No. 711,062. Patented Oct. 14, 1902.

P. MEEHAN.

METALLURGICAL FURNACE.

(Application filed Oct. 30, 1901.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

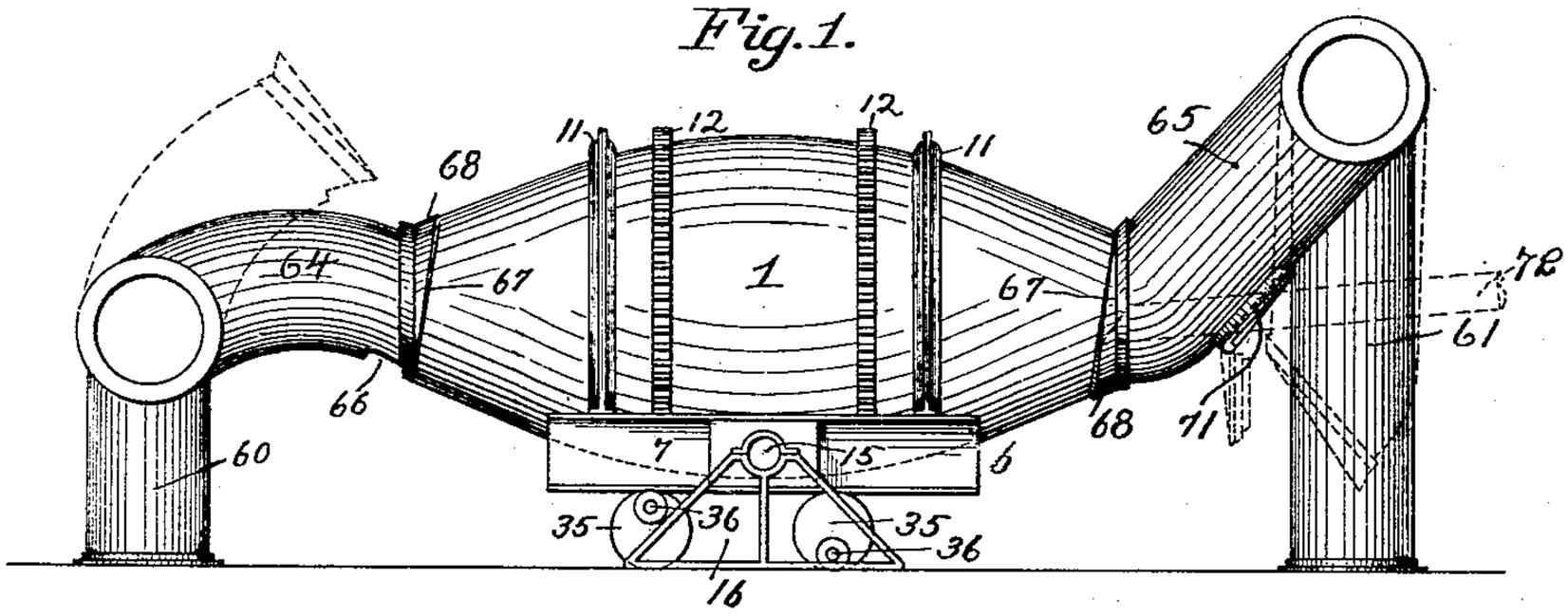
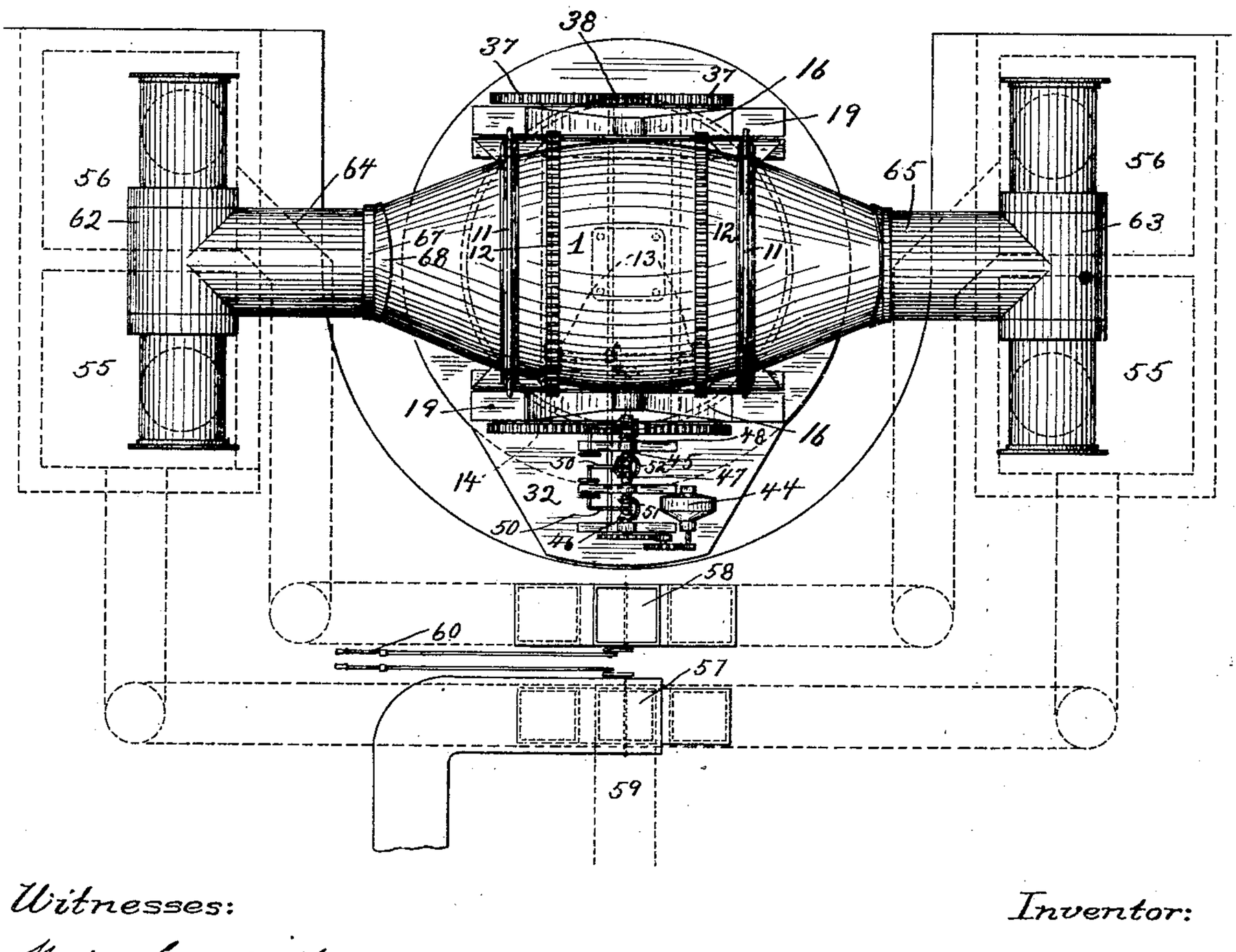


Fig. 2.



Witnesses:

Walter Famariss

Fred D Sweet

Inventor:

Patrick Meehan

By Kay & Totten

Attorneys:

No. 711,062. Patented Oct. 14, 1902.

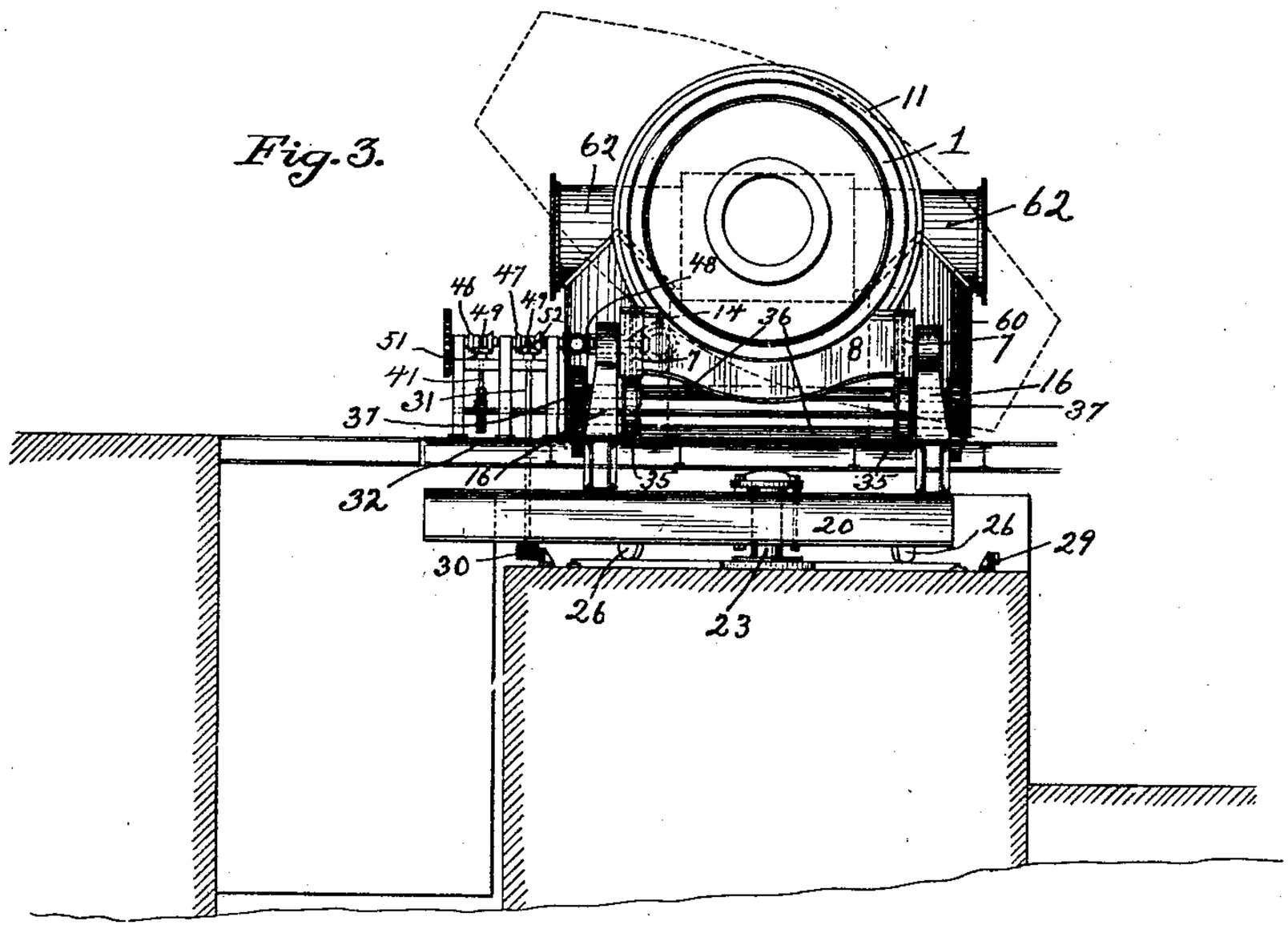
P. MEEHAN.

METALLURGICAL FURNACE.

(Application filed Oct. 30, 1901.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 3.



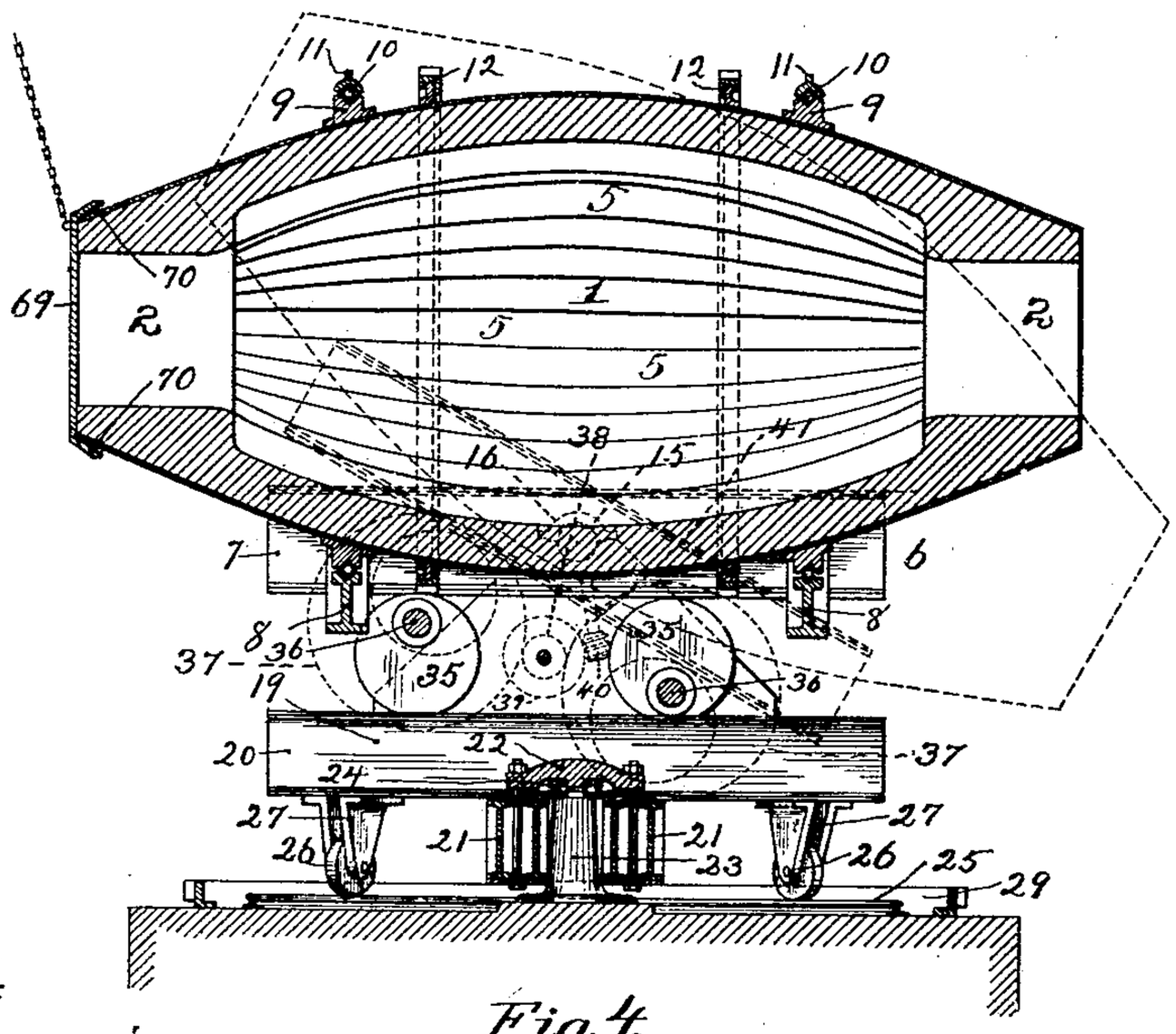


Fig. 4.

Witnesses:
Walter Famariss
Fred D Sweet.

Inventor:
Patrick Meehan
By Mary & Bothwell
Attorneys:

No. 711,062. Patented Oct. 14, 1902.

P. MEEHAN.

METALLURGICAL FURNACE.

(Application filed Oct. 30, 1901.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 5.

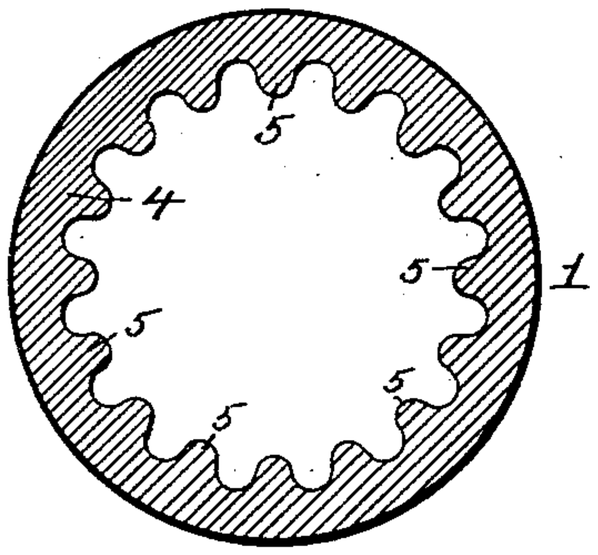
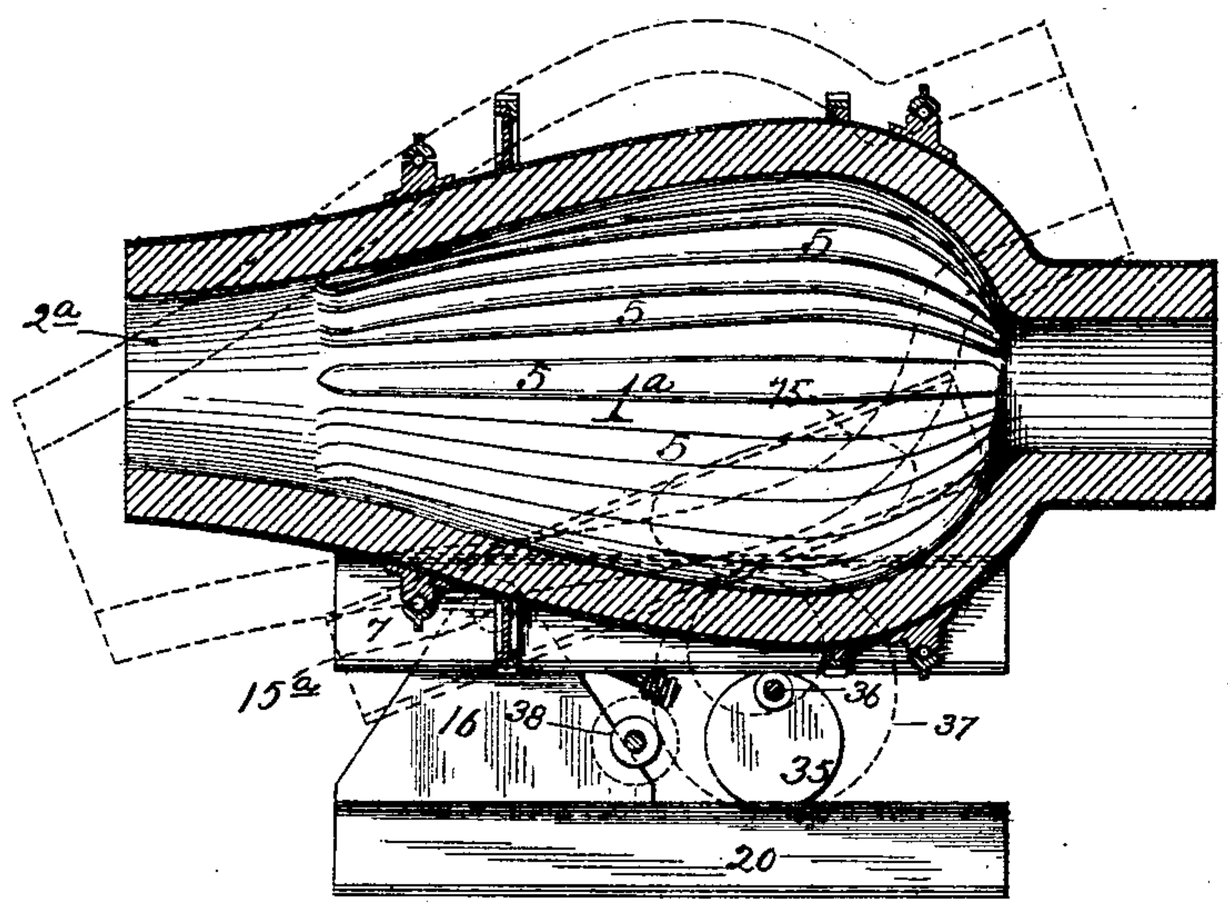


Fig. 6.



Witnesses:
Walter Famariss
Fred D Sweet

Inventor:
Patrick Meehan
By Macy & Totten
Attorneys.

UNITED STATES PATENT OFFICE.

PATRICK MEEHAN, OF LOWELLVILLE, OHIO.

METALLURGICAL FURNACE.

SPECIFICATION forming part of Letters Patent No. 711,062, dated October 14, 1902.

Application filed October 30, 1901. Serial No. 80,530. (No model.)

To all whom it may concern:

Be it known that I, PATRICK MEEHAN, a resident of Lowellville, in the county of Mahoning and State of Ohio, have invented a new and useful Improvement in Metallurgical Furnaces; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to metallurgical furnaces, and more particularly to such furnaces as are adapted for mixing, cleaning, refining, puddling, or balling metal.

The object of my invention is to provide a furnace for these purposes which will work or agitate the metal and facilitate the removal of slag and other impurities from the metal, thereby shortening the period required for mixing, cleaning, refining, or puddling the metal, which is so constructed that the metal can be readily discharged therefrom and which is adapted for use in connection with a reversing, regenerative, or similar furnace.

In the accompanying drawings, Figure 1 is a side view showing diagrammatically the furnace and heat-supplying means therefor. Fig. 2 is a diagrammatic plan view of the furnace and gas and air heating apparatus. Fig. 3 is an end view of the furnace, showing in dotted lines its position when rotated and tilted. Fig. 4 is a longitudinal vertical section of the furnace. Fig. 5 is a transverse section through the furnace-barrel, and Fig. 6 is a vertical longitudinal section of a modification.

My improved furnace is substantially barrel-shaped, such as shown at 1, and is provided with an open neck 2 at each end thereof. The body of the barrel is preferably formed of a metal casing lined with suitable fire-resisting material or brick 4. This barrel-shaped furnace in operation lies in substantially a horizontal position and is rotated about its axis to stir and work the metal contained therein, and to facilitate the working, stirring, and mixing of the metal the lining 4 is preferably provided with projections, ribs, or corrugations 5, extending longitudinally of the furnace. These provide shelves or projections which in the rotation of the barrel will carry the metal up and then allow it to fall down, thereby insuring a thorough working and mixing of the metal and so agitating it as to bring the slag and other impurities quickly to the surface. This barrel-shaped furnace is mounted in any suitable manner to permit it to rotate about its longitudinal axis, and for this purpose I have shown a frame 6, composed of the side beams 7 and the transverse curved saddle or cradle beams 8. These saddle-beams 8 are provided on their upper faces with suitable seats, upon which rest annular bands 9, secured to the barrel. The seats and bands are preferably provided with V or other shaped grooves, as shown, for receiving antifriction-balls 10. Semicircular cap-bands 11 are secured to the saddle-beams 8 and extend over the barrel, inclosing the annular bands 9 and preventing the barrel from becoming displaced. These cap-bands 11 are likewise provided with V or other shaped grooves, and the antifriction-balls 10 extend entirely around the barrel. These balls fit so closely in the grooves in the seat and bands that they prevent endwise displacement of the barrel. The barrel may be rotated in this frame by any suitable means or mechanism. As a convenient means for this purpose I have shown the barrel provided with a pair of annular or peripheral gears 12, which are engaged by spur-gears 13 on a shaft 14, mounted in the frame 6, parallel to the axis of the barrel. This shaft is driven by any suitable mechanism, and preferably by that which will be hereinafter more fully described. By means of the gears 13 and peripheral gears 12 a steady rotary motion is imparted to the barrel, which works, agitates, and mixes the charge of metal in the latter.

The frame 6 is provided midway of its length with trunnions 15, which are journaled in brackets or bearings 16 on the frame 19. This last-named frame is composed of suitable longitudinal I or channel beams 20, resting upon and secured to transverse I or channel beams 21. To the latter beams is secured a strong cap frame or casting 22, which bears upon the top of the central post or stud 23, so that the frame 19 can rotate about said post. To facilitate this rotation, antifriction-rollers or similar devices 24 are preferably interposed between the upper end of the post 23 and the casting 22. To steady the rotation of the frame 19 about this post, I provide the annular track 25, upon which run the

rollers or wheels 26, mounted in the lower ends of hangers 27, secured to the frame 19. The frame 19 will be rotated about the post 23 by any approved means, and it may even be rotated by hand. I prefer, however, to use mechanism for this purpose, and to this end I secure to the foundation or floor the annular rack 29, which is engaged by a pinion 30 on the lower end of a shaft 31, extending upwardly and driven from suitable mechanism on a platform 32, carried by the frame 19. By means of this mechanism the frame 19 can be rotated about the post 23, thereby carrying the barrel in line with the heating-furnaces or at right angles thereto for the purpose of discharging the metal from the barrel, as will hereinafter more fully appear.

The purpose of trunnioning the barrel 1 on the frame 19 is to permit the tilting of the barrel, first, so as to have one end slightly lower than the other in the normal operation of the furnace, thereby allowing the slag and other impurities to readily run out, and, secondly, to permit the discharge of the metal from the furnace. Any suitable mechanism may be used for tilting the barrel about the trunnions 15 and for holding it in any position to which it is tilted. I have shown for this purpose two pairs of cams or eccentrics 35, mounted upon the transverse shafts 36. These cams rest upon the longitudinal beams 20 of the frame 19 and bear on the lower side of the longitudinal beams 7 of the frame 6. The cams or eccentrics of one pair are arranged on the shaft 36 in reverse position with reference to the cams on the other shaft, as clearly indicated in Figs. 1 and 4. The shafts 36 are adapted to be rotated simultaneously and in opposite directions, so that when the eccentricity of one pair of cams is increasing that of the other pair of cams will be correspondingly decreasing. As a convenient means for accomplishing this I have secured to each of the shafts 36 a spur-gear 37, and between these spur-gears and meshing with both of them is a spur-pinion 38, which may be rotated in any convenient manner—as, for instance, by having a worm-wheel 39 connected thereto and engaged by a worm 40 on the lower end of a shaft 41, which shaft is preferably rotated by means of mechanism located on the platform 32, before referred to.

It will be seen that in the apparatus thus far described three separate sets of driving mechanism are necessary—namely, the mechanism for rotating the frame or table 19 about the post 23, the mechanism for rotating the cam-shafts 36 to tilt the barrel, and the mechanism for rotating the barrel on the frame 6. Each of these mechanisms may derive its power from any desired source or sources. I prefer, however, to employ a single source of power for all of them, and to this end I have shown an electric motor 44, mounted on the platform 32 and connected by intermediate gearing to a main driving-shaft 45. This shaft 45 is provided with three separate pairs of bevel-pinions 46, 47, and 48, which are loosely mounted on the shaft 45, and each pair being provided with an intermediate clutch 49, adapted to be actuated by any suitable means, such as the lever 50. By means of the various clutches either one or the other of each pair of bevel-pinions may be locked to the driving-shaft, or both of said pinions may be disengaged therefrom; but at no time can both pinions of each pair be locked to the shaft. The pair of pinions 46 is in engagement with a similar pinion 51 on the upper end of the worm-shaft 41, and by means of this pair of pinions the shafts 36 will be rotated either in one direction or the other to tilt the barrel 1, as above described. The pair of pinions 47 are in mesh with a similar pinion 52 on the upper end of the shaft 31, and by means thereof the frame 19 can be rotated about the post 23 in either direction. The pair of pinions 48 is connected by intermediate mechanism with the shaft 14, and by means thereof the barrel 1 can be rotated in the frame 6. The current will be brought to the motor 44 by means of suitable flexible conductors or other means, and the shaft 45 can be in constant rotation. Then by manipulating the various clutch-levers the apparatus can be moved and operated in any of the above-described ways.

In order to heat the metal in the barrel 1, it is necessary to connect said barrel to a suitable source of heat, and for this purpose I prefer to use ordinary reversing regenerative furnaces, such as of the Siemens type. In Fig. 2 I have shown diagrammatically an arrangement of furnaces suitable for this purpose. On each side of my rotating mechanism are located air and gas regenerating chambers 55 and 56, which are connected by suitable flues to the reversing-valves 57 and 58, the former controlling the admission of air and the latter the admission of gas. 59 indicates the flue leading to the chimney or stack, and 60 indicates diagrammatically the levers for operating the reversing-valves 57 and 58. This apparatus is all of an old and well-known type and detailed description thereof is deemed unnecessary. By the manipulation of the valves 57 and 58 the air and gas will first be caused to flow through the air and gas chambers on one side of the furnace, thence through the barrel and out through the air and gas chambers on the opposite side of the furnace, thereby heating the last-named chambers, and thence to the stack. When the valves are reversed, the air and gas flow in the opposite direction, the waste products of combustion then serving to heat the regenerating-chambers which are first used to heat the air and gas. From the regenerating-chambers 55 56 the air and gas pass through vertical flues 60 and 61, which connect with the horizontal pipes 62 and 63. Between the ends of these horizontal pipes are pivoted the

pipes 64 and 65, so that they can swing in a vertical plane. The air and gas pass into the pipe-section 64 on one side of the furnace, and for the first time are mixed, and then pass into the barrel, where combustion takes place, and thence out through the corresponding pipe 65 on the other side of the furnace, or just the reverse course, as the case may be. These pipes 64 and 65 are pivoted as shown, so that they can be swung out of the way in order to permit the rotation of the entire apparatus around the post 23 to a position at right angles to its normal position, as shown in Fig. 4, to permit the discharge of the metal into a suitable mold, ladle, or car. One of the connecting-pipes, such as the pipe 64, is provided on its end on its lower side with an opening 66, which permits the slag to run out. When in operation, the barrel 1 will necessarily be slightly inclined toward the pipe 64, so that the slag will run in that direction. The degree of inclination of the barrel 1 will depend upon the quantity of metal in the barrel, and it is necessary that the pipes 64 and 65 fit closely on the ends of the barrel at all inclinations of the latter. To secure this result, the ends of the pipes 64 and 65 are provided with cup-shaped ends 67, which fit over the ends of the barrel and which are extended on one side, as at 68, to keep the joint closed when the barrel is inclined. The joint is, in effect, a ball-and-socket joint.

When the barrel is turned and tilted to discharge the metal therefrom, it may in some cases be desirable to close the neck 2 opposite the one through which the metal is discharged. Any convenient closure may be used for this purpose, such as the cap 69, which preferably is not attached to the barrel and is suitably suspended, as by a chain or derrick, so it can be quickly and easily put in place, and it may be held on the end of the barrel in any convenient way, as by taking over the band or shoulder 70, which is some distance from the end of the barrel, so as not to interfere with the connecting-pipe 64, but which will hold the cover 69 in place to close the neck 2 when the pipe 64 has been disconnected.

If desired, a blast may be introduced into the barrel, and this blast can be supplied in any approved manner—as, for instance, having a blast-pipe, as shown in dotted lines at 72, pass through a door 71 in the pipe 65 or pipe 64.

The operation of the device will be readily gathered from the foregoing description. The charge of metal, molten or otherwise, is introduced into the barrel 1 in any desired manner—as, for instance, by introducing a runner through the door 71—and then the pipes 64 65 are connected to the ends of the barrel. The air and gas are then turned on, thereby causing combustion in the furnace-barrel 1, and this air and gas is reversed from time to time as is common in reversing furnaces. The barrel 1 is slightly inclined and is kept in constant rotation about its axis by the mechanism before described, so that the metal inside the furnace is being constantly worked, agitated, and mixed by the ribs or corrugations 5 and the impurities caused to flow out through the opening 66. When the metal has been sufficiently worked and refined, the flow of air and gas is stopped, and the pipes 64 and 65 are swung out of the way, as indicated in dotted lines, and the entire apparatus rotated about the post 23 by the mechanism before described until the barrel is substantially at right angles to its former position. Then the cams or eccentrics 35 are rotated in opposite directions by the mechanism described, thereby raising one end of the barrel and lowering the other to discharge the metal into a mold, ladle, or car.

In Fig. 6 is shown a modified form of barrel which is particularly suitable for balling or puddling iron. This barrel 1^a is somewhat egg-shaped, so that in the rotation of the barrel a ball 75 will be formed at the largest diameter of the barrel, as shown. One of the necks is formed larger than the other, as shown at 2^a, to permit the discharge of the ball from the barrel. The barrel is also shown as trunnioned at one side of its transverse middle, as at 15^a, so that it has a bias toward the horizontal position. As a consequence only a single cam or eccentric 35 is necessary for tilting it, as will be readily understood. The mounting and operation of this modification are the same as in the preferred form.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A furnace having open necks on opposite sides thereof, heating pipes or flues arranged to be connected to and disconnected from said necks, a rotary frame on which said furnace is mounted, and mechanism for rotating said frame.

2. A barrel-shaped furnace having an open neck at each end, heating pipes or flues arranged to be connected to and disconnected from said necks, a rotary frame on which said barrel is mounted, mechanism for rotating said frame, and mechanism for rotating the barrel in said frame.

3. A furnace having closed or unbroken side walls and open necks on opposite sides thereof, heating pipes or flues arranged to be connected to and disconnected from said necks, one of said pipes having an opening in its end on the lower side to permit the escape of slag and other impurities, and means for varying the inclination of said furnace.

4. A barrel-shaped furnace having closed or unbroken side walls, and an open neck at each end, a frame in which said barrel is mounted, mechanism for rotating the barrel in said frame, heating pipes or flues arranged to be connected to and disconnected from the necks of said barrel, one of said pipes having

an opening in its end on the lower side to permit the escape of slag and other impurities, and means for varying the inclination of said furnace.

5. A furnace having open necks on opposite sides thereof, movable heating-pipes arranged to be connected to and disconnected from said necks, and a pivoted frame in which said furnace is mounted.

6. A furnace having open necks on opposite sides thereof, and heating pipes or flues mounted on pivots to swing in vertical planes and arranged to be connected to and disconnected from said necks.

7. A furnace having open necks on opposite sides thereof, heating pipes or flues mounted on pivots to swing in vertical planes and arranged to be connected to and disconnected from said necks, a rotary frame on which said furnace is mounted, and mechanism for rotating said frame.

8. A barrel-shaped furnace having an open neck at each end, pipes or flues mounted on pivots to swing in vertical planes and arranged to be connected to and disconnected from said necks, reversible regenerative furnaces connected to said pipes, a frame in which said barrel is mounted, and mechanism for rotating the barrel in said frame.

9. A furnace having open necks on opposite sides thereof, transverse trunnions on which said furnace is mounted, means for tilting said furnace about said trunnions, and heating-pipes mounted on pivots to swing in vertical planes and arranged to be connected to and disconnected from said necks, said pipes having cup-shaped ends to fit over said necks.

10. A barrel-shaped rotary furnace having an open neck at each end, swinging heating pipes or flues arranged to be connected to and disconnected from said necks, a frame in which said barrel is mounted, mechanism for rotating said barrel in said frame, trunnions on said frame, and mechanism for tilting said frame about said trunnions.

11. A furnace for treating molten metal comprising a barrel-shaped rotary furnace having an open neck at each end, movable heating-pipes arranged to be connected to and disconnected from said necks, a frame in which said barrel is mounted, annular gears on said barrel, power-driven pinions engaging said gears, trunnions on said frame, and mechanism for tilting said frame about said trunnions.

12. A furnace for treating molten metal comprising a rotary barrel-shaped furnace having an open neck at each end, annular bands having V-grooves secured to said barrel, a bearing-frame provided with semicircular V-grooved seats, antifriction-balls between said bands and seats, mechanism for rotating said barrel in said frame, trunnions on which said bearing-frame is mounted, and mechanism for tilting said frame about said trunnions.

13. A furnace for treating molten metal, said furnace having an open neck on opposite sides thereof, a frame in which said furnace is mounted, trunnions on said frame, a supporting-frame, a rotary cam between said bearing-frame and supporting-frame for tilting the furnace about its trunnions, and movable heating-pipes arranged to be connected to and disconnected from said necks.

14. A furnace for treating molten metal, said furnace having an open neck on opposite sides thereof, a bearing-frame in which said furnace is mounted, trunnions on said frame, a supporting-frame having bearings for said trunnions, two cams between said frames on opposite sides of the trunnions, and mechanism for simultaneously rotating said cams in opposite directions.

15. A furnace having an open neck on opposite sides thereof, trunnions on which said furnace is mounted, means for tilting the furnace about said trunnions, a rotary frame having bearings for said trunnions, and mechanism for rotating said frame.

16. A barrel-shaped rotary furnace having an open neck at each end, a rotary frame, a tilting frame trunnioned thereon, said tilting frame having bearings in which the barrel is rotatably mounted, mechanism for rotating the supporting-frame, mechanism for inclining the tilting frame, and mechanism for rotating the barrel.

17. In a furnace, the combination with a rotating supporting-frame, of a tilting frame mounted thereon, a barrel-shaped furnace having an open neck at each end mounted in said tilting frame, mechanism for rotating said barrel in said frame, mechanism for tilting said frame, a stationary annular rack, and gearing on the supporting-frame and engaging said annular rack.

18. In a furnace, the combination with a rotating supporting-frame, of a tilting frame mounted thereon, a barrel-shaped furnace having an open neck at each end mounted in said tilting frame, gearing for inclining said tilting frame, gearing for rotating said supporting-frame, gearing for rotating said barrel, a driven shaft, three sets of gears and clutches on said shaft, and connecting mechanism between said sets of gears and the gearing for rotating said furnace and supporting-frame and inclining said tilting frame.

19. A furnace for treating molten metal comprising a barrel-shaped rotary furnace having unbroken side walls and an open neck at each end, longitudinal ribs or corrugations on the inside thereof, a bearing-frame in which said barrel is mounted, mechanism for rotating said barrel, and movable heating-pipes arranged to be connected to and disconnected from said necks, one of said pipes having an opening in its end on the lower side to permit the escape of slag and other impurities.

20. A barrel-shaped rotary furnace having an open neck at each end, longitudinal ribs

or corrugations on the inside thereof, a bearing-frame in which said barrel is mounted, mechanism for rotating said barrel, trunnions on said frame, mechanism for tilting said frame about said trunnions, and heating pipes or flues arranged to be connected to and disconnected from said necks, one of said pipes having an opening in its end on the lower side to permit the escape of slag and other impurities.

In testimony whereof I, the said PATRICK MEEHAN, have hereunto set my hand.

PATRICK MEEHAN.

Witnesses:
F. W. WINTER,
ROBERT C. TOTTEN.