No. 612,186. Patented Oct. 11, 1898.

P. ARGALL.

MEANS FOR OPERATING ROTARY FURNACES FOR ROASTING AND DRYING ORES.

(Application filed Jan. 21, 1898.)

(No Model.) 3 Sheets—Sheet 1.

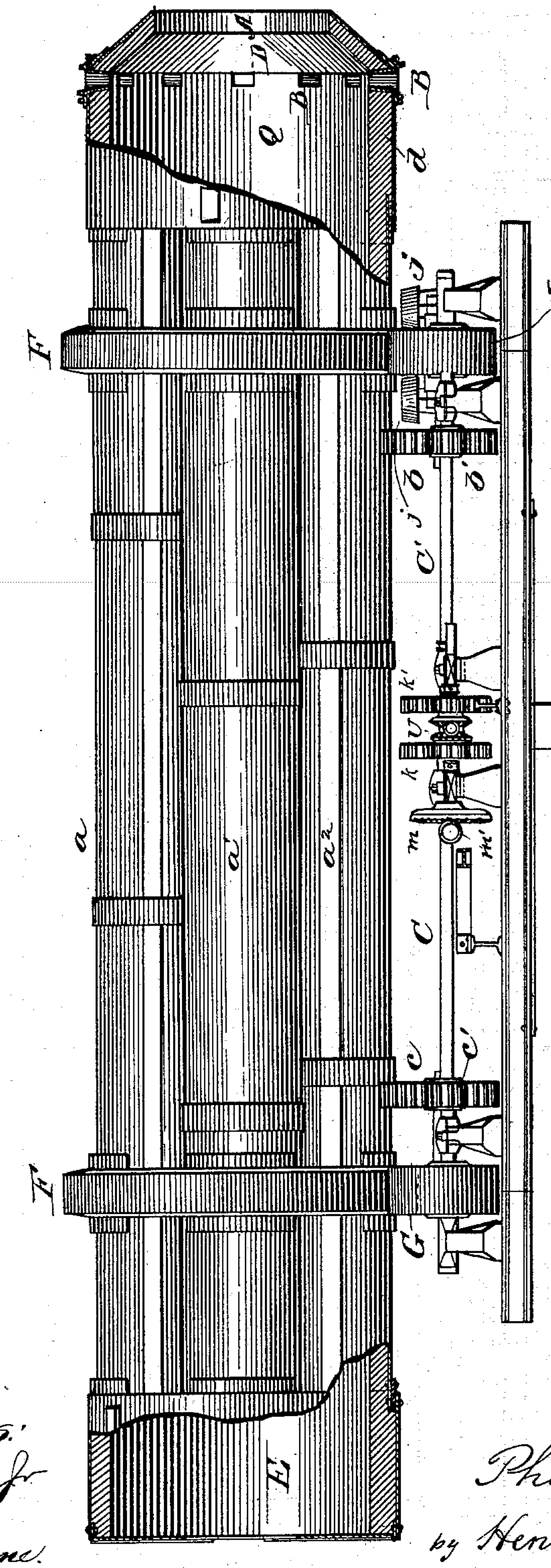

Fig. 1.

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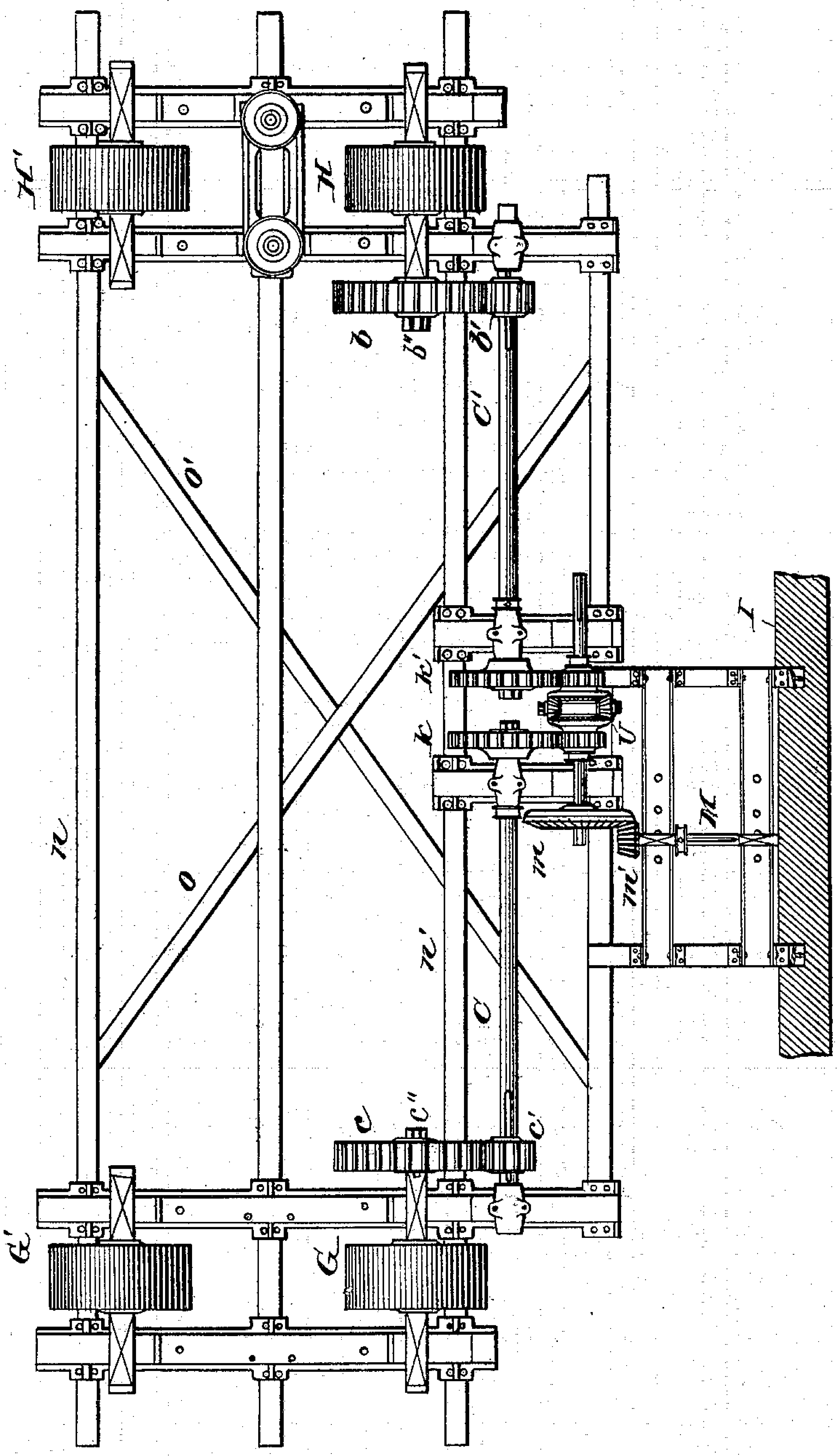

Fig. 2.

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Fig. 4.

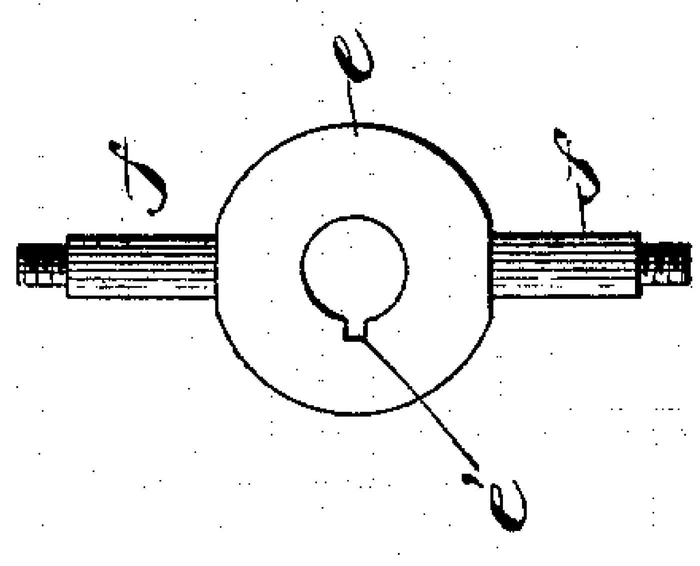
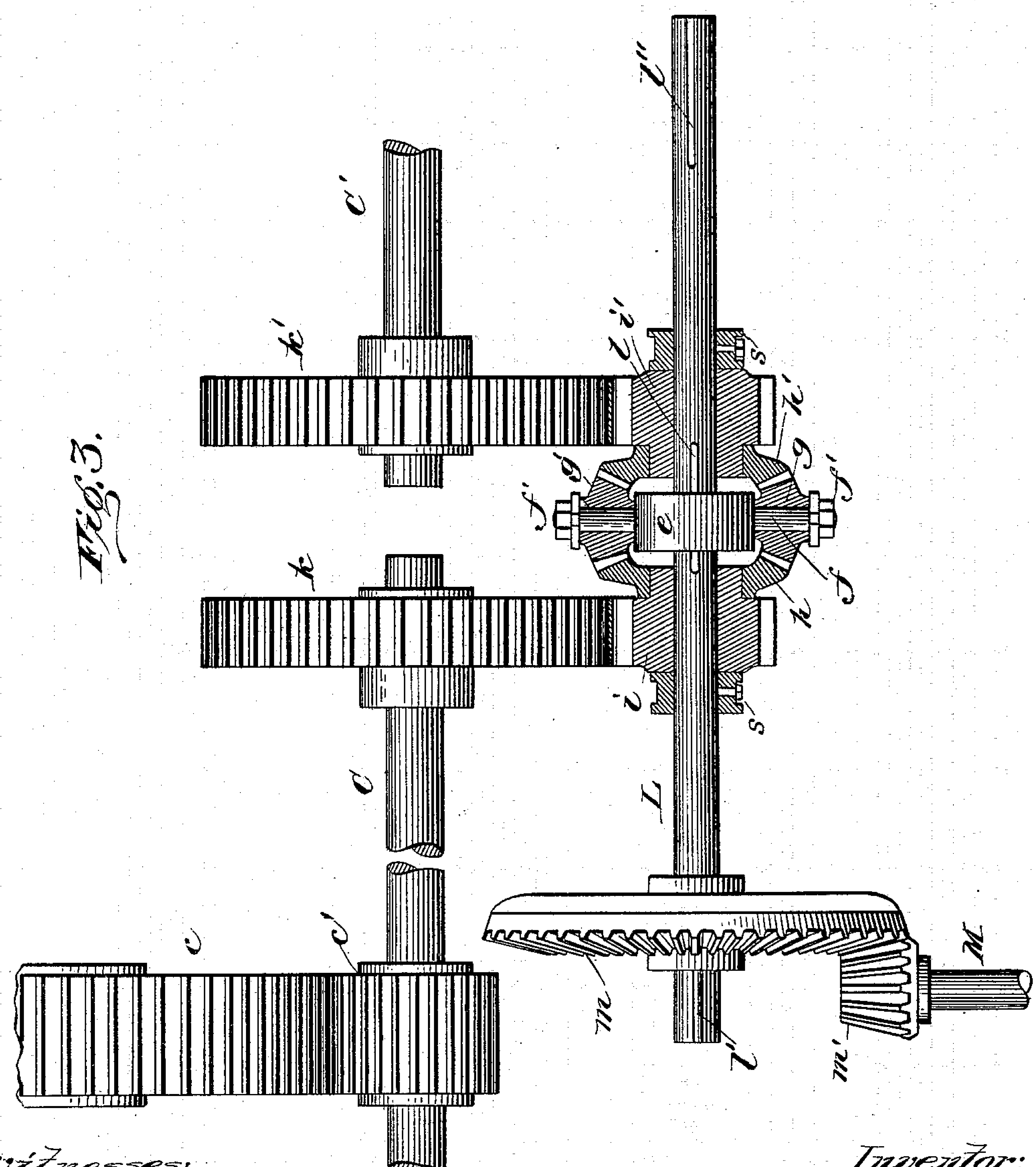


Fig. 3.



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UNITED STATES PATENT OFFICE.

PHILIP ARGALL, OF DENVER, COLORADO.

MEANS FOR OPERATING ROTARY FURNACES FOR ROASTING AND DRYING ORES.

SPECIFICATION forming part of Letters Patent No. 612,186, dated October 11, 1898.

Application filed January 21, 1898. Serial No. 667,474. (No model.)

To all whom it may concern:

Be it known that I, PHILIP ARGALL, a citizen of the United States, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Means for Operating Rotary Furnaces for Roasting and Drying Ores; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In the accompanying drawings, forming a part of this specification, Figure 1 is a side view of a multitubular rotary furnace, partially in section, showing my improved driving mechanism in operative position. Fig. 2 is a plan view of said driving mechanism, the rotary furnace being detached. Fig. 3 is an enlarged detail view showing the principal parts of the improved driving mechanism, partially in section. Fig. 4 is a detail view of the driving-lug detached.

Like letters of reference refer to like parts in the several figures.

My invention relates particularly to improvements in the mechanism employed to operate rotary tubular furnaces for roasting and drying ores, especially the improved multitubular furnace patented to me October 19, 1897, No. 591,909; and it consists in the application of means whereby the torsional strain and friction and consequent tendency to slip in the drivers and injurious irregularity of movement are wholly obviated to the great saving of power and improvement of result.

The rotary furnace above referred to is composed of a group of massive tubular cylinders symmetrically arranged about a common axis, so as to rotate when suitable power is applied. These tubes are of metal lined with fire-resisting material and provided with unitary cylinders or hoods at each end, also lined with fire-clay or its equivalent. The whole group is a matter of thirty-five to forty feet long and weighs upward of forty tons, inclusive of load, thus requiring very strong and massive supports and mechanism of superior construction to insure the equable rotation necessary for good practical results It has hitherto been found difficult, however, to prevent a certain amount of strain upon the drivers and related mechanism, owing to the mechanical impossibility of producing or maintaining the drivers and the coöperating track-bands of precisely the same diameter at both extremities of the tubular group. This strain was expended upon the rotative mechanism and resulted in an inevitable slip between the drivers and the track-bands, causing irregularity of movement and wear and sudden jars of readjustment, which occasioned great injury to the gears and shafting, necessitating frequent repairs. By my improved driving means, now to be described, I have wholly obviated these defects and obtained a smooth even motion of the heavy revolving furnace with its load and an even wear with an expenditure of much less power than heretofore and at a much less cost for repairs.

In the drawings, $a\ a'\ a^2$ indicate the multitubular group symmetrically bound together, so as to rotate as one cylinder. F F denote the circular track-bands, which encircle and sustain the said cylinder and on which it revolves. These track-bands have beveled sides and run in contact with coned guide-pulleys *j j* on one or both tracks, by which the cylinder is kept in rotative alinement.

G G' H H' denote the drivers and supports firmly sustained upon suitable shafting and bearings on the framework of the apparatus. Rotary motion is communicated, preferably, through the front pair of supports or drivers G H by a suitable train of gearing connecting to a source of power through the main shaft L and prime motor-shaft M. Heretofore this train of gearing has been continuous, so that the same velocity was imparted to both drivers G and H, causing slip at the only point where it could occur—namely, between the driver and the track-band offering the least resistance. By my improvement these drivers are driven by separate shafts from one source of power by a differential and compensating motion allowing for slip and constructed as follows:

The prime motor-shaft M communicates motion to the shaft L through the bevel-wheels *m m'*. On this shaft L is located two pinions *i i'*, (shown in section in Fig. 3,) running loosely on said shaft and held in position by collars *s s*, adjustably secured on the shaft. To the said pinions *i i'* are firmly and rigidly keyed or otherwise secured the bevel-wheels h h', so as to rotate with said pinions. Said bevel-wheels face each other and between the same is keyed on the shaft L, so as to rotate with it, the lug e, having arms f f. (Shown in detail in Fig. 4.)

l l' are keyways excavated in shaft L to receive keys securing the lug e and the bevel-gear m against rotation with the shaft. e' is a corresponding keyway slotted in lug e. On the arms f f, which form axes therefor, are located the loose bevel-pinions g g', secured by nuts f' f' or other suitable means. These said pinions g g' intermesh with the bevel-wheels h h' and form the driving means therefor, which motion is communicated through pinions i i' to the spur-gears k k' and shafts C C', and thence through spur-gears b b' c c' to drivers G H, and thence through the track-bands running thereon to the rotary furnace or cylinder.

It is evident that since the gears h h' face each other and intermesh with pinions g g' on both sides the latter cannot revolve on their respective axes when the resistance is equal on both sides and rotary motion is applied to shaft L and lug e, but carry the bevel-wheels h h' around with them, and with them the train of dependent gearing on both sides, thereby imparting motion to the drivers G H as from one shaft. Suppose now the resistance to motion of one of these drivers, G, from any cause becomes greater than the resistance of the other driver, H. This resistance is instantly transferred to bevel-wheel h, causing lug e to assume a new position relatively by reason of the tendency to arrest of motion on that side, imparting rotary motion to bevel gears or pinions g g' and increased motion to bevel-wheel h' in compensation for arrested motion in bevel-wheel h. The tendency to slip is thus compensated within the limits of the compensatory gear, readjustment occurs without torsional strain, and the movement of the rotary cylinder becomes practically uniform. In practice the lug e is continually taking up new positions relatively to gears h h', accordingly as the strain varies from one to the other of the drivers and track-bands, resulting in a steady even motion, absolutely free from slip or jar, which is highly essential to economical work in the massive heavy furnaces of this description.

In Figs. 1 and 2 I have designated the compensatory gear by the letter U, the scale in these figures being too small to show said gear in detail. The details are shown in Fig. 3. I am aware that such an arrangement of bevel-gears and loose pinions is not new *per se*, it having been invented and first described by James White in his *Century of Inventions*, Manchester, England, 1822. It has not, however, to my knowledge been employed in the relations and connections above described to accomplish the above-named useful results.

I claim and desire to secure by Letters Patent—

1. In a rotary tubular furnace, the rotary tube or tubes, track-bands surrounding the same rotary supports frictionally engaging with the said track-bands, separate shafts and trains of gearing communicating rotary motion to two of said rotary supports, a single main shaft from which motion is imparted to said separate shafts and gears, and an intermediate compensating gear including loose pinions between said single main shaft and said separate shafts and gears, whereby differential motion is imparted to said separate shafts and gears in compensation of the varying strain, substantially as specified.

2. In a rotary tubular furnace, the combination of the symmetrical group of tubes, circular track-bands surrounding the same, and rotary supports and drivers therefor, with the separate shafts C, C', gears k k', loose pinions i i', gears h h', shaft L, lug e, bevel-pinions g g', and intermediate gearing between said shafts C C' and said rotary supports whereby differential motion is imparted to the said drivers from the single shaft L, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

PHILIP ARGALL.

Witnesses:

HENRY A. VEZIN,

H. M. MUNROE.