J. B. ETHERINGTON.

ORE COOLING APPARATUS.

APPLICATION FILED JUNE 17, 1910.

986,813. Patented Mar. 14, 1911.

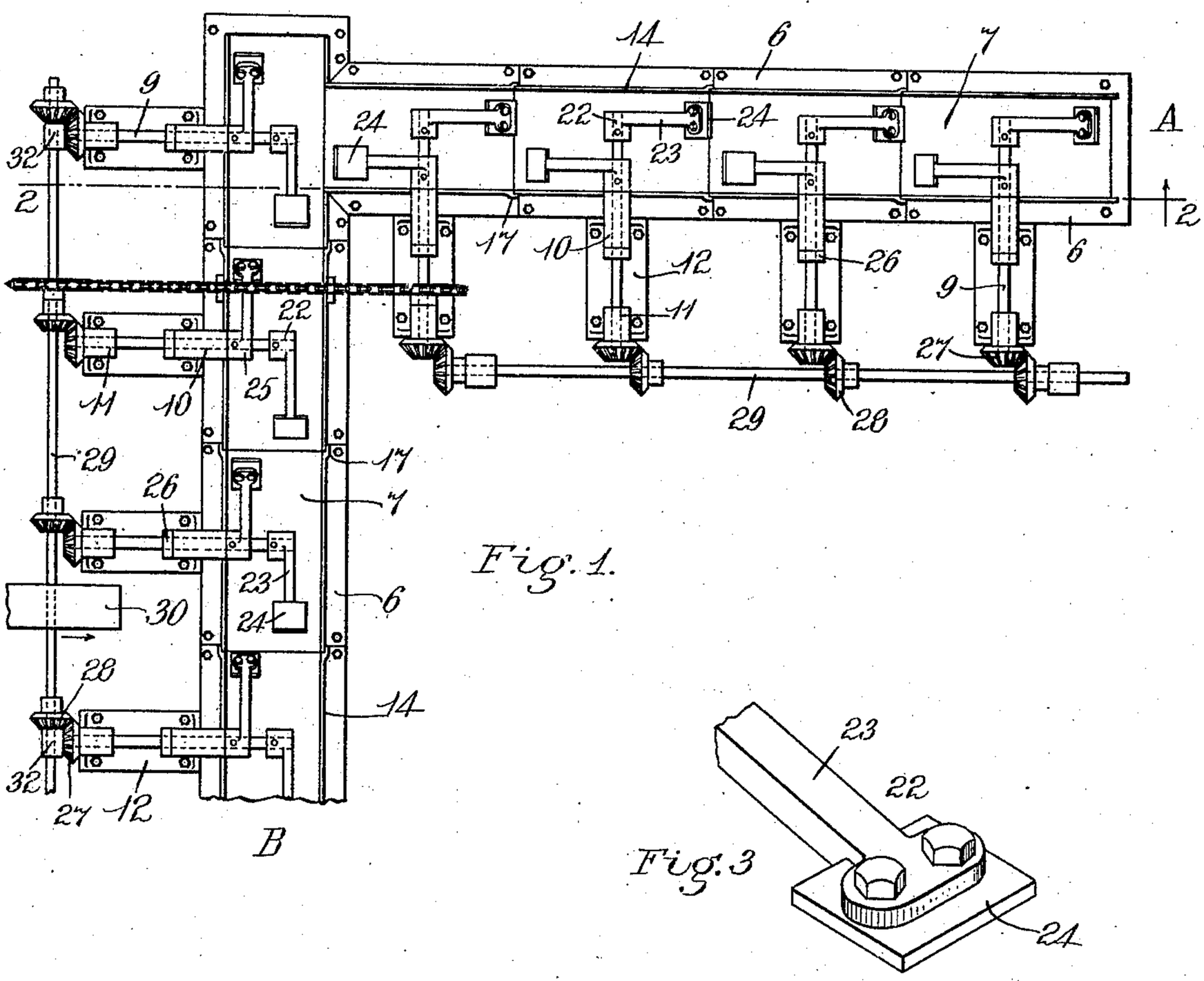

Fig. 1.

Fig. 3

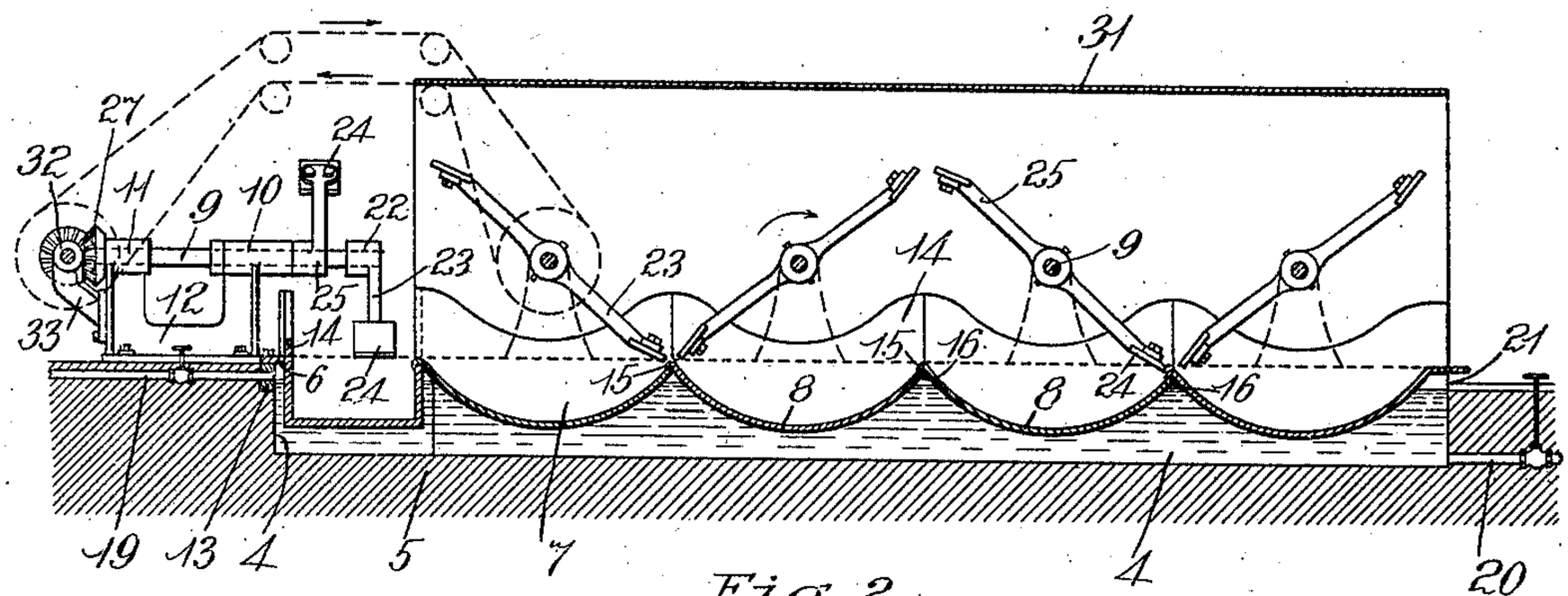

Fig. 2.

Witnesses.

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UNITED STATES PATENT OFFICE.

JAMES BELCHER ETHERINGTON, OF WINTHROP, MASSACHUSETTS, ASSIGNOR TO CAMPBELL MAGNETIC SEPARATING COMPANY, A CORPORATION OF ARIZONA TERRITORY.

ORE-COOLING APPARATUS.

986,813. Specification of Letters Patent. Patented Mar. 14, 1911.

Application filed June 17, 1910. Serial No. 567,511.

To all whom it may concern:

Be it known that I, JAMES BELCHER ETHERINGTON, a citizen of the United States, residing at Winthrop, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Ore-Cooling Apparatus, of which the following is a specification.

My invention relates to apparatus for conveying and cooling ore after it has been roasted in a furnace, and its objects are to convey the heated ore directly from the furnace to the receiving bins or to other machines or apparatus, to cool the same while in transit, to remove from the ore during its passage the noxious fumes with which it may be impregnated, and to provide a compact and efficient arrangement of the several parts.

My invention consists in constructing a continuous trough for the passage of the ore, and in providing means for cooling said trough by circulating cold water about the same, the ore being conveyed through said trough by means of revolving paddles or shovels.

My invention further consists in providing a series of revolving paddles with detachable blades for advancing the ore along the trough, the paths of the adjacent paddles overlapping one another, and each of said paddles being mounted upon a countershaft operated from the main shaft.

My invention further consists in forming a continuous trough of connected pans, each of which is provided with a curved bottom conforming to the path of one of the paddles, guards at the sides to prevent the escape of the ore, and flanges projecting from said sides for securing the pan to the sides of the canal.

My invention further consists in the improvements and modifications illustrated in the accompanying drawing and more fully hereinafter pointed out and claimed.

Reference is hereby made to the drawing in which similar numerals of designation refer to similar parts throughout the several views.

Figure 1, is a plan view of my improved apparatus showing the same extending around a corner, and shafts and gearing for operating the paddles. Fig. 2, is a vertical section on line 2—2 of Fig. 1. Fig. 3, is a view in perspective of one of the paddles, showing the removable blade, and means for attaching same.

Referring to the drawing, the canal 4 is a channel formed of suitable depth and width in the floor 5 of the building structure where the conveyer and cooler is to be used. Preferably the entire floor 5 is constructed of cement or other material suitable for the purpose, but if desired the sides and bottom of said canal may be built of suitable material, and the floor composed of any material whether impervious to moisture or not. Along the sides of said canals near the top thereof are strips 13 which serve to reinforce the edges of said canals, and provide a surface to bolt and support the flanges 6 on the pans 7. Each of said pans 7 is constructed with a curved bottom 8, the curve of which coincides with the circumference of a cylinder, the center of which is coincident with the center of shaft 9 located directly above said curved bottom, and journaled in bearings 10 and 11, which are preferably integral with standards 12 secured to the floor 5 by bolts or lag screws, or in any suitable manner. One edge of the bottom of each pan 8 is bent into a flange 15 to overlap and engage with the adjacent edge 16 of the bottom of the adjoining pan, the sides 14 of said pans extending upwardly to a substantial extent and overlapping at their adjacent edges 17 in a manner similar to the connecting edges of the pan bottoms aforesaid. So connected, the said pans form a continuous trough with an undulating bottom for the passage of the ore, the bottom of each pan being located so as to be partially immersed in the water of the canal when the same is full, and leaving the connected edges of the pans above the level of said water in order that there may be no ingress for the same into said pans. In order that the said pans may be so located I provide on the outside of edges 14 of the pans 7, horizontally extending flanges 6 which are preferably integral therewith and are firmly bolted or otherwise suitably secured as above stated to the reinforced edges 13 of the canal 4.

In those cases where it is found desirable to extend the canal around a corner of the building structure, I preferably employ the arrangement shown in Fig. 1, the side of one of the pans 7 being cut away to form a joint

with the flange 15 of the bottom of the adjoining pan, each joint being located at the same distance above the level of the water in the canal as the other joints connecting the bottoms of the remaining pans. (See Fig. 2.) Preferably the canal is made of such a depth in order that there may be a considerable volume of water between the bottom of the pans and the floor of the canal; and to insure the effective cooling of the ore and renewal of the water, I provide supply pipes 19 and waste pipes 20, each being provided with stop cocks for regulating the supply and discharge of the water. And for the purpose of preventing the water in the canal from rising up to or above the level of the joints of the pan bottoms, I provide overflow ports 21, which are connected with suitable drains (not shown).

For advancing the ore through the trough formed by the pans 7, I employ the paddles 22, each consisting of an arm 23 keyed at one end to the end of a shaft 9, the opposite end of said arm being secured to a blade 24 which is preferably made detachable. Similarly constructed and mounted are the paddles 25, located on the opposite side of the shafts 9. Preferably each of said pairs of paddles are made of such length as nearly to touch the bottom of the pans in the lower arc of their passage, and are located in such proximity to the paddles over the adjacent pans that the path of each paddle will intercept and cross the path of the corresponding paddle of each of the adjacent pans. Upon the shaft 9, I also mount the collar 26 next to the bearing 10, and at the end of said shaft opposite to that bearing the paddles are mounted bevel gears 27 which mesh into bevel gears 28 on shaft 29, which is journaled in bearings 32 secured in brackets 33 mounted upon the standards 12 and which is connected by a pulley 30 to any suitable source of power. Over the pans where the ore is first to be introduced, I preferably locate the hood 31 for the purpose of carrying away any noxious fumes with which the ore may be impregnated, and if desired the said hood may extend over the said pans for the entire distance over which the ore is conveyed. In practice, however, I have found that it is necessary only to use the hood for part of the distance, such fumes quickly passing away before the ore has proceeded any substantial distance, and in some cases where practically no fumes are present in the ore, I may dispense with said hood entirely.

The operation of my apparatus is as follows:—The ore is slowly fed into the pans 7 at the receiving end A, and is gradually advanced by the paddles from one pan to another, the rotation of the same being so timed that as the ore of one pan is advanced by the paddles above it, the corresponding paddle of the adjacent pan in the path of the ore will complete one full revolution and then will contact with the ore so advanced and will push the same along to the next pan where the corresponding paddles thereof will act thereon in like manner. By arranging the paddles of each pan in pairs on opposite sides of the shaft 9, the ore is advanced first in one side of the pans and then in the other, the effect being to alternately propel each division of the ore, and to permit each division to remain in each pan during a full revolution of the paddle and thus rest in contact with the cooling surface of the pan for a short space of time. Preferably I extend the sides 14 of the pans six inches or more above the line of the floor in order to act as guides for the ore and to prevent the same from spilling over upon the floor.

Through the use of the above described apparatus, I provide a means of conveying the ore directly from the roasting furnace to elevators or receiving bins and to cool the said ore during its passage. I find my invention useful in the art of magnetic separation of pyritiferous ores, where the iron particles of the ore are first made susceptible to magnetic attraction through the application of heat, and then the ore is run through a magnetic separator and the attracted portion thereof removed by the magnets. When used for such purpose, the ore will be taken as it comes from the furnace and after it has passed through my apparatus will be found sufficiently cool to be handled by said separator, this result being accomplished in a fraction of the time heretofore required for this purpose. The radiation of the heat through the iron causes said heat to pass readily into the water which is constantly flowing through the canal and is kept renewed by a constant supply of cold water, so that the cooling and conveying are concurrent.

By having the blades 24 detachable, I am enabled to provide a variety of sizes of the same, and therefore to increase or decrease within certain limits the speed with which the ore is conveyed through the trough without changing the gears of the apparatus. If it be found that the ore be advanced at too rapid a rate and thereby not be sufficiently cooled, it is necessary only to remove one of the pairs of blades, and to use the other alone, or practically the same result could be accomplished by replacing the blades with those smaller in size,—it being advisable in the majority of cases to permit the ore to remain for a substantial interval upon the bottom of the pan.

While I have explained the nature of my invention, and described apparatus for embodying the principle of the same, I by no means have attempted to set forth all the

forms in which it may be utilized, it being apparent that my invention could be variously modified without departing from the spirit thereof.

What I claim and desire to secure by Letters Patent is:—

1. An apparatus for conveying and cooling ore, consisting of a trough, and means for cooling the exterior of the same, combined with mechanism for alternately advancing and halting the ore a portion at a time through said trough.

2. An apparatus for conveying and cooling ore, consisting of a trough, means for circulating water about the same, combined with revolving paddles the blades of which engage with and advance the ore through said trough, and means for revolving said paddles.

3. An apparatus for conveying and cooling ore, consisting of a trough for the passage of the ore, means for circulating water about said trough, combined with a successive series of revolving paddles the blades of which engage with and advance the ore through said trough, and mechanism for revolving said paddles.

4. An apparatus for conveying and cooling ore, consisting of a stationary trough for the passage of the ore, means for circulating water about said trough, combined with a successive series of overlapping revolving paddles the blades of which engage with and advance the ore through said trough, and mechanism for revolving said paddles.

5. An apparatus for conveying and cooling ore, consisting of a continuous stationary trough for the passage of the ore formed of pans connected at their adjacent edges, means for partially immersing said pans in water, combined with a series of revolving paddles located above said pans, each of said paddles being provided with blades which engage with and advance the ore through said trough, and mechanism for revolving said paddles.

6. An apparatus for conveying and cooling ore, consisting of a continuous stationary trough for the passage of the ore formed of pans having concave bottoms connected at their adjacent edges, means for partially immersing said pans in running water, combined with a series of revolving paddles located above said pans, each of said paddles being provided with blades which engage with and advance the ore through said trough, and mechanism for revolving said paddles.

7. An apparatus for conveying and cooling ore, consisting of a continuous stationary trough for the passage of the ore formed of pans having concave bottoms connected at their adjacent edges, means for partially immersing said pans in running water, combined with a series of revolving paddles arranged in pairs, one pair being located above each of said pans, and having blades which alternately engage with and advance the ore through one pan to the next, and means for revolving said paddles.

8. An apparatus for conveying and cooling ore, consisting of a canal, means for causing water to flow through said canal, a continuous trough located above said canal and formed of connected pans with curved bottoms, said bottoms being normally immersed in the water of said canal, combined with a series of revolving paddles located above said pans, each of said paddles being provided with blades which engage with and advance the ore through said trough, and means for revolving said paddles.

9. An apparatus for conveying and cooling ore, consisting of a canal, means for causing water to flow through said canal, a continuous trough located above said canal and formed of connected pans with curved bottoms, said bottoms being normally immersed in the water of said canal, combined with a series of revolving paddles located above said pans, each of said paddles being provided with blades which engage with and advance the ore through said trough, and means for revolving said paddles, and the paddles being in such proximity that the paths of adjoining paddles overlap and cause the ore to be passed from one paddle to another.

10. In an apparatus for conveying and cooling ore, a stationary trough for conveying the ore, means for cooling said trough and contents, combined with revolving paddles having detachable blades located above said trough for engaging with and advancing the ore in said trough, and mechanism for revolving said paddles.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses, this 13th day of June 1910.

JAMES BELCHER ETHERINGTON.

Witnesses:

SAMUEL W. STEPHENS,

HENRY D. MELOY.