E. A. CUSTER.

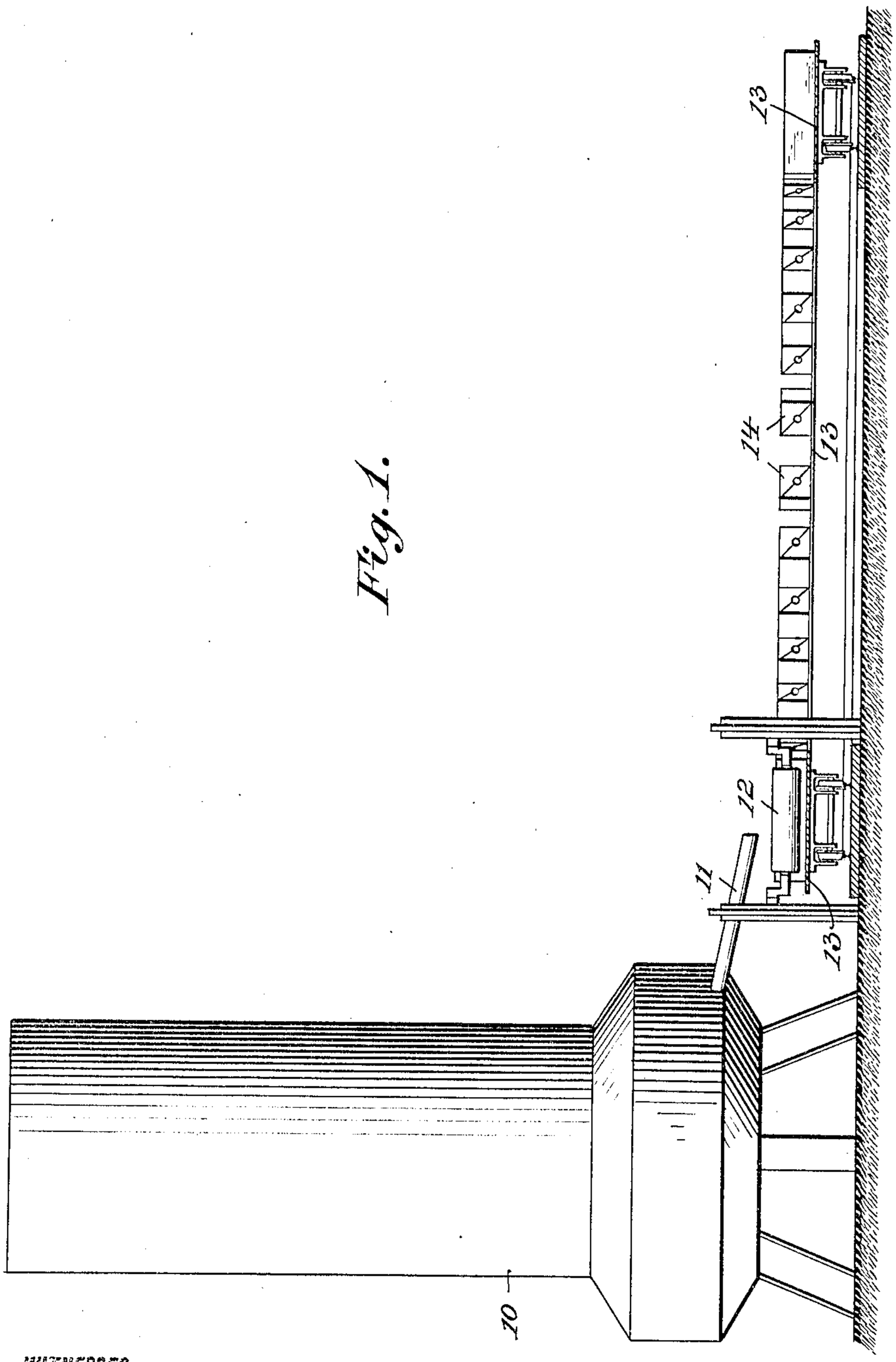
MODE OF CASTING SOIL, WATER, AND GAS PIPE DIRECT FROM THE BLAST FURNACE IN PERMANENT MOLDS.

APPLICATION FILED MAR. 3, 1908.

904,759. Patented Nov. 24, 1908.

6 SHEETS—SHEET 1.

Fig. 1.



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6 SHEETS—SHEET 2.

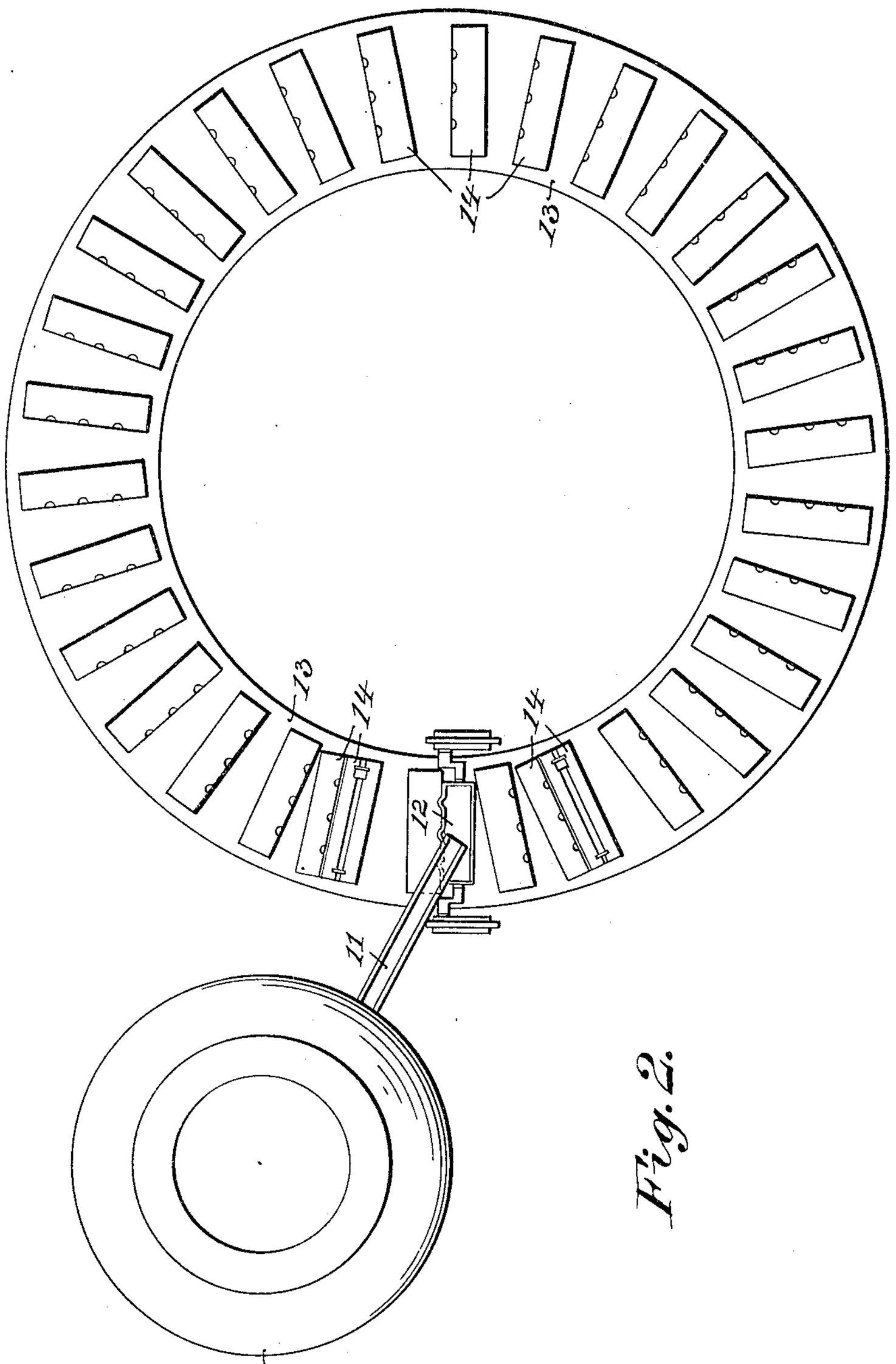

Fig. 2.

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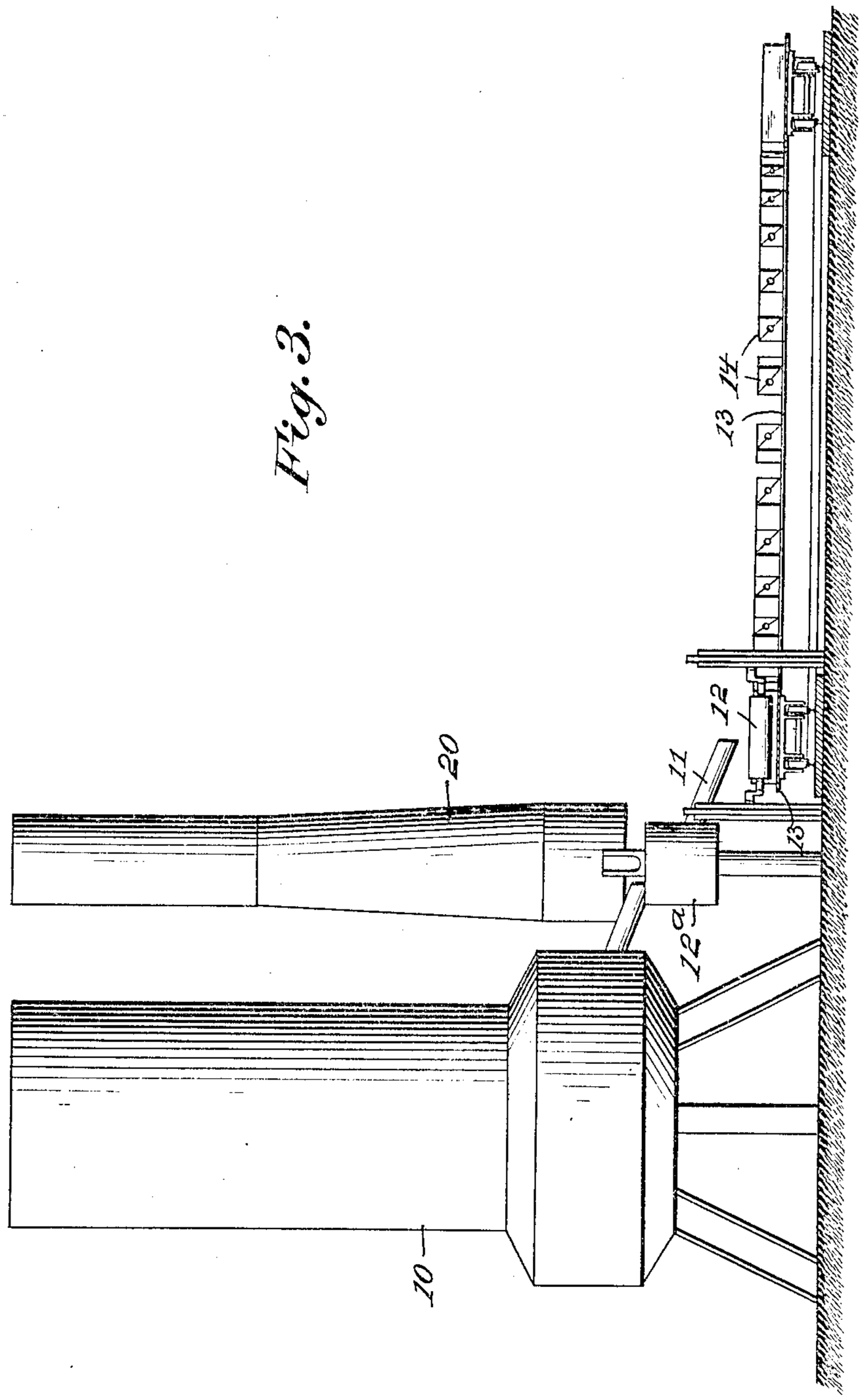
6 SHEETS—SHEET 3.

Fig. 3.



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6 SHEETS—SHEET 4.

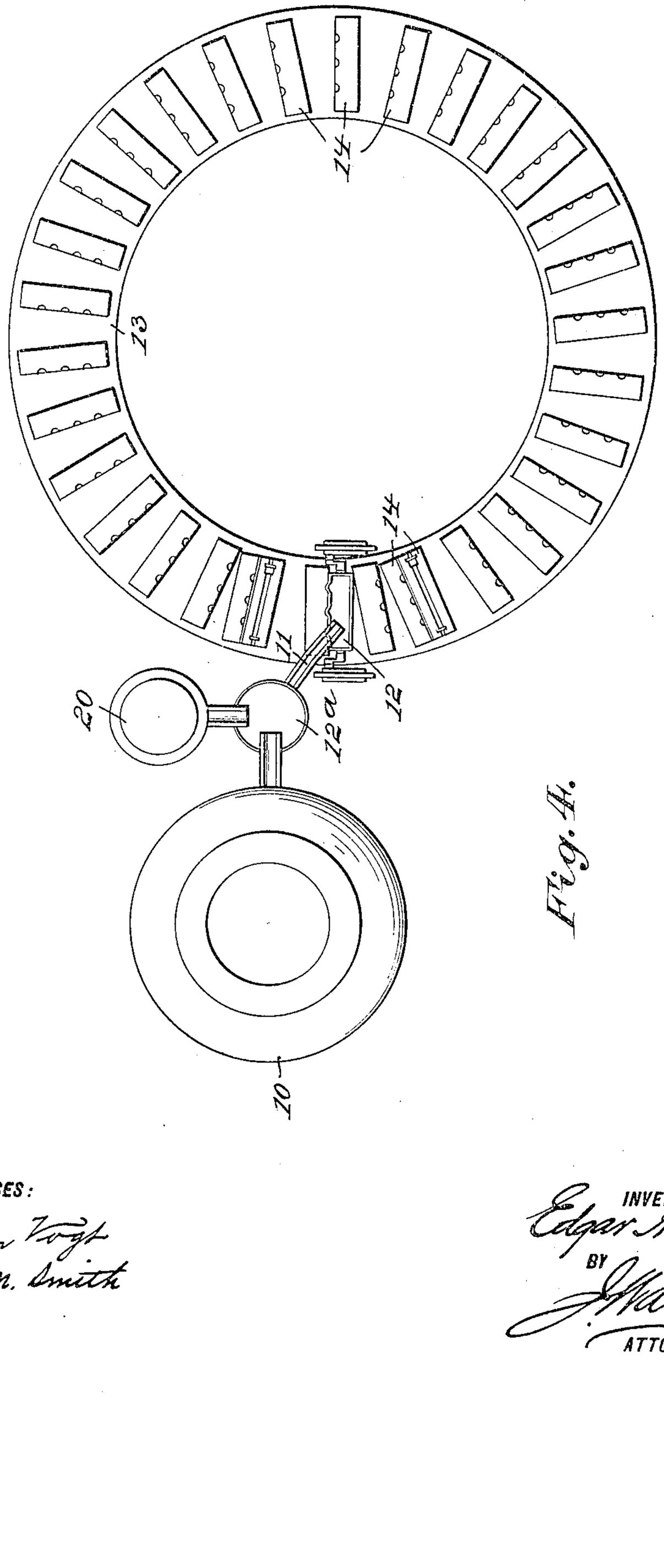

Fig. 4.

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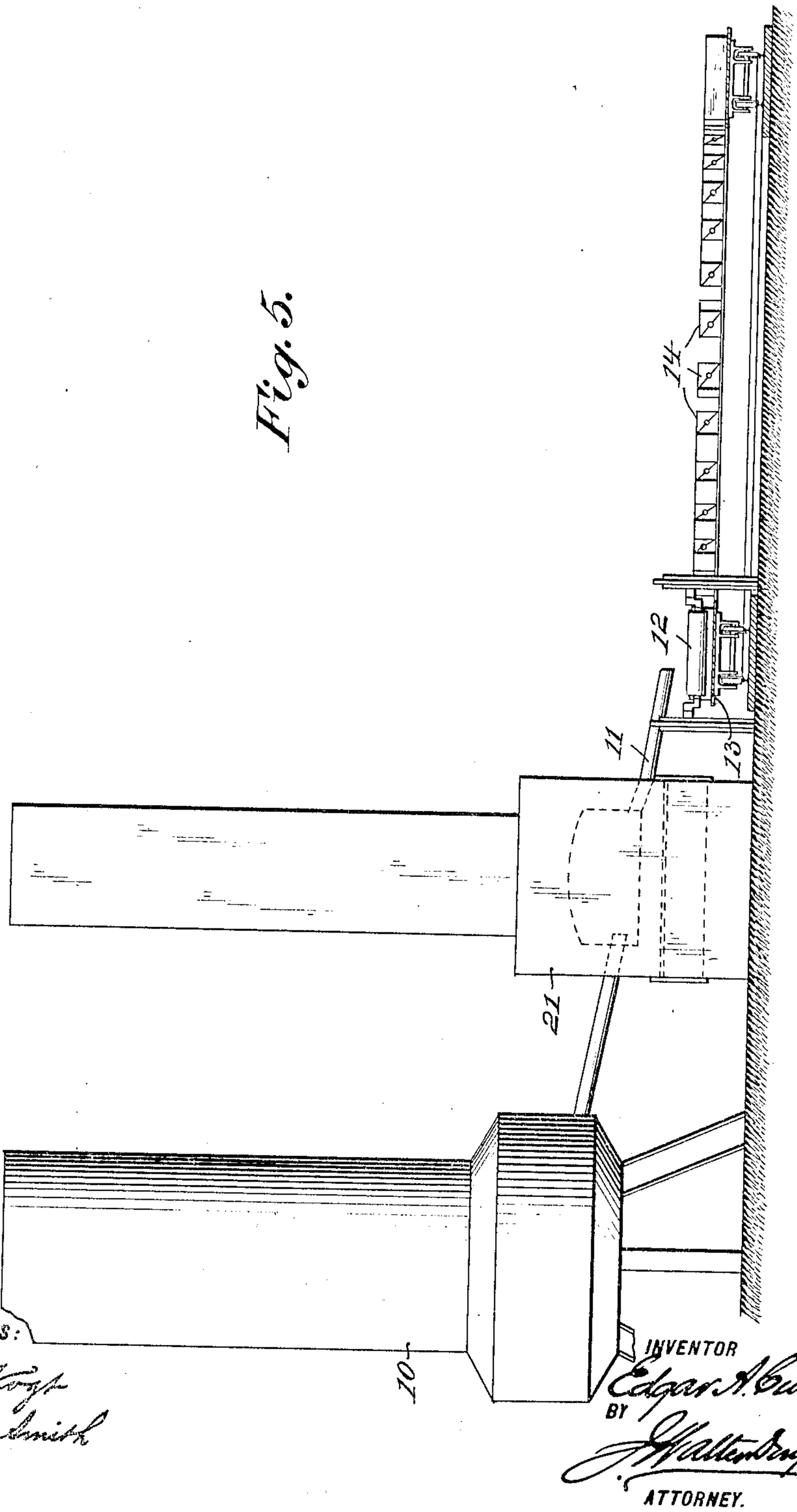
6 SHEETS—SHEET 5.

Fig. 5.



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APPLICATION FILED MAR. 3, 1908.

904,759.

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6 SHEETS—SHEET 6.

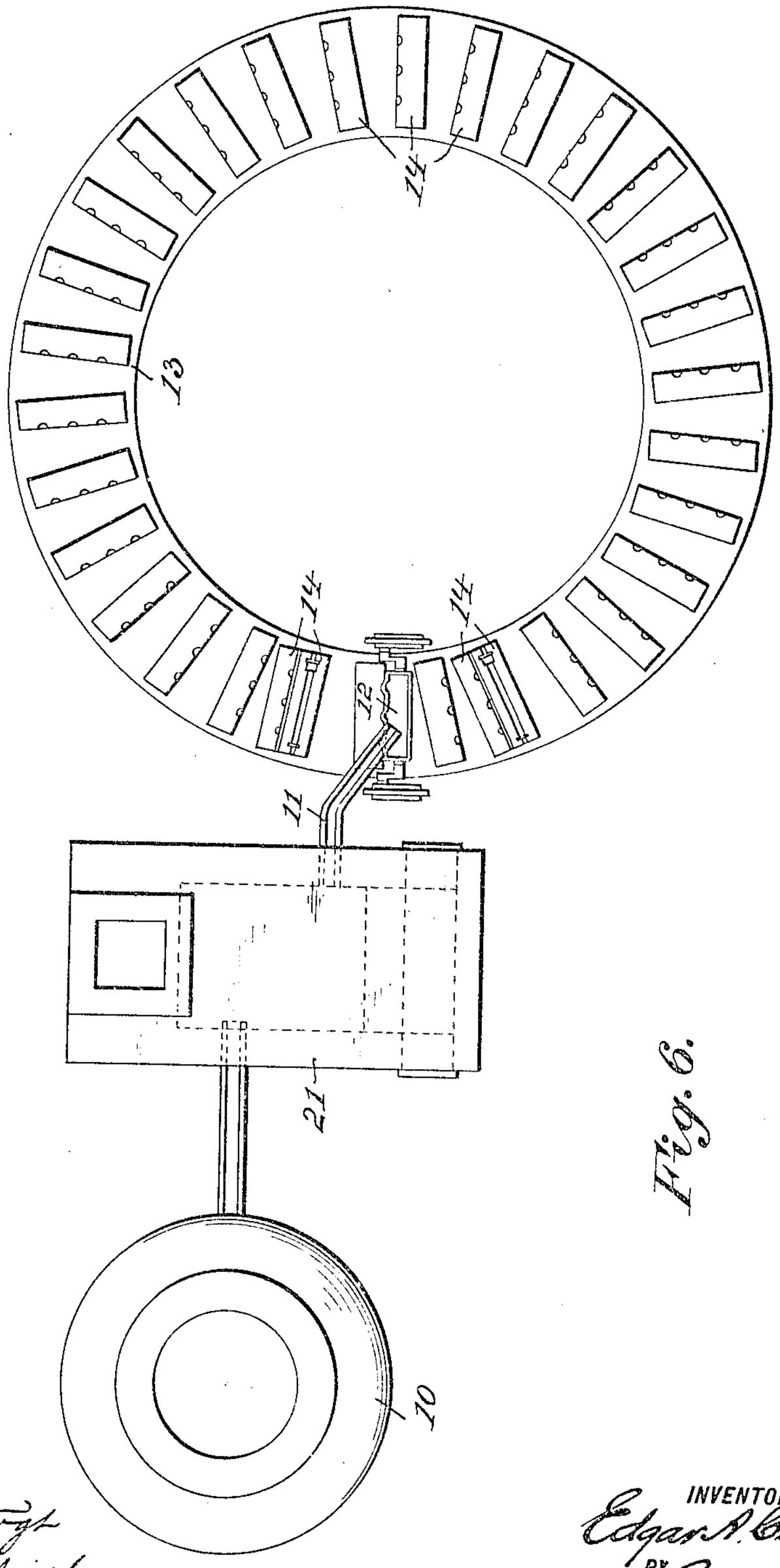

Fig. 6.

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UNITED STATES PATENT OFFICE.

EDGAR ALAN CUSTER, OF PHILADELPHIA, PENNSYLVANIA.

MODE OF CASTING SOIL, WATER, AND GAS PIPE DIRECT FROM THE BLAST-FURNACE IN PERMANENT MOLDS.

No. 904,759. Specification of Letters Patent. Patented Nov. 24, 1908.

Application filed March 3, 1908. Serial No. 419,020.

To all whom it may concern:

Be it known that I, EDGAR ALAN 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 the Mode of Casting Soil, Water, and Gas Pipe Direct from the Blast-Furnace in Permanent Molds, of which the following is a specification.

My invention has relation to the mode of casting soil, water and gas pipe direct from the blast furnace in permanent molds; and such invention has been particularly evolved and reduced to practical applications and forms for the making of soil, water and other pipe, by the defined art as described and claimed in the United States Letters Patent No. 870,817, granted to me, under date of November 12th, 1907.

In the practice of making marketable pipe in permanent molds by the said patented system so as to be suitable for varying conditions of use, it is highly desirable, that the irons presented to the molds for assuming form therein should have such constituency as to provide for certain molecular conditions in the cast structure which is aided by the mold with respect to rapidity of cooling as well as expansion and contraction of the metal assuming form in the mold.

The principal object of my invention is to provide a definite or certain mode for permitting of the proper constituency and temperature of metal being presented to permanent molds direct from the blast furnace and aiding to effect and conserve molecular conditions of the formed structures in such molds coupled with the effect such molds have upon the molten iron in momentarily assuming form therein.

The nature and scope of my invention will be more fully understood from the following description taken in connection with the accompanying drawings illustrating three different forms of means for carrying into effect the object and defined purposes of my said invention, in which

Figures 1 and 2, are respectively, elevational and top or plan views of means, in one form, for carrying out the mode of casting pipe direct from the blast furnace in which the molecular conditions subsequently of the formed pipe are modified so to produce a homogeneous pipe in either a soft condition or hard and tough state, as may be required. Figs. 3 and 4, are respectively, another form of means for the conduct of the said mode, showing the blast furnace connected with a cupola furnace, for corrective relations, in the treatment of the metal prior to presenting at or about a definite temperature to the molds, for giving a resultant product of defined molecular conditions and with a homogeneous character and either soft or hard and tough in texture, as may be desirable; and Figs. 5 and 6, are respectively, similar views of still another form of means for carrying out the defined object of my invention, for not only correctively regulating the constituency of the metal, but also controlling within certain limits the temperature of the metal conducted into the permanent molds, for producing homogeneous pipe of defined molecular character or conditions, and ready for use, without further finishing, upon removal from the molds and after natural cooling.

Referring to the drawings with reference to Figs. 1 and 2, 10 is an ordinary blast furnace provided with a discharge spout 11, leading to a pouring means 12, of the type for instance forming the subject-matter of the United States Patent No. 870,869 granted to me under date of November 12th, 1907, and located above or about a turntable 13, containing a series of hinged molds 14, each provided with a cope and a drag, such type of mold being set forth in the United States Patent No. 870,868, granted to me, under date of November 12th, 1907, and No. 887,070 granted to me under date of May 12th, 1908. The table being operated by a motor or other means, not shown. The ore is smelted in the furnace 10, under test as to the constituencies thereof and of whether there is an excess of whatever pristine element or elements present, as sulfur or phosphorus or both and whether high or low in silicon, determined analytically, and when these corrective relations of the iron as to its constituency are arrived at definitively, the molten metal is then discharged through the spout 11, into the pouring means 12, which is then run through gates of the molds 14, in a closed position into the interior around a composition core so that the gases can be liberated in different directions to not affect the cast structure, either internally or externally and to also insure ready removal of

the same in an unchilled condition, for cutting or machining, as may be required. With the constituency of the iron corrected analytically, as to the proportions of the pristine element or elements, the structure subsequently cast in the permanent mold is found to have a molecular condition with the crystals thoroughly interlaced, thereby rendering the product stronger and tougher. This result is aided by a maintained high temperature of the metal in casting with respect to the temperature maintained normally of the permanent molds in use. This temperature in the molds for such results is maintained and controlled with certainty owing to the extent of metal out of all proportion to the quantity of metal at any one time brought in contact with the interior body of the mold and to the resistant pressure of the inner wall of the mold combined, to change or modify the molecular conditions in the resultant structure, so as to give thereby a homogeneous product with geometrical interlacing of the crystals of the metal to greatly toughen as well as strengthen the structure and without chilling of the exterior surface calculated to make it difficult to subsequently machine or cut the structure. Further the pipe cast in such a mold will expand and contract uniformly with respect the volume of contacting metal of the mold present, while the molten metal is assuming form therein, thus giving a pipe which when removed from the mold will be maintained at such temperature long enough to naturally and uniformly anneal itself, so as to easily machine, if necessary, when cold.

In Figs. 3 and 4, the means is the same, as that described save that the iron from the blast furnace 10, passes by the spout 11, into a large ladle 12ª, and from thence into a two-part mold 14, of the series of the turntable 13. If however, the iron is not of the required constituency, this may be remedied by the cupola corrective furnace 20, passing molten metal for obtaining that constituency into the ladle 12ª, before the hot mass passes into the molds 14. This mode of preparing the iron for conducting from the blast furnace to the molds is employed only when from any conditions of the iron, corrective influences are necessary to bring such into a state for the required results in the casting, for instance, where the percentage of silicon in the iron is low or the graphitic or combined carbon needs to be increased or decreased. The above arrangement of apparatus provides a ready means for economically and efficiently deriving such results.

In Figs. 5 and 6, the means differs from that of Figs. 1 and 2, by the inte position of a reheating corrective furnace 21, so as to provide for the maintenance of the temperature of the metal to be transformed in a molten state from the blast furnace 10, to and from the furnace 21, at a defined temperature, for the casting operation. Moreover, such arrangement furnishes an economical manner of carrying out such a defined mode, with respect to the maintenance of required degrees of heat just prior to the casting act, as well as enabling the operations to be carried on upon a much larger scale, due to the fact that the temperature of the iron for conditioning, for casting into structures, when established can be readily maintained for regulating the temperature of the metal in casting into form to insure uniform resultant homogeneous cast structures, having defined molecular conditions.

The methods carried out by any of the several forms of apparatus of my invention, as described, not only positively avoids the presence of conditions in the resultant product to prevent uniform structures being obtained continuously, but it insures also structures cast of the qualities and character always required, with certainty and not haphazardly, as hitherto when cast by any of the well known sand molding methods.

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

1. The herein described mode of casting structures, which consists in conducting molten metal of defined constituency and temperature from a blast furnace into a permanent mold, the temperature whereof differs materially from that of the metal presented thereto and bringing said metal swiftly under a materially different temperature to the point of setting to change or modify molecular conditions and thereby to derive a resultant product in a homogeneous condition, substantially as described.

2. The herein described mode of casting structures, which consists in conducting molten metal of defined constituency and high temperature from a blast furnace, correctively treating the same, introducing it into a permanent mold, the temperature whereof is materially lower than that of the molten metal correctively treated when presented thereto and then bringing the same swiftly to the point of setting, whereby through the series of steps the molten mass undergoes prior to the point of setting, the molecular conditions thereof are changed or modified in the resultant gradually cooled structure to give a product definitely hard or soft, as required, substantially as described.

3. The herein described mode of casting structures, which consists in conducting molten metal of certain constituency and temperature from a blast furnace, correctively treating the same, introducing it into a permanent mold, wherein at a temperature differing materially from that of the molten metal presented to the mold the mass

is brought swiftly to the point of setting and thereafter cooling the metal gradually, whereby the molecular conditions of the metal is conserved and a resultant product derived having a homogeneous structure, substantially as described.

4. The herein described mode of casting structures, which consists in conducting molten metal of certain constituency and temperature from a blast furnace, correctively treating the same, introducing it into a permanent mold, wherein at a temperature differing materially from that of the molten metal presented to the mold the mass is brought swiftly to the point of setting and thereafter cooling the metal gradually, whereby the molecular conditions of the metal is conserved and a resultant product derived having a homogeneous structure, and definitely tough or hard or soft, substantially as described.

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

EDGAR ALAN CUSTER.

Witnesses:

J. WALTER DOUGLASS,

THOMAS M. SMITH.