3 Sheets--Sheet 1.

W. & G. H. SELLERS.
Rotary-Puddlers.

No. 144,416. Patented Nov. 11, 1873.

FIG. 1.

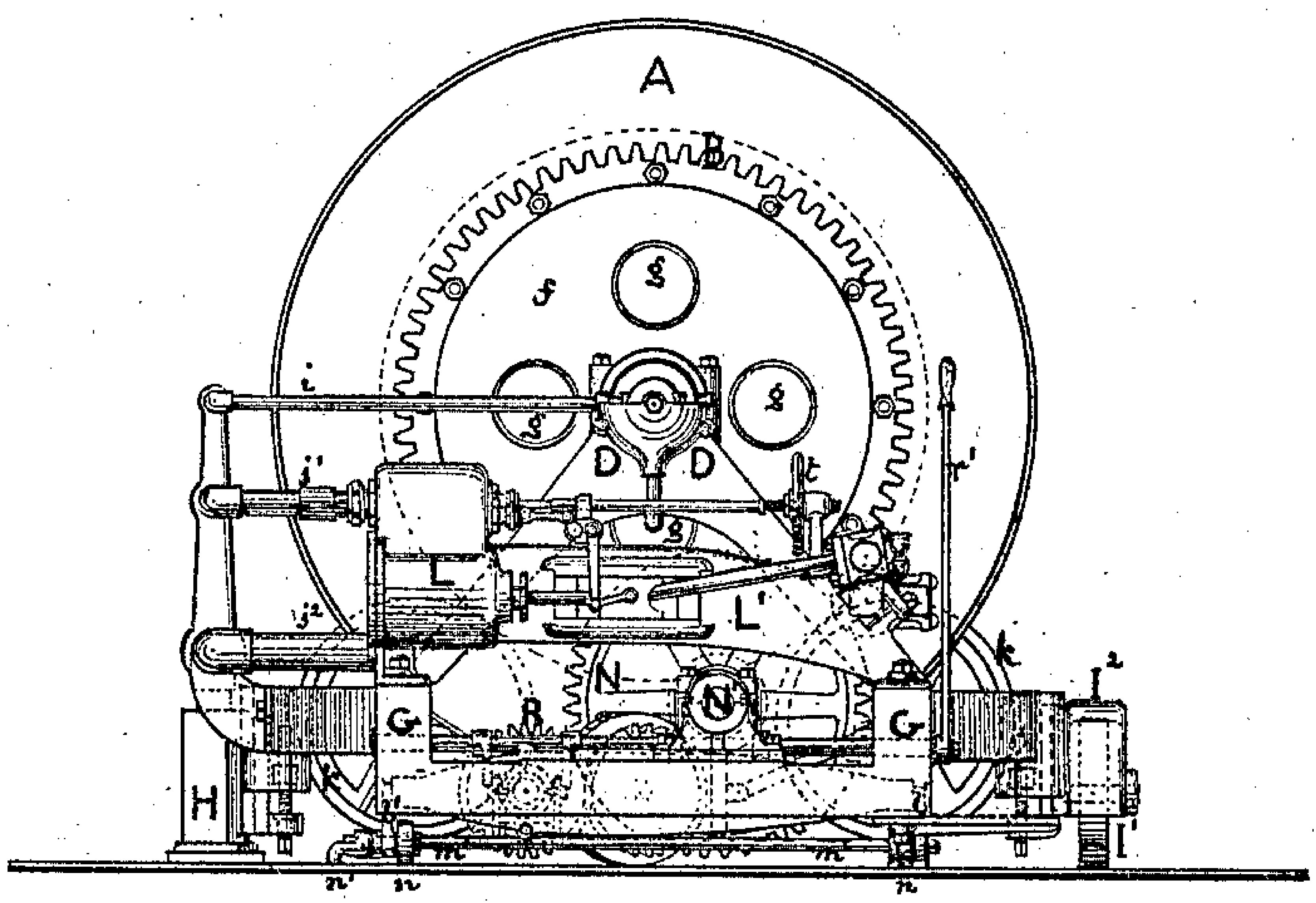
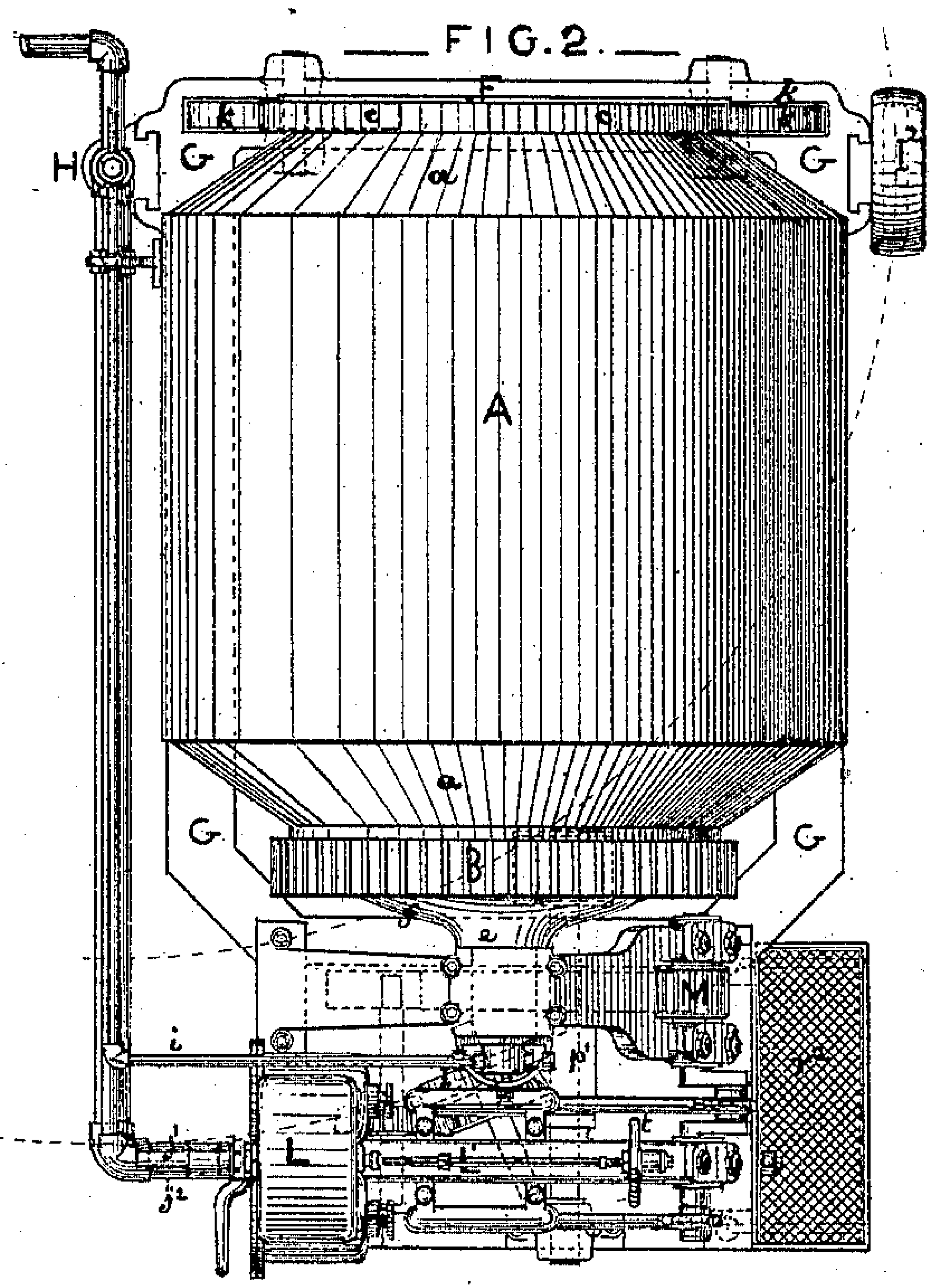


FIG. 2.



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AM. PHOTO-LITHOGRAPHIC Co. N.Y. (OSBORNE'S PROCESS)

3 Sheets--Sheet 2.

W. & G. H. SELLERS.

Rotary-Puddlers.

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FIG. 3.

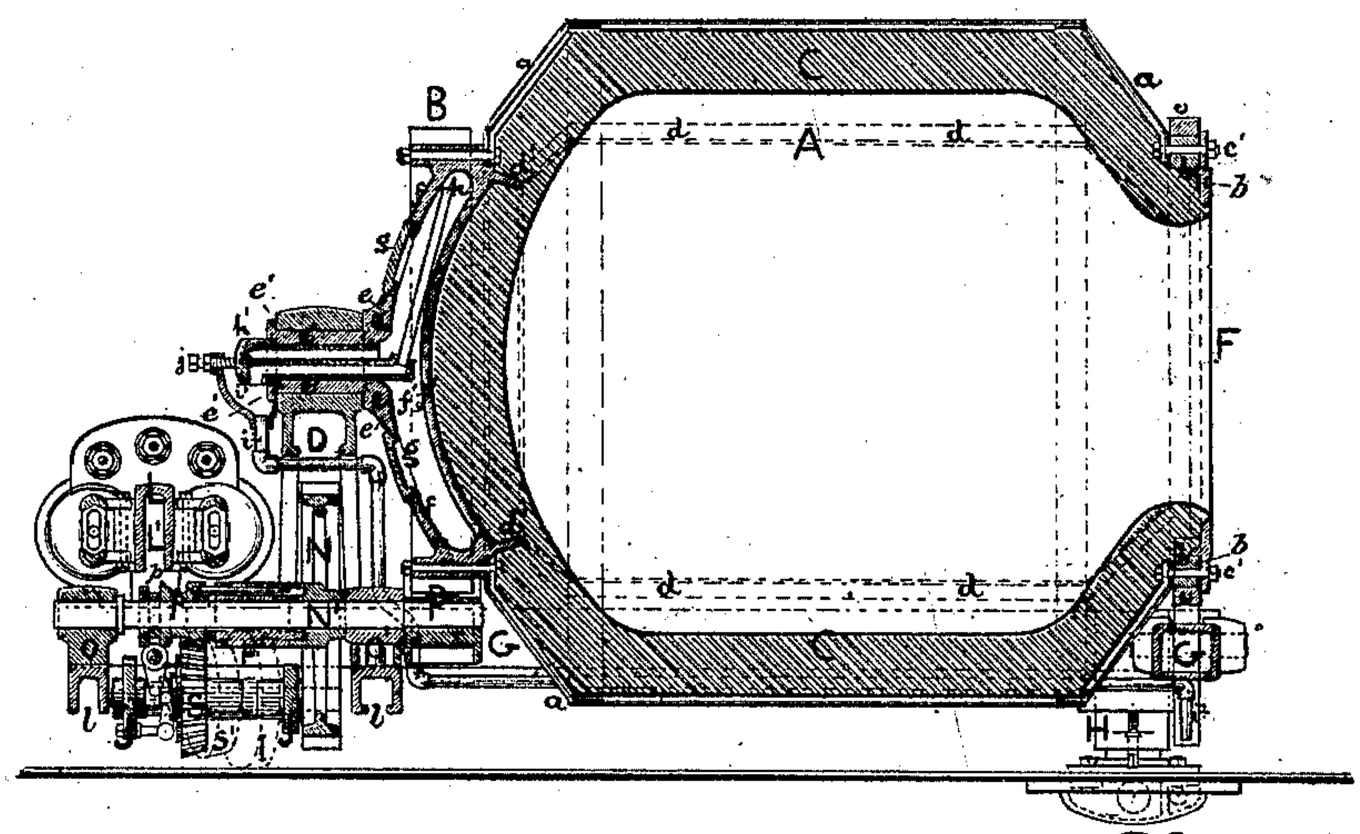


FIG. 4.

FIG. 5.

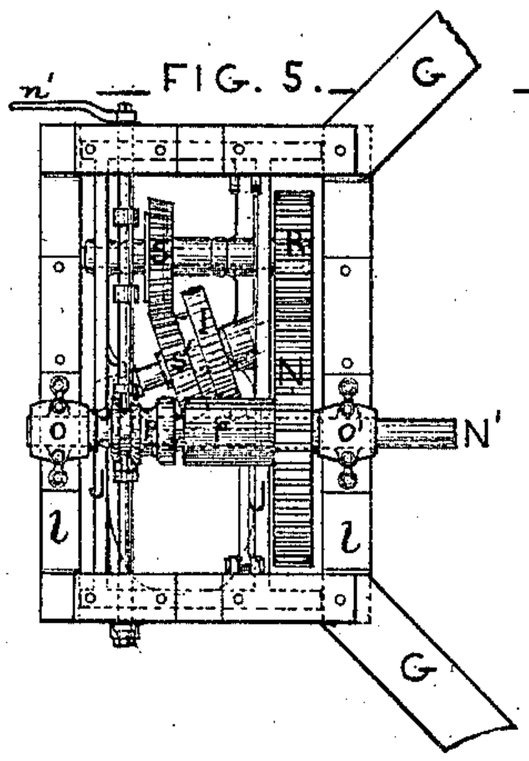


FIG. 6.

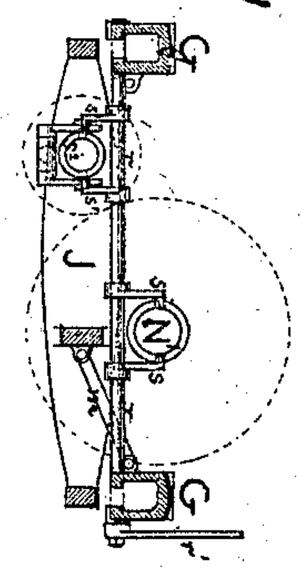


FIG. 8.

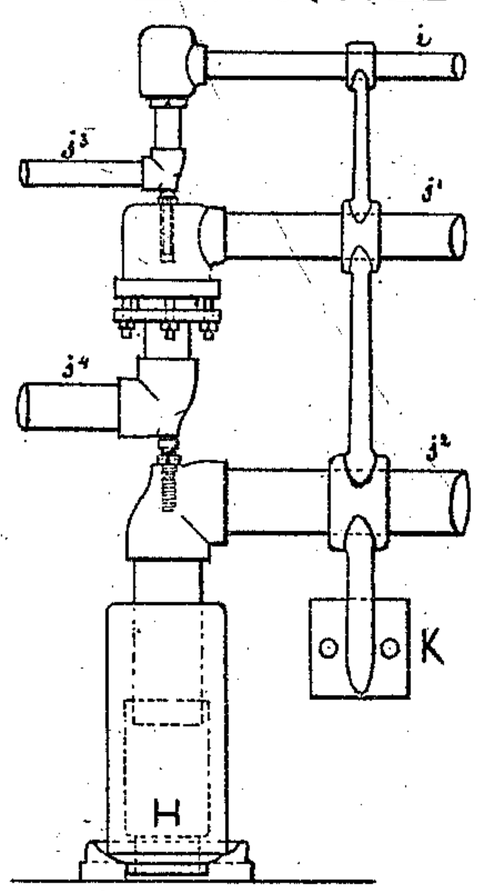
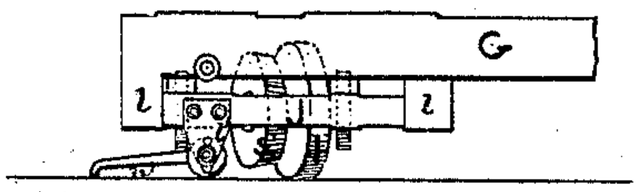


FIG. 7.



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3 Sheets--Sheet 3.

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Rotary-Puddlers.

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FIG. 9.

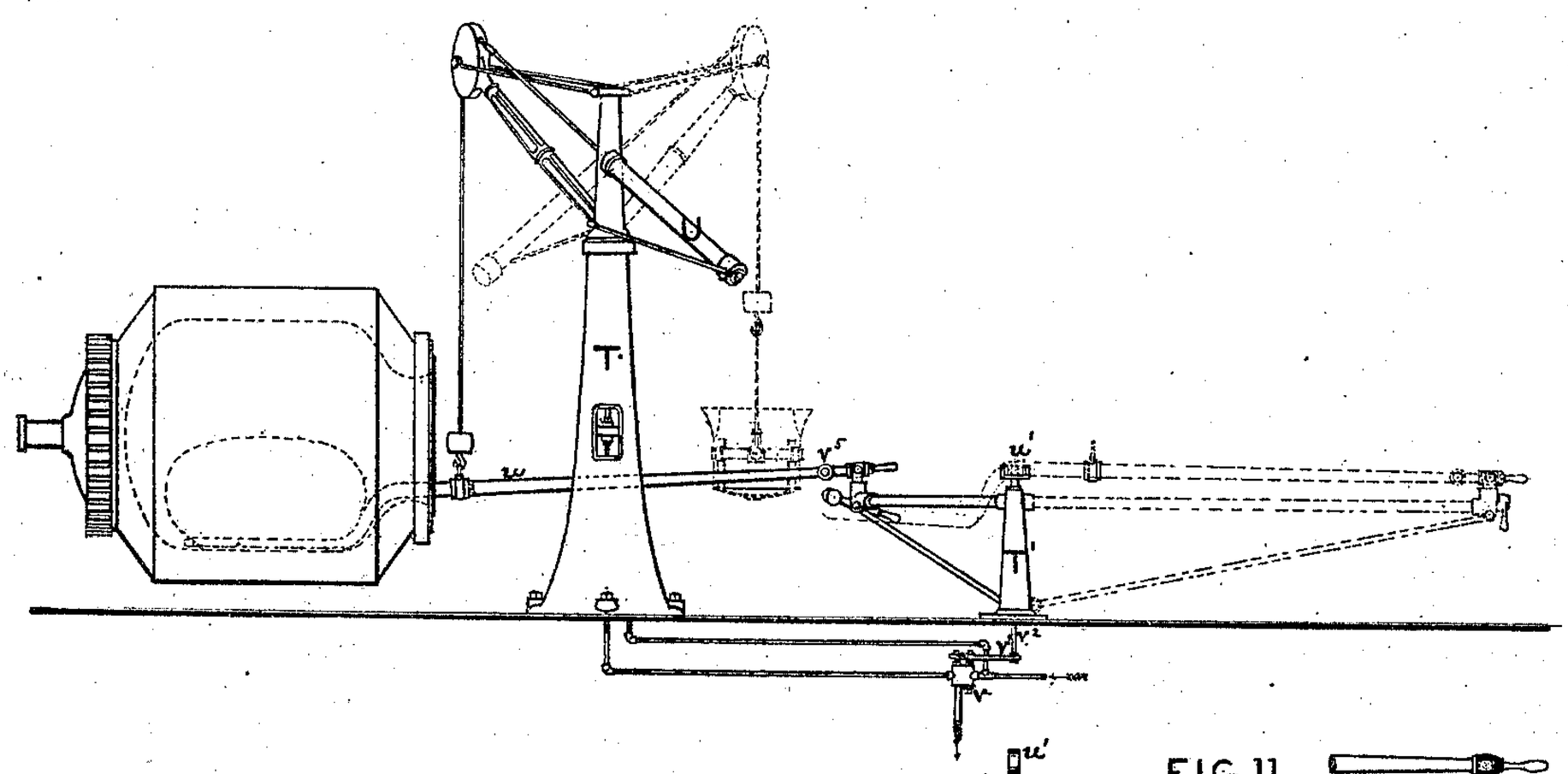


FIG. 11.

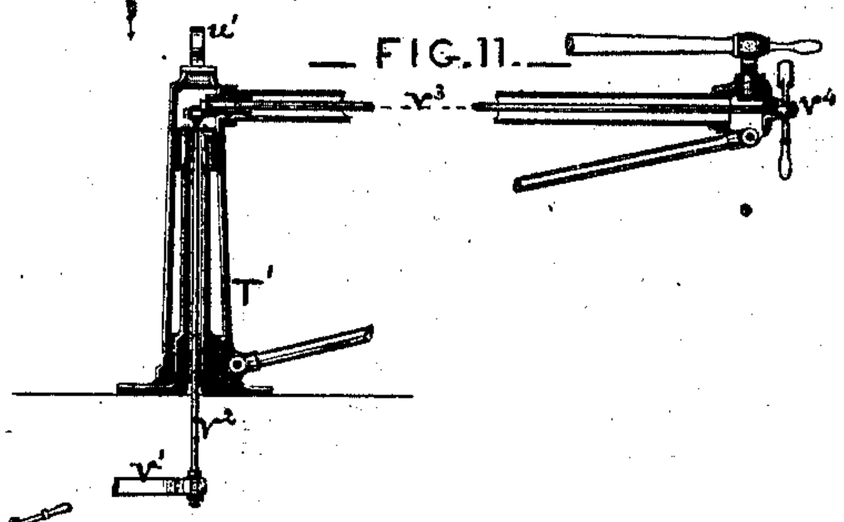
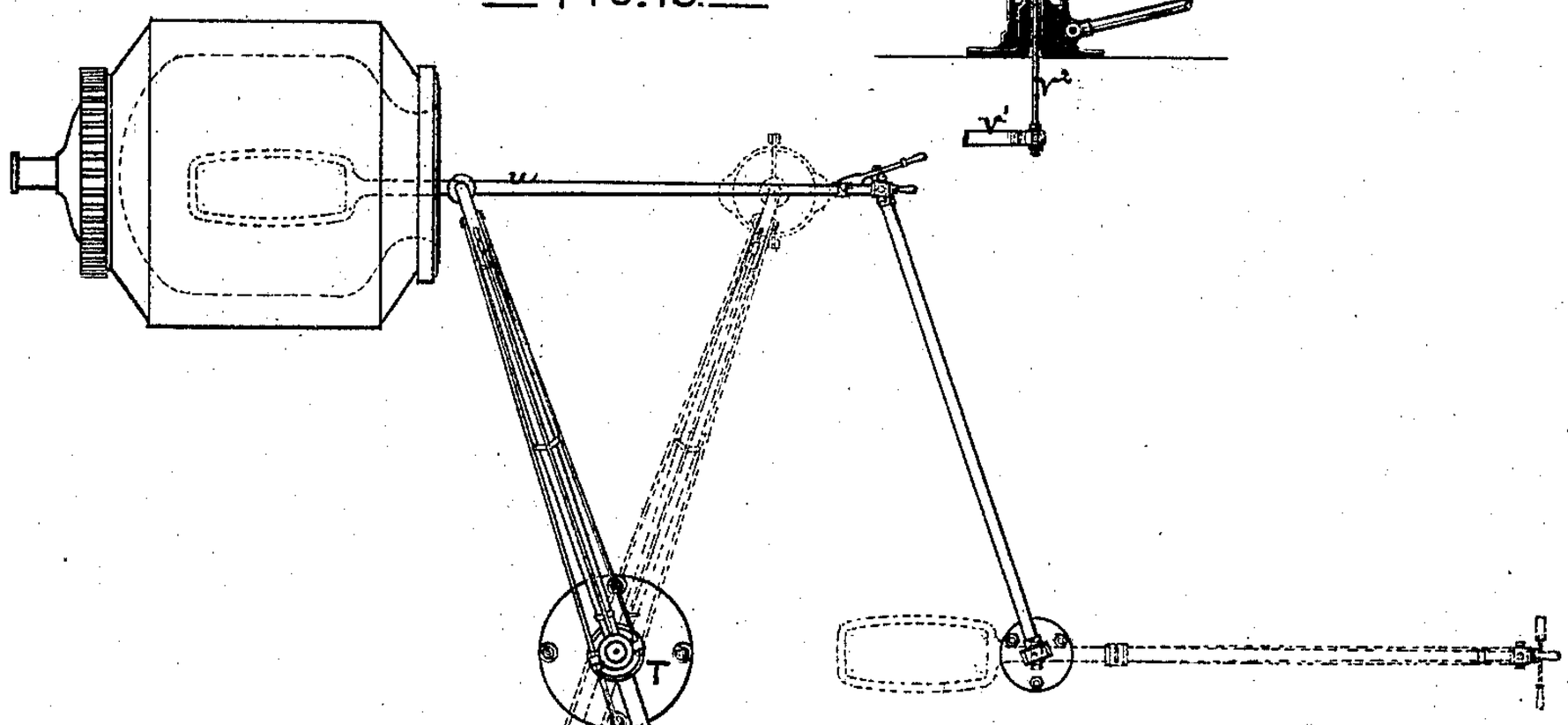


FIG. 10.



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UNITED STATES PATENT OFFICE.

WILLIAM SELLERS, OF PHILADELPHIA, PENNSYLVANIA, AND GEORGE H. SELLERS, OF WILMINGTON, DELAWARE.

IMPROVEMENT IN ROTARY PUDDLERS.

Specification forming part of Letters Patent No. **144,416**, dated November 11, 1873; application filed September 3, 1873.

To all whom it may concern:

Be it known that we, WILLIAM SELLERS, of the city and county of Philadelphia, in the State of Pennsylvania, and GEORGE H. SELLERS, of Wilmington, in the county of New Castle and State of Delaware, have jointly invented certain new and useful Improvements in the Mechanical Puddling of Iron, of which improvements the following is a specification:

Our present invention comprises, first, improvements upon the invention for which Letters Patent, No. 124,224, were granted to the said WM. SELLERS under date of March 5, 1872; second, additional inventions as adjuncts of said improvements; and, third, a novel means for charging molten metal into the puddling-vessel, and for removing the puddled ball therefrom; the first class including an improved construction of the puddling-vessel itself, and improved devices in the mechanism for supporting and rotating the puddling-vessel, and for traversing the frame, and the second class including a frame for adjusting the traversing frame and the vessel, a transposable arrangement of parts, and a novel system of gearing for imparting to the puddling-vessel a more rapid rotation than heretofore, the objects of which will be hereinafter set forth.

In the accompanying drawings, which make part of this specification, Figure 1 is an end elevation of the rotating vessel and traversing frame with the operative mechanism; Fig. 2, a plan of the parts shown in Fig. 1; Fig. 3, a vertical longitudinal section through the same; Fig. 4, a plan of the step in which the pintle supporting the traversing frame vibrates; Fig. 5, a plan of the adjusting-frame which supports the end of the traversing frame, with the operative mechanism; Fig. 6, a side view of the parts shown in Fig. 5; Fig. 7, an end view of the same; Fig. 8, detail of a system of pipe-joints in the axis of vibration of the traversing frame; Fig. 9, an elevation of the apparatus for charging molten metal into the puddling-vessel, and for removing the puddled ball therefrom; Fig. 10, a plan of the parts shown in Fig. 9; Fig. 11, a sectional elevation of a portion of the mechanism shown in Figs. 9 and 10.

The puddling-vessel A, Figs. 1, 2, and 3, like the one described in said Letters Patent No. 124,224, is open at one end only; but, with a view to obtaining enlarged capacity without unduly enlarging its diameter, we make it cylindrical, with ends *a a*, Figs. 2 and 3, in the form of frustums of cones, thus reducing the terminal diameters to the size required for the opening at one end, and for the gearing attachment at the other; while, to avoid the destructive effects of expansion and contraction, we make the cylinder, with its conical ends, of wrought-iron plate. The outer ends of the conical frustums *a a*, Fig. 3, are flanged or bent inward, so as to form a plane annular surface, the inner edge of this surface being turned off to make the openings at each end of the vessel of the same internal diameter, so that the cylinder A may be closed by the driving-gearing attachment B, Figs. 1, 2, and 3, at either end indifferently, the turned edge of the plate fitting over a projection upon the gearing B, Fig. 3, for the purposes of support; a construction which further enables us to drive the cylindrical vessel by a gear-wheel of smaller diameter. A heavy wrought-iron ring, *b b*, Fig. 3, of rectangular section, is fitted to the open end of the vessel against the plane annular surface previously described, and is securely attached thereto. The outer surface of this ring is turned off to receive a steel tire, *c c*, Figs. 2 and 3. The interior of the vessel A and frustums *a a* are provided with bars *d d*, Fig. 3, riveted to the plate, for holding the fix or lining C, Fig. 3, of the vessel in place, and a circular ring, *d' d'*, on the gear-wheel B, performs the same office for the closed end of the vessel. The rim of the spur-wheel B is attached to its hub, *e*, Figs. 2 and 3, by a spherically-formed plate, *f*, Figs. 1, 2, and 3, having circular openings *g g*, Figs. 1 and 3, through it, which are closed by covers, Fig. 3, cemented into place. A hollow projection, *e'*, Fig. 3, is formed upon the hub *e*, and is accurately turned to form a journal, which supports this end of the vessel. Attached to the rim of the wheel B, Fig. 3, and parallel to the plate *f*, we provide a second plate, *f'*, Fig. 3, which closes the end of the vessel, the space thus inclosed between the two plates being of sufficient width to admit of a water circulation,

which can be maintained through the upright pipe *h* and horizontal plug *h'*, Fig. 3. The hollow journal *e'*, Fig. 3, is bored out to receive the horizontal plug *h'*, which is turned upon its exterior to fit the same. The outer end of the plug *h'* is enlarged to form a collar, fitting into a corresponding recess in the journal *e'*, so that packing may be inserted between this collar and the bottom of the recess to prevent the egress of the water at that point. The plug *h'* is provided with two passages. The upper passage is connected at its outer end to the water-pipe *i*, Fig. 2, and its inner end opens into the space between the plates *f* and *f'*, while the lower passage is connected at its inner end to the upright water-pipe *h*, and its outer end opens into the basin i^1. (See Fig. 3.) The basin i^1 is secured to the stand D, Fig. 3, and a screw, *j*, through the back of this basin serves to sustain the plug *h'* against the water-pressure. To the bottom of the basin i^1 a pipe, i^2, is attached, the outlet for which is in the open vessel i^3, cast with the step-plate E, Fig. 4. The traverse of the pipe i^2 over the vessel i^3 (as the puddling-vessel A and its supporting-frame are moved to and fro) is indicated by the curved dotted line in the vessel i^3, Fig. 4. The pipe *i*, Fig. 2, will prevent the plug *h'* from turning as the gear-wheel B revolves, so that the pipe *h* will always maintain its vertical position in the water-space between the plates *f* and *f'*, and when water is admitted through the pipe *i* to this space it can only flow out through the pipe *h* and the plug, and only then when it rises above the upper end of the pipe. The hottest water, being at the top, will flow out as it is displaced by colder water entering through the pipe *i*, thus maintaining a circulation in the water-space. The tire *c c* is shrunk on the heavy wrought-iron ring *b b*, and is further secured in place by the ring F and through-bolts *c' c'*, Figs. 2 and 3. The face of the ring F serves to make a joint between the puddling-vessel and the gas, air, and downtake flues, encompassed by a corresponding ring. The vessel A is supported at its closed end upon a traversing frame, G, by the journal *e'* and stand D, and at its open end by the steel tire *c c* resting upon the two wheels *k k*, the journals of which are in the frame G. The traversing frame G is supported upon three points—viz., the pintle H, resting and vibrating in the step-bearing E, Fig. 4, and the two wheels I and I^1, the axles of which are placed radially to the pintle H, upon which it traverses about the step in the plate E. The journals of the wheel I^1 are placed in a box, I^2, which is vertically adjustable in the frame G; and the box is secured to the frame G by a T-formed projection upon its side fitting into a correspondingly-formed groove in the frame, which permits a free vertical movement, but prevents any lateral motion. The vertical adjustment is regulated by a screw passing through a projection from the wheel-box and taking into the frame G. The pintle H is attached to the frame G in precisely the same manner, and these features of adjustment are made so exactly alike that the positions of the pintle H and wheel-box I^2 are transposable, for a purpose that will be hereinafter explained. The wheel I is supported in a frame, J J, Figs. 5, 6, and 7. The frame J J is constructed so that it may be placed either side up, and yet always have the axle of the wheel I radial to the pintle H, and at an angle to the frame, as shown in the drawings. When the pintle H and wheel-box I^2 are transposed, and the frame J J turned the other side up, the axle of the wheel I will still be radial to the pintle H in their changed positions. The object of this arrangement is to admit of swinging the vessel A to and from the flues, either to the right or left, indifferently, as the construction and arrangement of the plant (of which the puddling-machine is an element) may require. The frame J J is maintained in its place by the downward-projecting cross-girts *l l* of the frame G, Figs. 3, 5, and 7, and the radius-bar *m*, Fig. 6, the use of which will be presently described. The vertical adjustment of the frame G is effected by inserting packing-pieces of suitable thickness between the upper side of the frame J J and the under side of the frame G, these pieces being provided with gibs, which project below the upper surface of the frame J J to maintain them in position. Upon the ends of the frame J J we bolt two stands, *l' l'*, Figs. 1 and 7, which serve to support the eccentric shaft *m' m'*, carrying the two wheels *n n*, which revolve freely upon the eccentrics. The shaft *m' m'* is partially rotated by means of the handle *n'*, and, when brought to the position represented in Figs. 1 and 7 of the drawings, the eccentrics have forced the wheels *n n* downward upon the floor-plate, relieving the radial wheel I from the weight of the puddling-vessel and traversing frame. The shaft *m' m'* being nearly tangential to the arc of vibration of the frame G, it is evident that, when the weight is shifted from the radial wheel I to the wheels *n n*, the frame G will be locked and prevented from vibrating, so that when the ring F is brought up to the corresponding ring, which encircles the flues, by depressing the handle *n'*, the frame G will be locked in this position, and when the handle *n'* is raised the weight will again be shifted to the radial wheel I, and the traversing frame G, with the puddling-vessel, may be swung away from the flues.

For the purpose of rotating the puddling-vessel A and vibrating the frame G, we provide the double-cylinder steam-engine indicated by the letter L, Figs. 1, 2, and 3; but, as the construction of this engine forms no part of our invention, it is unnecessary for the purposes of this patent to describe it further than as a steam-engine of similar construction to those in common use upon hoisting-machines, and capable of being reversed by means of a valve which reverses the ports of the main valves.

The cylinders, crank-shaft, bearing, and guides are cast with, or securely attached to, a piece, L′, Figs. 1, 2, and 3, which is provided with a foot at each end, by which it is bolted to the frame G. These feet, the bolts, and their location in the feet, are made so nearly alike that the position of the engine upon the frame G may be reversed or transposed. The stand D, which supports the closed end of the puddling-vessel, is widened on one side near its base, to embrace the pinion M upon the double-crank shaft of the steam-engine, and bearings are formed in this stand on each side of the pinion M, in line with the bearing upon the engine-frame L′, making three bearings for this shaft, Figs. 1 and 2. The feet of the stand D, through which it is bolted to the frame G, the bolts, and their position in the feet of the stand, are respectively made so nearly alike that the position of the stand upon the frame G may be reversed or transposed. Motion is communicated from the pinion M to the wheel N, Figs. 1, 3, and 5. This wheel N runs loosely upon the shaft N′, to which it can be clutched by the sliding collar *p*, carrying three pins, sliding freely through the collar *p′*, which is secured to the shaft N′. These pins take into corresponding holes in the hub of the wheel N, Figs. 2, 3, and 5. On the end of the shaft N is a pinion, P, which gears into the wheel B, thus completing the train of wheels from the engine to the puddling-vessel. The shaft N′ is supported in bearings O and O′, which are secured to the cross-girts *l l* of the frame G, Figs. 1 and 7. The bearing O′ is made in two pieces, divided horizontally, and, by taking out the lower piece, the bearing may be lowered until the teeth of the pinion P will come out of gear with the wheel B, so that this shaft and these gears may be taken out and replaced without removing the stand D or lifting the puddling-vessel from its supports. Two locations for the bearings O and O′ are provided upon the cross-girts *l l*. (See Fig. 5.) These locations are one on each side of the center line of the frame G, and equidistant from it, so that when the positions of the engine and the frame J J are reversed or transposed, as provided for, the bearings O and O′ may be shifted, and the wheel N will still gear with the pinion M, and the pinion P with the wheel B. The wheel N, which has been described as running loosely upon the shaft N′, and gearing with the pinion M, also gears with the wheel R, fastened securely upon a shaft passing across and through the sides of the frame J J, which at this point is provided with hubs on each side to form a bearing for the shaft, in which it can freely revolve. (See Figs. 3 and 5.) The vertical adjustment of the traversing frame G is effected at its rear end by inserting packing-pieces between the frame J J and the traversing frame G, as previously described; but a variation of the distance between these two frames would affect the gear-wheels N and R, unless provision was made for a lateral movement of the frame J J proportionate to the vertical movement of the traversing frame. This lateral movement is produced by the radius-bar *m*, which is attached at one end to the center, vertically, of the frame J J, and at the other to the traversing frame, the angle of the bar to the traversing frame being the same as a line drawn from the center of the wheel N to the center of the wheel R, the length of the bar *m* being as nearly as possible the same as the distance from center to center of these two wheels. Mounted upon this shaft, and revolving freely upon it, is the bevel-wheel S, which may be clutched to the shaft by a conical friction-clutch operated through a grooved collar and lever. The bevel-wheel S gears with the bevel-wheel S′ fastened to the wheel I, thus completing the train of wheels from the engine to the wheel I, for effecting the traversing motion of the frame G. The wheels N and S are clutched to their respective shafts by means of the lever-shaft *r r*, Fig. 6. This shaft passes through and is supported by the frame G, and is operated by the hand-lever r^1. It is provided with one set of arms, *s s*, which take into the groove in the sliding collar *p* on the shaft N′, and one set, s^1 s^1, which press against short levers s^2, Fig. 6, hinged to the frame J J, which take into the grooves in the hub of the friction-clutch in the wheel S. The arms s^1 s^1 do not take into this friction-clutch in the wheel S directly, because, as has been previously described, the distance of the frame J J from the frame G is variable. The friction-clutch is pressed out from the wheel S by a spring placed between the clutch and the wheel, and is forced into gear by the arms *s s* pressing against the short levers s^2, previously described, and upon which they can slide to accommodate the distance that may be established between the frames J J and G.

It will thus be seen that, by pressing the hand-lever r^1 in one direction, the engine will be coupled positively to the puddling-vessel; and by pressing it in the other direction, it will be released from the puddling-vessel, and coupled by friction to the wheel for traversing the frame, the latter movement continuing only so long as the operator continues to hold the friction-clutch in gear.

The reversing-valve of the engine is operated through the balance-wheel *t*, Fig. 2, immediately in front of the hand-lever r^1; and a platform, r^2, is provided, upon which the operator may stand, and be carried along with the vessel, in the most convenient position for controlling the rotation of the puddling-vessel or the vibration of the traversing frame. The platform r^2 is bolted to the under side of the frame G, and is transposably arranged, like the details of mechanism previously described, so that it may be attached in the same position upon either side of the frame. The water-pipe *i*, which supplies the water-space in the wheel B, the steam-pipe j^1, to operate the engine, and the exhaust-pipe j^2 from the same, are exhibited in Figs. 1 and 2; and the mode

by which they are supported from the frame G, and the latter allowed to vibrate and to be vertically adjusted, is shown in Fig. 8. The supply of water and steam and the exhaust are taken into and discharged from the system upon the traversing frame by short vertical pipes, the axes of which are in the axis of the pintle H, suitable packings being provided for each to prevent leakage. The pipes are supported by the stand K, which is bolted to the frame G; and the vertical pipes j^3 and j^4 are maintained in their position against the pressure of the steam and water by adjusting-screws, as shown.

It is evident, from this description, that all the machinery of this apparatus is so constructed and arranged that the same machine may be readily set up, and operated to swing the puddling-vessel to and from its flues, either to the right or left, indifferently, the driving mechanism operating substantially the same in either case—an advantage of the greatest value, as the direction in which the puddling-vessel must open may now be determined by its relation to the other machinery in conjunction with which it operates, instead of controlling, as heretofore, the arrangement of such other machinery, at whatever inconvenience, unless specially constructed for movement in the required direction.

The apparatus by means of which the puddling-vessel is charged and discharged is exemplified by Figs. 9, 10, and 11; and consists, substantially, of two cranes, T and T′, united at the ends of their respective jibs by an iron bar, *u*, and wire-rope, the end of this bar intended to enter the puddling-vessel projecting beyond the point at which it is supported by the rope, and being formed into a fork, united across the ends of its prongs. This end of the bar can be elevated or depressed by raising or lowering the rope by which it is suspended over a pulley in the end of the crane-jib next the puddling-vessel. This crane nearest the puddling-vessel is provided with hoisting apparatus, preferably water-pressure. The other crane merely maintains the end of the fork *u* farthest from the puddling-vessel in a horizontal plane. The first crane, T, is placed in the rear of the puddling-vessel when this vessel is closed against its flues, while the other crane, T′, is placed so that a line drawn from the center of one crane-post to the other will be at right angles to the axis of the puddling-vessel when it is in the position just described. The support for the fork *u*, where suspended from the rope, is such as to permit the fork to turn freely about its axis; in the present case, by means of a collar provided with a hook-and-eye attachment between it and the end of the rope. The outer end of the fork is attached to the end of the jib on the crane T′ by a universal joint, which will permit the fork to turn upon its axis, and to be raised or lowered, and the crane T′ to be turned about its axis, this end of the fork remaining under all circumstances in the same horizontal plane. The crane-post T′ is provided with a support, *u′*, Figs. 9 and 11, on its top, in which the bowl end of the fork *u* may be laid when it is detached from the rope, as shown by the dotted lines in Figs. 9 and 10. The fork, when attached to the rope, is raised or lowered by admitting water under pressure to one side or the other of a piston in the cylinder U, Figs. 9 and 10, the direction being determined by a valve, *v*, Fig. 9, operated through a lever, v^1, and vertical rod v^2, passing up through the center of the crane-post T′. The connection between the lever v^1 and the vertical shaft v^2 should be by a universal joint, Fig. 11, which will permit the vertical shaft to turn freely in the end of the lever, and the lever to stand at an angle to the axis of the vertical shaft. The upper end of the rod v^2 is attached to a crank-pin on the end of the horizontal shaft v^3, which passes through the center of the jib, and is provided with a handle, v^4, on its outer end. The crane being in the position shown in the drawings, the fork must be swung against the lining of the puddling-vessel, alongside of the puddled ball. Rotating the puddling-vessel slightly will cause the ball to roll on to the fork, the fork moving laterally with the surface of the lining, against which it is resting. The operator, being at the end of the crane-jib T′, will then move the handle v^4 so as to raise the ball in the vessel sufficiently to allow it to pass out. When in this position it is sustained entirely by the two cranes, so that by pulling upon the end of the crane-jib T′ the ball can readily be withdrawn from the vessel, the position of the cranes being such as to maintain the fork parallel with the axis of the puddling-vessel during its withdrawal. The handle v^4 is then moved so as to lower the ball to the height required for depositing it upon the buggy by which it is to be carried away; and, by inserting a bar in the eye v^5 of the fork-handle, the fork may be turned upon its axis so as to discharge the ball. The fork is then detached from the crane T, to permit the use of this crane for raising the ladle containing the molten metal for the next charge, as shown in dotted lines, Figs. 9 and 10, the raising and lowering being effected by moving the handle v^4, as already described.

It is evident that, if the two cranes should be turned half-way around, the fork will be moved laterally a distance equal to double the length of the crane-jibs; and one object in adapting a parallel motion with a vertical axis of rotation is, that we may, as we contemplate doing, use one such apparatus for two or more puddling-vessels, for which our transposable system is specially available.

It is not necessary that the hydraulic cylinder should be placed in the position described; nor even that it should be placed upon the crane at all, the details of such construction being common and well understood. It will in all cases, however, be found advantageous that the means for controlling the application of the power should be located as we have described, so that the raising, lowering, and with-

drawing operations may all be performed from the same point in the apparatus.

Our experience in the practical operation of the apparatus for puddling iron described in the patent No. 124,224, hereinbefore recited, while demonstrating its advancement of the art, developed its susceptibility of further progress; and, first, in respect to the open-end vessel, we found that, inasmuch as the flame could be readily delivered to the back of a vessel of greater depth, and as great depth, while very desirable, was incompatible with the spherical form without a proportionate increase of diameter, which would involve disadvantages not only in respect to economical construction, but to economical working, we resorted to the cylindrical form herein described and shown, wherein we combine in an open-end puddling-vessel an increase of capacity, limited only by the depth to which flame can be delivered to the back of the vessel, without enlarging its diameter. Again, in this same direction, we discovered that, by increasing the speed at which the puddling-vessel is rotated during a portion of the process, we may increase its capacity, limited only by the necessity for overturning the metal during the process, and by our ability to withdraw the puddled ball through the opening in the mouth of the vessel after the operation is completed.

It is well known that during the earlier part of the puddling operation the charge swells to a volume greatly in excess of that which it occupies when first melted, or of its bulk in the latter stages of the operation.

In a stationary puddling-furnace the charge may be retained within the furnace by building up the outlet during a portion of the operation, or it may be, and usually is, reduced by "bleeding," as the operation of depriving it of a portion of its slag is techinally termed, when its volume is too great; but in a rotating vessel the outlet cannot be reduced or closed during any part of the operation, and, should the charge assume a volume greater than the retaining capacity of the vessel, it must overflow, and will seek an outlet as it crosses the dividing line between the rotating vessel and the stationary apparatus, in connection with which it operates. In so doing a portion of the charge will flow into this outlet, producing not only greatly-increased friction, but also a most destructive action upon the apparatus itself.

The highest speed heretofore deemed requisite for the puddling-vessel has been simply sufficient to prevent the metal from balling until the whole mass was thoroughly puddled. No provision for the swelling of the charge had been made other than limiting its amount within what the puddling-vessel would contain when the bulk of the charge was greatest, or else to permit it to flow into the stationary apparatus in connection with which the rotating vessel operates.

We discovered that by increasing the speed of the puddling-vessel during this stage of the process the charge will be spread over a larger area in the vessel, and this overflow, with its increased friction and destructive action, will be prevented; and in this instance we accomplish these ends by means of the improved system of gearing hereinbefore described, in conjunction with those features in the construction of the vessel itself which prevent the transmission of heat to the journal upon which the rear end of the puddling-vessel is supported and turned. This journal is thus maintained in a condition to operate with the smallest amount of friction; and, by reducing the temperature at this point, we have, also, the further advantage of enabling the fix to withstand the action of the flame impinging directly upon it. We, however, contemplate the application of this principle of enlarging the area by increasing the speed in puddling-vessels of other constructions, and operated by different mechanism from that which we have shown and described as the best known to us, such applications being evidently within the scope of this part of our invention, which renders available the maximum productive capacity of the vessel.

In the process of mechanical puddling it is extremely important to transfer the puddled ball to the apparatus in which it is to be worked with the least possible loss of heat, and all the appliances for this purpose, whether the vessel or the flue is moved to afford access to the ball, should be capable of easy and rapid manipulation; moreover, after the ball is formed, any further rotation of the vessel would be only injurious to the fix without benefit to the iron, so that this rotation should be promptly discontinued at the proper moment. We have contrived to meet these requirements, and our advance in these respects comprises the hereinbefore-described method of rotating the vessel, when charged, by the same power which, when it is to be charged or discharged, separates it and the flues, and the method of removing the puddled ball and recharging the vessel with molten metal. It is not enough that the separation of the vessel from the flues should be easily and rapidly effected; but it is equally essential to maintain with facility the relation of the vessel to its flues during the puddling operation, and we have accomplished this in our hereinbefore-described method of transferring the weight from a movable to a fixed support.

Our experience with the puddling-vessel open at one end only satisfying us that its adaptability for different locations would be enhanced by arranging the apparatus to swing either to the right or to the left, we contrived to this end the hereinbefore-described transposable arrangement of parts, by which we are enabled, as constructors, to make all apparatus of any given capacity precisely alike, whereby the first cost would be greatly diminished, and as users to operate the machines in connection with other apparatus, as the circumstances of the case may dic-

tate, while the similarity of parts and the facility with which duplicates could be supplied would not only reduce the first cost of the parts, but lessen the time required for their substitution, whereby economy of maintenance would be secured. Moreover, with two machines—one right-hand and one left—we found one charging and discharging apparatus might be applied to both without increasing its cost; and with a special view to such use we have devised the hereinbefore-described charging and discharging apparatus.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. As an improvement in the art of mechanical puddling, the hereinbefore-described method of spreading the charge during ebullition.

2. As an improvement in the art of mechanical puddling, the method, substantially as hereinbefore set forth, of rotating the vessel, when charged, by the same power which, when it is to be charged or discharged, separates it and the flues.

3. As an improvement in the art of mechanical puddling, the hereinbefore-described method of locking the traversing frame when the puddling-vessel is against the flues.

4. As an improvement in the art of mechanical puddling, the hereinbefore-described transposable arrangement of parts, so that the puddling-vessel may be traversed to the right or left, as required.

5. A cylindrical puddling-vessel open at one end only.

6. The combination, with a rotary puddling-vessel, of a water-back, substantially as described.

7. The combination, with a rotary puddling-vessel and a water-back, of a hollow journal, through which the water is admitted and discharged.

8. The combination of the water-back, the hollow journal, the plug h', and pipe h, for the purposes described.

9. The combination of the rotary puddling-vessel, the water-back, the hollow journal, the waste-pipe i^2, and basin i^3.

10. The combination, with the traversing frame G and the radial wheel I, of the supporting-frame J J, substantially as and for the purposes described.

11. The radius-bar m, connecting the supporting-frame J J with the traversing frame G, substantially as described.

12. The eccentric shaft m' m' and lever n', in combination with the wheels n n, for the purposes described.

13. The shaft N′, common to the respective systems of gearing, for rotating the puddling-vessel A, and for traversing the frame G, substantially as described.

14. The combination of a rotary puddling-vessel, a traversing frame, and a system of pipes jointed in the axis of vibration of the frame, for the purpose described.

15. The combination, with a rotary puddling-vessel and the traversing frame, of the platform r^2, for the purpose described.

16. The combination, with a rotary puddling-vessel, of a discharging-fork swinging about two centers in a line parallel to the axis of the puddling-vessel, substantially as described.

17. The combination, with a rotary puddling-vessel, of a discharging-fork swinging about two centers, one end moving only in a horizontal plane, the other having both a vertical and horizontal movement, substantially as described.

18. The combination, with a rotary puddling-vessel, of a discharging-fork having a flexible support at one end and a universal joint at the other, substantially as described.

19. The combination, with a rotary puddling-vessel, of a discharging-fork having a flexible support at one end and a universal-joint support at the other, so that the fork may be turned upon its axis, substantially as described, and for the purposes set forth.

20. The handle v^4, located and arranged substantially as described, so that the various movements of the fork may be managed from one and the same point, substantially as set forth.

WM. SELLERS.
GEO. H. SELLERS.

Witnesses:
SAMUEL L. TAYLOR,
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