, in the central longitudinal axis of the shafts 33, and of an unobstructed discharge of molten metal therefrom, as shown in Fig. 3. Moreover, the ladles 31, are so supported by the shafts 33, that their spouts 32, are held in the same horizontal plane and thus at a uniform height above the mold 16, on the turntable 6, in which substantially fixed position, as hereinbefore described, the spouts are held and are maintained at and during the tilting of the ladles 31.

In order to insure the uniform tilting of both sets of oppositely arranged ladles 31, one of the sectional shafts 33, of one set of ladles is provided with a hand-crank 40, and a gear-wheel 41, meshing with a gear-wheel 42, secured to one of the shaft sections 33, of the other set of ladles of the truck. Thus the movement of the one shaft 33, is transmitted to the other shaft 33, and both sets of ladles will be thereby tilted at exactly the same time, and with exactly the same speed, at which time their spouts 32 remain in a substantially fixed position irrespective of the extent of tilting of the ladles of such truck. The spouts of the ladles being of substantially the same size equal quantities of molten metal, can be discharged therefrom, which metal will assume the same velocities and pressures maintained in the discharges and such will be maintained until reaching the depressions 25 of the drag 23, and the cope 24 o. the mold by passing through the pour-holes 26, of the cope and through the gates 27, of the drag of such mold. The flow of each portion of the metal into the depressions 25, will thus be uniform, thereby insuring the casting of a pipe 30, perfect in outline and shape and having a smooth exterior surface which is imparted thereto, by mainly the character of the permanent unyielding metal mold.

In order to permit of the concentration of the gases arising from the flowing metal, the cope 24, is provided with a depression or channel 52, extending lengthwise thereof, as shown in full and dotted lines in Figs. 3 and 4. The gases liberated during the pouring of the molten metal will accumulate in the channel 52, located at the highest portion of the depression 25, of the cope 24, thus preventing the formation of a depression or depressions in the surface of the pipe cast, which occurs when no provision is made for the concentration of the gases. The main portion of the gases present in the casting of the pipe 30, are freed into the interior of the hollow body 29, of the core 28, by their passing through the covering and the perforations of the body into the interior thereof. After the pipe 30, has been cast the metal conveying truck 37, is shifted from the turntable 6, onto the track 17, and by the same upon the branch track 18, opposite the receiving ladle 43, placed between the branch tracks 18 and 19, and by means of which, the pouring ladles 31 of another metal conveying truck 37, will have been filled with molten metal during the casting of the pipe 30. As soon as the truck 37, is removed from the table 6, the same is rotated for a distance sufficient to bring the next succeeding mold 16, and the track grooves 20, opposite the track 17, in which position the second metal conveying truck 37, is shifted upon the table 6, and over the mold 16, occupying a casting position, after which the metal is introduced into the same, by the pouring ladles 31 in the same manner, as hereinbefore described. The cope 24, of the mold 16, previously filled with molten metal

is now lifted from the drag 23 preferably by a hoisting mechanism 44, such as is shown in Fig. 2, and is then placed on the table 6, alongside the drag 23. The pipe 30, cast is now laid bare and is then removed from the drag 23, after which both the cope and drag are cleaned and again coated and a cope replaced on its drag, by the hoisting mechanism, during the further s ep-by-step rotation of the table 6, and before the mold 16, has again been shifted into a casting position opposite the track 17.

The receiving ladle 43, is tiltably supported by a frame-work 45, and is provided with a spout extension 46, which serves to conduct the molten metal into the outer set of pouring ladles 31, while the spout 47, thereof, serves to discharge the metal into the inner set of pouring ladles 31, as will be readily understood in conjunction with Fig. 1 of the drawings. The receiving ladle 43, is directly placed beneath the discharge spout 48, of any preferred type of cupola furnace 49.

Owing to the comparatively large size in cross-section of the drag and cope of each of the molds 16, of the turntable 6, the same will retain a sufficient amount of heat absorbed from the molten metal introduced therein to materially aid in the production of a perfect pipe 30, by running a quick and uniform flow of molten metal from the gates 27, without any appreciable lowering of temperature of the metal.

Having thus described the nature and objects of my invention, what I claim as new and desire to secure by Letters Patent is:—

1. An apparatus for casting metal pipes, consisting of a permanent unyielding material two part mold, means for introducing molten metal in equal portions simultaneously into said mold at uniform pressures and velocities, and means to remove the cast structure from said mold.

2. An apparatus for casting metal pipes, consisting of a permanent unyielding mold provided with a cope and a drag, means for introducing molten metal in equal portions simultaneously into said mold, a core, means for permitting of the freeing of gases or volatile matter from the metal in the mold during casting of the structure and means to remove the cast structure from the mold.

3. An apparatus for casting metal pipes, consisting of a permanent unyielding metal mold provided with a cope and a drag, means for introducing molten metal in equal portions, in unison, and at uniform pressures and velocities into both cops and drag of said mold, an internal perforated core, means for permitting of the freeing of gases or volatile matter during the running of the metal in the casting operation and means to remove the cast structure.

4. In an apparatus of the character described, the combination with a movable table having a plurality of pairs of track grooves and arranged to support intermediate of each pair of track grooves a mold, consisting of a drag and a cope of permanent unyielding material, stationary means for receiving molten metal, and movable means for conveying the molten metal from the stationary means to said table and arranged to be held by one of the pair of track grooves thereof in proper operative position over a mold, substantially as and for the purposes described.

5. In an apparatus of the character described, the combination with a movable table arranged to support a plurality of molds, each consisting of a drag and a cope of permanent unyielding material, and each cope having a plurality of pour-holes, a stationary ladle for receiving molten metal, a truck, a plurality of pouring ladles adapted to receive molten metal and to be conveyed by said truck to said table and over one of the molds thereof, and means for tilting the pouring ladles to simultaneously discharge the molten metal into and through the pour holes of the cope of the mold.

6. In an apparatus of the character described, the combination with a movable table having a plurality of pairs of track-grooves and said table arranged to support intermediate of each pair of track-grooves a radially disposed mold, consisting of a drag and a cope of permanent unyielding material, a stationary tiltable ladle for receiving molten metal, two sets of pouring ladles adapted to be charged with molten metal from said stationary ladle, a truck, means supported by said truck to hold each set of pouring ladles in a certain position thereon, means connecting the supporting means of each set of pouring ladles with each other to permit of the simultaneous discharge of the molten metal into a mold, when said truck is held in position on said table by one of the pairs of grooves thereof.

7. In an apparatus of the character described, the combination with a table having a plurality of pairs of track-grooves and said table arranged to support a plurality of molds, each consisting of a drag and a cope of permanent unyielding material, a stationary tiltable ladle, a trackway substantially surrounding said ladle and extending into a single track terminating at said table, means for imparting to said table a step-by-step movement in one direction to bring a mold and each pair of track-grooves successively opposite said single track, a truck movably mounted on said track and adapted to be held in proper operative position over a mold of said table by a pair of the track-grooves thereof, pouring ladles adapted to be charged with molten metal by said stationary ladle, means for supporting said pouring ladles with their spouts uniformly in a horizontal plane with respect to each other, and means for simultaneously tilting said pouring ladles.

8. In an apparatus of the character described, the combination with a table having a plurality of pairs of track-grooves and said table arranged to support a plurality of molds, each consisting of a drag and a cope of permanent unyielding material, a stationary tiltable ladle adapted to receive molten metal, a trackway arranged adjacent to said ladle and terminating at said table, means for imparting to said table a step-by-step movement in one direction to bring a mold and each pair of track-grooves successively opposite said track, a truck movably mounted on said track and carrying shafts adapted when shifted on said table to be held in proper operative position over a mold by a pair of said track-grooves, pouring ladles, each having a spout carried by said truck-shafts, said ladles adapted to receive molten metal from said stationary ladles and to be held with their spouts in the longitudinal central axis of said shafts, at and during discharge of the metal therefrom into a mold of said table.

9. In an apparatus of the character described, the combination with an annular table having a plurality of pairs of track grooves and said table arranged to support intermediate of each pair of track-grooves a radially disposed mold, consisting of a drag and a cope of permanent unyielding material, a truck adapted to be shifted on said table and to be held in proper operative position over a mold, by a pair of track-grooves thereof, ladles adapted to contain molten metal having discharge spouts, and means for supporting said ladles on said truck and for holding the spouts thereof in the same horizontal plane and in a substantially fixed position with respect to said mold, at and during the discharge of metal into the same.

10. In an apparatus of the character described, the combination with an annular table having a plurality of pairs of track-grooves and said table arranged to support intermediate of each pair of track-grooves a radially arranged mold, consisting of a drag and a cope of permanent unyielding material, a stationary tiltable ladle adapted to receive molten metal, a trackway arranged adjacent to said ladle and terminating at said table, means for imparting a step-by-step movement to said table in one direction to bring a mold and each pair of track-grooves successively opposite said track, a truck movably mounted on said track and having supports carrying pouring ladles adapted to receive molten metal from said stationary ladle and to be held in proper position over a mold by a pair of the track-grooves of said table, the spouts of said pouring ladles adapted to be held by the supports of said truck in substantially fixed position to a mold of said table, and during discharge of the metal therefrom.

11. In an apparatus of the character described, the combination with an annular table having a plurality of pairs of track-grooves and said table arranged to support intermediate of each pair of track-grooves a radially arranged mold, consisting of a drag and a cope of permanent unyielding material, a stationary tiltable ladle adapted to receive molten metal, a trackway arranged adjacent to said ladle and terminating at said table, means for imparting a step-by-step movement to said table in one direction to bring a mold and each pair of track-grooves successively opposite said track, a truck movably mounted on said track and having supports carrying pouring ladles adapted to receive molten metal from said stationary ladle and to be held in proper position over a mold by a pair of the track-groves of said table, the spouts of said pouring ladles adapted to be held by the supports of said truck in substantially fixed position to a mold of said table, at and during discharge of the metal therefrom and means for removing and placing the copes of said molds on said table and from the same back onto the respective drags thereof.

12. An apparatus of the character described, consisting of a permanent mold of unyielding material having a plurality of gates at determinate points thereof, means for introducing molten metal in equal portions, simultaneously in the same horizontal plane through the gates of said mold and with like pressures and velocities, a core, and means to permit of removal of the cast structure from the mold perfect in outline or shape, ready for use, without further finishing.

13. An apparatus of the character described, consisting of a permanent mold of unyielding material having a plurality of gates at determinate points thereof, means for introducing molten metal in equal portions simultaneously in the same horizontal plane through the gates of said mold and with like pressures and velocities, a perforated unyielding material core, means for freeing volatile matter and gases from the metal during casting into a structure, and means to permit of removal of the cast structure perfect in outline or shape, ready for use, after cooling, and without further finishing thereof.

In witness whereof, I have hereunto set my signature in the presence of two subscribing witnesses.

EDGAR A. CUSTER.

Witnesses:

J. WALTER DOUGLASS,

THOMAS M. SMITH.