A. L. WEST.

COMPENSATING DRIVE FOR CONCENTRIC CYLINDERS OR MILLS.

APPLICATION FILED MAY 9, 1912.

1,144,272.

Patented June 22, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

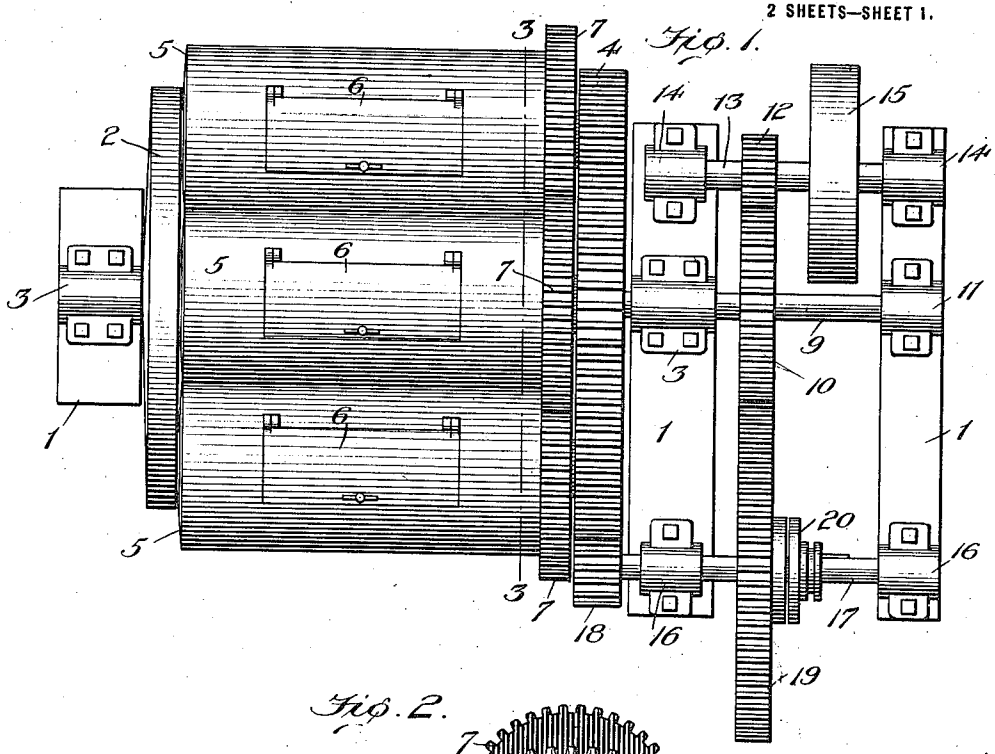
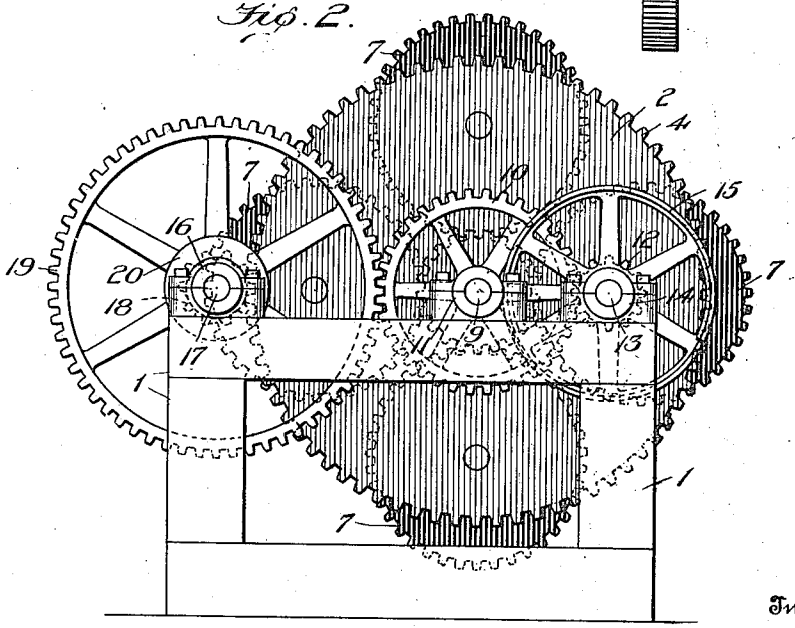


Fig. 2.



Witnesses

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Fig. 3.

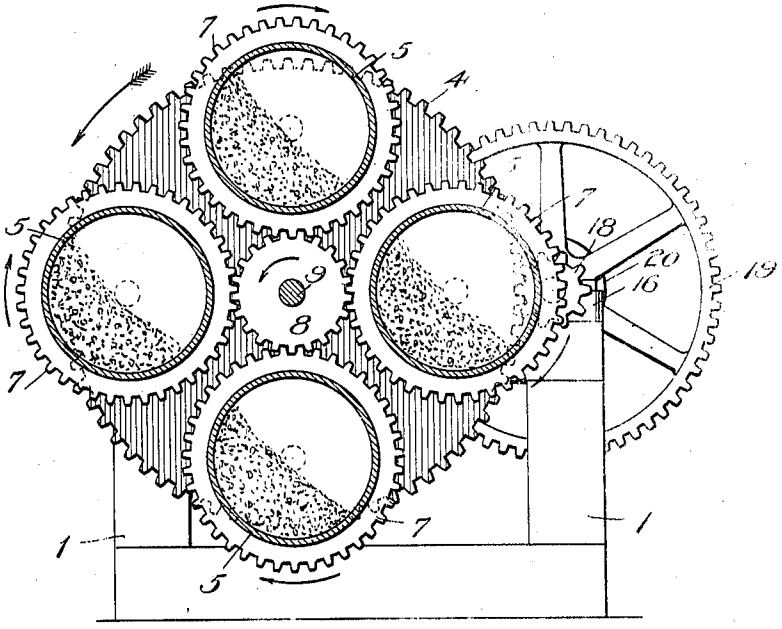
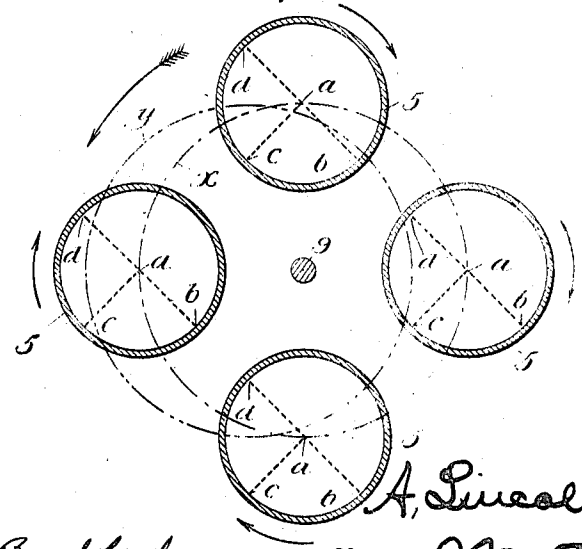


Fig. 4.



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UNITED STATES PATENT OFFICE.

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COMPENSATING DRIVE FOR CONCENTRIC CYLINDERS OR MILLS.

1,144,272. Specification of Letters Patent. Patented June 22, 1915.

Application filed May 9, 1912. Serial No. 696,193.

To all whom it may concern:

Be it known that I, ABRAHAM LINCOLN WEST, a citizen of the United States, residing in the city of Newark, in the county of Essex and State of New Jersey, have invented a new and useful Compensating Drive for Concentric Cylinders or Mills, of which the following is a specification.

This invention relates to mills generally, but more particularly to power driven rotatable mills and analogous appliances employing hollow working receptacles barrels or drums for inclosing the material or materials operated upon, such for example as tube mills, pebble mills, ball mills, grit mills, triturating mills, crushers, grinders, pulverizers, screens, tumbling barrels, driers, roasters, mixers, churns, and all mechanisms employing like principles of operation.

It is a well recognized fact that mechanisms of the character indicated, when charged and in operation, have to contend with what will hereinafter be termed a "suspended or extended load," by which is meant that portion of the contents of each revolving working receptacle which is always upon the up side, or side revolving upward, and consequently the heavier side of the receptacle. When properly charged such receptacles are only partly filled by the material operated upon, together with the balls, pebbles, grit or other polishing, grinding or mixing agents employed, so that, as they are rotated upward the load is constantly carried outward and upward, in the same direction that the receptacles revolve, which results in a load extended or suspended to one side of the axial center of each receptacle, of an amount regulated and determined by the weight of the load in the particular receptacle or receptacles, and proportionate to the same. That is to say, while the receptacle is revolving all particles which go to make up its contents continually climb to the up side thereof until the natural angle of repose is passed when they as naturally gravitate to the bottom, at an angle of approximately forty five degrees; so long, therefore, as this angle, or approximately this angle, of the load line is maintained it is quite obvious that the balance of weight is materially to one side of the axial center of the receptacle and must be overcome by the rotating means.

One object of this invention therefore, is to provide means for overcoming and utilizing the suspended or extended load of mills and mill receptacles, by employing the aforesaid overbalanced weight to induce, or assist in a downward axial rotation of the main supporting frame upon its heavier side, thereby greatly economizing the amount of power required to operate the mill as a whole.

Another object of the invention is to provide means whereby the dead load of a mill of the character indicated, may be started with an expenditure of horse power approximately commensurate with that required to continue it in operation, and without the necessity of providing an excess of power to be used at the moment of starting.

A further object is to provide means whereby the prime mover, or driving power, may be relieved of a portion of its load at the moment of starting the mill, and at all times, by causing the suspended or extended load in each of the working receptacles aforesaid to assist in the rotation of the main supporting frame, and to thereby transmit such rotary motion back to the driving gears of the prime mover.

A further object is to provide means whereby the driving power may be given full speed, if desired, before the maximum of power is actually required, that is to say the supporting frame and all working receptacles may at the outstart be rotated collectively or in cluster at full speed of the motor, before certain auxiliary driving mechanism is thrown into action for the purpose of imparting to the working receptacles independent rotary motion. Whereas mills of the character referred to must ordinarily be started at low speed and gradually increased to the maximum speed required. These, together with other objects and advantages of the present invention, will now become apparent to persons skilled in the art to which it relates, and to all such uses I lay claim the same as if herein specifically pointed out.

The invention will be hereinafter particularly described and pointed out in the claims following.

In the accompanying drawings which form part of this application for Letters Patent, and whereon corresponding nu-

merals indicate like parts in the several views: Figure 1 is a top plan view of the invention showing the driving gears, a vertically rotatable supporting frame, and three of a series of working receptacles pivotally carried by said frame. Fig. 2 is an end elevation of parts shown by Fig. 1. Fig. 3 is a transverse vertical section of the mill taken on the line 3—3 of Fig. 1 looking toward the driving gears, and, Fig. 4 is a diagrammatic view indicating directions of rotation, the centers of rotation both axial and orbital of the working receptacles, and the constantly shifting center of gravity of the overbalancing portion of the load in each of said receptacles.

Reference being had to the drawings and numerals thereon, 1 indicates a stationary foundation-frame pedestal or piers of any approved form or material upon which the mill as a whole is supported. Mounted upon this foundation 1 is a vertically rotatable supporting frame, comprising face-plates or frame head plates 2, 2 suitably connected by distance pieces or struts (not shown), and journaled at their axial centers upon bearings such as 3, 3. One of said face-plates 2 is provided with a peripheral gear 4 by means of which the frame is adapted to be driven or rotated, while between said plates are axially journaled, in independent bearings, a plurality of working cylinders 5 by preference of cylindrical form having closed ends, suitable charging doors 6, and each provided with a peripheral driven gear 7, as shown by Figs. 1, 2 and 3.

Meshing with all of the driven gears 7 aforesaid, is a central driving pinion 8 keyed to a main-driving shaft 9 extending loosely through the center hub of one face-plate 2 to the outer or opposite bearings of the other of said face-plates, and provided also with a larger gear 10 intermediate of its bearings 3, 11, as best shown by Fig. 1. Meshing constantly with said gear 10 is a driving pinion 12 carried by a counter-shaft 13 mounted in journal bearings 14, 14 and equipped with an ordinary driving pulley 15 to which a belt may be attached in any approved manner for transmitting power from an engine or other prime mover (not shown) in the usual manner. The said parts 15, 13, 12, 10, 9 and 8 constituting what may be termed the main driving mechanism.

Journaled in suitable bearings 16, 16 is an auxiliary or compensating drive shaft 17, provided at one end with a pinion 18 running into the peripheral gear 4 of face-plate 2, hereinbefore mentioned; and intermediate of bearings 16, 16 upon said shaft 17 is a larger gear wheel 19 adapted to run loosely upon this shaft, or to be fixed with relation thereto by agency of a manually operated clutch 20 in the well understood manner. The parts last described constituting an auxiliary driving mechanism for purposes which will now appear in a brief statement of operation.

The herein disclosed embodiment of the present invention having been constructed substantially as shown and described, working receptacles 5 are first partially filled through their respective charging doors 6. Power is then applied, at full speed and full capacity of the engine or motor if desired, to pulley 15, pinion 12, and gear 10 thereby rotating the main driving shaft 9 and with it the concentrically positioned driving pinion 8 in the direction indicated in Fig. 3 by the arrow. At this stage of the operation, the gear wheel 19 of the auxiliary driving mechanism, meshing with the intermediate gear 10, runs loosely upon compensating shaft 17 so long as clutch 20 is disconnected, and is unaffected by the rotation of pinion 18 or said shaft 17 until such time as the clutch 20 is thrown in. As a consequence there is little or no resistance to the rotation of gear 4 and face plates 2 of the rotatable supporting frame, while on the contrary rotation of each individual working receptacle 5 is resisted by the weight of its contents, and as the result said supporting frame and receptacles are driven collectively, or in cluster, around shaft 9, as indicated by the feathered arrow in Figs. 3 and 4, under influence of the main driving mechanism until said frame has obtained full speed.

Clutch 20 is now thrown into action thus locking gear 19 with relation to the driving pinion 18 upon compensating shaft 17, whereupon the aforesaid rotation of said supporting frame is subjected to a resistance greater than that of the individual receptacles 5, which, following the line of least resistance, now begin to revolve upon their respective axes in the direction indicated by unfeathered arrows in Figs. 3 and 4, while at the same time performing a comparatively slow orbital movement about the axial center of their supporting frame. That is to say when the main driving shaft 9 and pinion 8 revolve to the right or clockwise, as indicated by arrow upon the back of said pinion 8 (Fig. 3) the intermeshing gears 7 and their respective working receptacles 5 will revolve to the left or counter clockwise, as indicated by the unfeathered arrows in Figs. 3 and 4. And, obviously, this action of the individual receptacles causes a displacement of the suspended or extended load in all of said receptacles, to the up side or right hand side of each as clearly shown by Fig. 3 (which it will be remembered is an inside or back view looking in the direction of the arrows on section line 3—3 of Fig. 1) thus projecting the load of all re-

ceptacles 5 away from their natural centers of balance, each in the same direction, and causing an overbalancing of the entire revolving frame in which they are pivotally supported. In other words that portion of the load in each receptacle 5 represented by dotted lines *a*—*b*—*c*, in diagrammatic Fig. 4, is in a state of equilibrium, or balance; while that portion of the load in each of said receptacles represented by the dotted lines *c*—*a*—*d* is always at one side of the natural vertical center of balance of the supporting frame or face-plates 2, and tending constantly to rotate same in the direction indicated by the feathered arrow. So that while the actual centers of said receptacles 5 perform an orbital movement around the axis of said face plates upon the dotted line *x*, the center of gravity of that overbalancing portion of the load in each receptacle marked *c*—*a*—*d* moves in a circle *y* eccentric to the circle *x* and always to one side thereof, thereby throwing the weight of the entire supporting frame out of balance approximately one half of the total load of the several receptacles so as to induce rotation thereof in the direction of the feathered arrow.

Obviously this rotary movement of the supporting frame and its attached peripheral gear 4, causes said gear to bear heavily upon pinion 18 of the compensating shaft 17 thus transmitting power through gears 19 and 10 back to the prime mover, or more properly speaking counterbalancing or reducing the load which it is required to drive.

Having thus described my invention it should be understood that I do not confine myself to the particular form and arrangement of parts hereinbefore set forth, but on the contrary lay claim to any and all modifications capable of producing the aforesaid results, and likewise to all mechanical equivalents of the parts and elements shown, either in respect to the power producing and power transmitting means, the location and form of the gears or equivalent parts employed, and the relative direction of rotation of the moving parts. And while I have herein illustrated and described a "single charge" mill or "dump" mill of the closed type provided with doors 6 for purposes of charging and discharging, it is quite obvious that the invention is equally applicable to mills of the continuous feed and discharge type, that is to say, mills which are continuously supplied at or near one end and as continuously discharged at or near the other.

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

1. In mechanism of the character indicated the combination with a vertically rotatable supporting frame and a plurality of working receptacles carried by said frame, of main driving mechanism for rotating said working receptacles, and an independently operable auxiliary driving mechanism for rotating said frame at a less angular speed than that of the working receptacles.

2. In mechanism of the character indicated the combination with a vertically rotatable supporting frame and a plurality of working receptacles carried by said frame, of separate driven elements carried by said receptacles, main and auxiliary driving mechanisms for rotating said receptacles and supporting frame respectively, and a clutch for disconnecting said main and auxiliary mechanisms.

3. In mechanism of the character indicated the combination with a vertically rotatable supporting frame provided with a driven gear and a plurality of working receptacles carried by said frame each provided with a driven gear, of main driving mechanism for rotating said working receptacles, a central pinion intermeshing with the driven gears of all of said receptacles, and an auxiliary driving mechanism actuated by said main driving gear and comprising a driving pinion meshing with the driven gear upon said rotatable supporting frame.

4. In mechanism of the character indicated the combination with a vertically rotatable supporting frame provided with a driven gear and a plurality of working receptacles carried by said frame each provided with a driven gear having an axial movement with relation to that of said supporting frame, of main driving mechanism comprising a driving pinion meshing with the gears of all of said receptacles, an auxiliary driving mechanism including a driving pinion meshing with the gear upon said supporting frame, means for transmitting power from said main to said auxiliary driving mechanisms, and a clutch for disconnecting said auxiliary driving mechanism.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

A. LINCOLN WEST.

Witnesses:
WM. E. DAVENPORT,
THOMAS W. FRAMPTON.